GHANA EDUCATION SERVICE

(MINISTRY OF EDUCATION)

REPUBLIC OF GHANA

MATHEMATICS
COMMON CORE PROGRAMME CURRICULUM
(BASIC 7 - 10)

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NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

Mathematics Curriculum for B7- B10

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INTRODUCTION

In the first four years of high school education, learners are expected to take a Common Core Programme (CCP) that emphasizes a set of high, internationally-benchmarked career and tertiary education ready standards. Learners need to acquire these for post-secondary education, the workplace or both. The standards articulate what learners are expected to know, understand and be able to do by focusing on their social, emotional, cognitive and physical development. The (CCP) runs from Basic 7 through Basic 10.

The common core attributes of the learner, which describe the essential outcomes in the three domains of learning (i.e. cognitive, psychomotor and affective), are at the centre of the CCP (see Figure 1). Inspired by the values which are important to the Ghanaian society, the CCP provides an education of the heart, mind and hands in relation to on the learner's lifetime values, well-being, physical development, metacognition and problem-solving. Ultimately, this will produce character-minded learners who can play active roles in dealing with the increasing challenges facing Ghana and the global society.

The features that shape the common core programme are shown in Figure 1. These are

- learning and teaching approaches – the core competencies, 4Rs and pedagogical approaches
- learning context – engagement service and project
- learning areas – mathematics, science, computing, language and literacy, career technology, social studies, physical and health education, creative arts and design and religious and moral education.

These are elaborated subsequently:

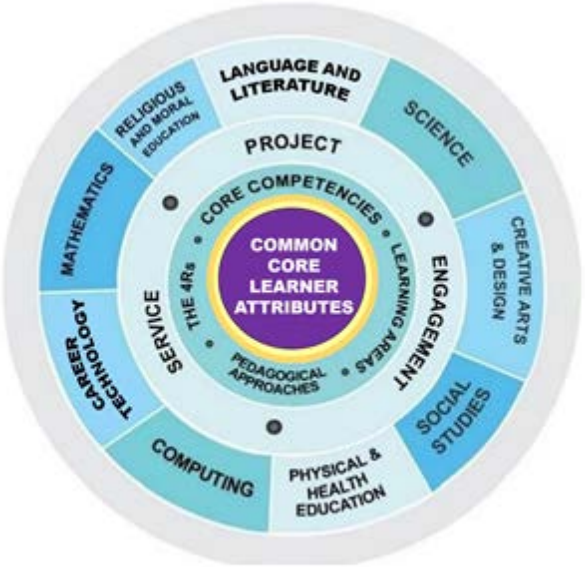


Figure 1: Features of the CCP

Learning and teaching approaches

- *The core competences:* Describe the relevant *global skills for learning* that the CCP helps learners to develop in addition to the 4Rs. The global skills for learning allow learners to become critical thinkers, problem-solvers, creators, innovators, good communicators, collaborators, digitally literate, culturally and globally sensitive citizens who are life-long learners that have keen interest in their personal development.
- *Pedagogical approaches:* The CCP emphasises creative and inclusive pedagogies that are anchored on authentic and enquiry-based learning, collaborative and cooperative learning, differentiated learning, and holistic learning as well as cross disciplinary learning.
- *The 4Rs across the Curriculum:* The 4Rs refer to Reading, wRiting, aRithmetic and cReativity, which all learners must become fluent in.

Learning context

The CCP places emphasis on engagement of learners in the classroom activities, projects (in and outside the classrooms). These projects can involve individual or group tasks which all learners are required to complete by the end of Basic 10. The CCP project provides learners with contexts to demonstrate creativity and inventiveness in various areas of human endeavor. Community service offers opportunity for learners to nurture, love and care for their community and solve problems in the community.

Learning Areas

The CCP comprises the following subjects:

1. Languages (English, Ghanaian Languages, French, Arabic)
2. Mathematics
3. Science
4. Creative Arts and Design
5. Career Technology
6. Social Studies
7. Computing
8. Religious and Moral Education (RME)
9. Physical and Health Education

This document sets out the standards for learning mathematics in the Common Core Programme (CCP). The standards in the document are posited in the expectation that CCP (B7 – B10) will offer quality education for all types of learners. The design of this curriculum is based on the features of the CCP as shown in Figure 1. It emphasizes a set of high internationally-benchmarked career and tertiary education ready standards. Learners need to acquire these competencies in mathematics for post-secondary education, the workplace training or both. The curriculum has been designed to be user friendly because it provides a detailed preamble that covers the rationale, philosophy, aims, profile of expected learning behaviours (i.e. knowledge, skills, attitudes and values), pedagogical approaches, core competencies and the 4Rs, assessment practices and instructional expectations.

RATIONALE

Mathematics forms an integral part of our everyday lives and it is a universal truth that development is hinged on mathematics. Mathematics is the backbone of social, economic, political, and physical development of a country. It is a never-ending creative process, which serves to promote discovery and understanding. It consists of a body of knowledge which attempts to explain and interpret phenomena and experiences. Mathematics has changed our lives and it is vital to Ghana's future development.

To provide quality mathematics education, teachers must facilitate learning in the mathematics classroom. This will provide the foundations for discovering and understanding the world around us and lay the grounds for mathematics and mathematics related studies at higher levels of education. Learners should be encouraged to understand how mathematics can be used to explain what is occurring, predict how things will behave and analyse causes and origin of things in our environment. The mathematics curriculum has considered the desired outcomes of education for learners at the basic level. Mathematics is also concerned with the development of attitudes and therefore it is important for all citizens to be mathematically and technologically literate for sustainable development. Mathematics therefore ought to be taught using hands-on and minds-on approaches which learners will find as fun and adopt mathematics as a culture.

PHILOSOPHY

Teaching Philosophy

Ghana believes that an effective mathematics education needed for sustainable development should be inquiry-based. Thus, mathematics education must provide learners with opportunities to expand, change, enhance and modify the ways in which they view the world. It should be pivoted on learner-centred mathematics teaching and learning approaches that engage learners physically and cognitively in the knowledge-acquiring process in a rich and rigorous inquiry-driven environment.

Learning Philosophy

Mathematics Learning is an active contextualized process of constructing knowledge based on learners' experiences rather than acquiring it. Learners are information constructors who operate as researchers. Teachers serve as facilitators by providing the enabling environment that promotes the construction of learners' own knowledge, based on their previous experiences. This makes learning more relevant to the learner and leads to the development of critical thinkers and problem solvers.

AIMS

General Aim

The curriculum is aimed at developing individuals to become mathematically literate, good problem solvers, have the ability to think creatively and have both the confidence and competence to participate fully in Ghanaian society as responsible local and global citizens.

Subject Aims

The mathematics curriculum is designed to help learners to:

1. recognize that mathematics permeates the world around us
2. appreciate the usefulness, power and beauty of mathematics
3. enjoy mathematics and develop patience and persistence when solving problems
4. understand and be able to use the language, symbols and notation of mathematics
5. develop mathematical curiosity and use inductive and deductive reasoning when solving problems
6. become confident in using mathematics to analyse and solve problems both in school and in real-life situations
7. develop the knowledge, skills and attitudes necessary to pursue further studies in mathematics
8. develop abstract, logical and critical thinking and the ability to reflect critically upon their work and the work of others

PROFILE OF EXPECTED LEARNING BEHAVIOURS

A central aspect of this curriculum is the profile of learning behaviour dimensions that should be the basis for instruction and assessment.
A learner may acquire knowledge through some learning experience. They may also show understanding of concepts by comparing, summarising, re-writing in their own words and constructing meaning from instruction.

Profile of learning behaviour dimensions

The learner may also learn to apply the knowledge acquired in some new context. At a higher level of learning behaviour, the pupil may be required to analyse an issue or problem. At a much higher level, the pupil may be required to synthesize knowledge by integrating a number of ideas to formulate a plan, solve a problem, pose a problem or compose a story problem. Further, the learner may be required to evaluate, estimate and interpret a concept. At the last level, which is the highest, learners may be required to create, invent, compose, construct and design. These six learning behaviours("knowing", "understanding", "analysis", "synthesis", "evaluation" and "creation") described are referred to as dimensions of learning. "Knowing" is a dimension, "applying knowledge" is also a dimension. More than one dimension forms a profile of learning behaviour dimensions.

In this curriculum, learning indicators are stated with action verbs to show what the learner should know and be able to do (e.g. "describe the numbers 1-5 in multiple ways, using objects …" etc. The learner being able to "describe" the activity after obtaining several experiences in it means that he/she has acquired "knowledge". Being able to explain, summarise, and give examples, etc., means that the learner has understood the concepts taught.

Similarly, being able to develop, defend, etc., means that the pupil can "apply" the knowledge acquired in some new context. You will note that each of the indicators in the curriculum contains an "action verb" that describes the behaviour the learners are expected to be able to demonstrate after a period of teaching and learning. "Knowing", "applying knowledge" etc., are dimensions that should be the prime focus of teaching and learning in schools. Teaching in most cases has tended to stress on knowledge acquisition to the detriment of other higher level behaviours such as applying knowledge.

Each action verb in any indicator indicates the underlying expected learning outcome or standard. It is therefore necessary for teachers to carefully read and comprehend[1] the standards they plan developing in their learners each week and identify the group of indicators the learners have to demonstrate for achieving these standards. Teachers must ensure the group of indicators selected for the week reflect the whole range of the profile of learning behaviour dimensions, that is, from the low level (knowing", "understanding, etc.) to the high level (solve or pose a problem, create a pattern, etc.) competences. The focus is to move learning from the didactic acquisition of "knowledge, where there is facts memorisation, heavy reliance on formulae, remembering facts without critiquing them or relating them to real world - surface learning - to a new position called deep learning. Learners are expected to deepen their learning by knowledge application to develop critical thinking skills, explain reasoning, and to generate creative ideas to solve real life problems in their school lives and later in their adult lives. This is the position where learning becomes beneficial to the learner.

Weighting of profile of learning behaviour dimensions

As already stated, it is important to consider the underlying behaviours for teaching, learning and assessment. In primary school mathematics, the three profile of learning behaviour dimensions that have been specified for teaching, learning and assessment are:

- Knowledge and Understanding 30%
- Application of Knowledge 40%
- Attitudes, Values and Process Skills 30%

Each of the learning behaviour dimensions has been given a percentage weight that should be considered in teaching, learning and assessment. The weights indicated on the right of the dimensions show the relative emphasis that the teacher should give in the teaching, learning and assessment processes.

[1]This can only happen if teachers learn to work together, in school-based in-service education (INSET), as colleagues within and across disciplines and grade levels to develop communities of STEM learners. STEM Education is an approach to teaching and learning that integrates the content and skills of the STEM disciplines (i.e. Science, Technology, Engineering and Mathematics) and other disciplines to answer complex questions, investigate global issues, solve real-world problems and challenges, and in the process, address the development of a set of personal attributes and transversal competencies needed for success in the 21st century. As well as working scientifically, STEM involves students working mathematically, working digitally (or technologically), and working like an engineer.

Emphasising the three domains of learning (cognitive, affective and psychomotor) in your teaching will ensure that mathematics will not only be taught and studied at the cognitive level but will also lead learners to the acquisition of positive attitudes and skills that will enable them to deal effectively with life in general.

The explanation of the key words involved in each profile of learning behaviour dimensions are as follows:

Knowledge and Understanding (KU)
Knowing: The ability to remember, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is the ability to remember or recall material already learnt and this constitutes the lowest level of learning.
Understanding: The ability to explain, outline, summarise, translate, rewrite, paraphrase, give examples, generalise, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some material or concept that may be verbal, pictorial, or symbolic.

Applying Knowledge (AK)
This dimension is also referred to as "Use of Knowledge". Ability to use knowledge or apply knowledge, apply rules, methods, principles, theories, etc. to situations that are new and unfamiliar. It also involves the ability to produce, solve, plan, demonstrate, discover etc.
Applying knowledge as used in this curriculum has a number of learning behaviour levels. These include analysis, synthesis, evaluation and creation. These may be considered and taught separately, paying attention to reflect each of them equally in your teaching. The dimension "Applying Knowledge", is a summary dimension for all four learning sub-levels. Details of each of the four sub-levels are as follows:

Analysing: The ability to break down material into its component parts; to differentiate, compare, distinguish, outline, separate, identify significant points etc., ability to recognise unstated assumptions and logical fallacies; ability to recognise inferences from facts etc.

Synthesising: The ability to put parts together to form a new whole. It involves the ability to combine, compile, compose, devise, plan, revise, organise, create, generate new ideas and solutions etc.

Evaluating: The ability to appraise, compare features of different things and make comments or judgment, compare, contrast, criticise, justify, argue, support, discuss, prove, conclude, prioritise, theorise, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some material, based on some criteria.

Creating: The ability to use information or materials or combine ideas or elements to create, form, produce, manufacture, invent, discover, design, or construct, formulate other (new) products.

From the foregoing, creation is the highest form of thinking and learning skill and is therefore a very critical behaviour. This unfortunately is the area where most learners perform poorly. It is therefore necessary for you to help your learners to develop a high level of thinking right from the Primary level. To be effective, competent and reflective citizens, who will be willing and capable of solving personal and societal problems, learners should be exposed to situations that challenge them to raise questions and attempt to solve problems.

ATTITUDES, VALUES AND PROCESS SKILLS

At the heart of curriculum is the belief in nurturing honest, creative and responsible citizens having the requisite skills for national development. Learners therefore need to acquire positive attitudes, values and psychosocial skills that will enable them participate actively in lessons and take a stand on issues affecting them and others. The Mathematics curriculum thus focuses on the development of attitudes, values and skills.

Values: As such, every part of this curriculum, including the related pedagogy is consistent with the following set of values:

Respect: This includes respect for the nation of Ghana, it's institutions and laws, and the culture and respect among its citizens and friends of Ghana.

Diversity: Ghana is a multicultural society in which every citizen enjoys fundamental rights and responsibilities. Learners must be taught to respect the views of all persons and to see national diversity as a powerful force for nation development. The curriculum promotes social cohesion.

Equity: The socio-economic development across the country is uneven. Consequently, it is necessary to ensure an equitable distribution of resources based on the unique needs of learners and schools. Learners are from diverse backgrounds, which require the provision of equal opportunities to all, and that all strive to care for each other both personally and professionally.

Commitment to achieving excellence: Learners must be taught to appreciate the opportunities provided through the curriculum and persist in doing their best in whatever field of endeavour as global citizens. The curriculum encourages innovativeness through creative and critical thinking and the use of contemporary technology. Ghana will instill the value of excellent service above self.

Teamwork/Collaboration: Schools are to be dedicated to a constructive and team-oriented working and learning environment. This also means that learners should live peacefully with all persons with an attitude of tolerance and collaboration.

Truth and Integrity: The curriculum aims to develop learners into individuals who: will consistently tell the truth irrespective of the consequences, be morally upright with the attitude of doing the right thing even when no one is watching, be true to themselves and lawful beliefs, and be willing to live the values of honesty and compassion. Equally important, the ethos of the work place, including integrity and grit, must underpin the learning processes to allow learners to see and apply academic skills and competencies in the world of work.

ASSESSMENT IN THE CCP

Assessment is a process of collecting and evaluating information about learners and using the information to make decisions to improve their learning. Assessment may be formative, summative, diagnostic, or evaluative depending on its purpose. It is integral to the teaching-learning process, promotes student learning and improves instruction. In CCP, it is suggested that assessment involves assessment for learning, assessment of learning and assessment as learning, which are described in the subsequent paragraphs.

Assessment for Learning (AfL)

Assessment for Learning (AfL) is the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learner is in their learning, where they need to be (the desired goal), and how best to get them there. AfL is one of the most suitable methods for improving learning and raising standards (Black and Wiliam, 1998)[2]. Assessment for Learning also refers to all their activities undertaken by teachers and/or by their learners, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. AfL can be achieved through processes such as sharing criteria with learners, effective questioning, and feedback.

AfL, therefore, provides timely feedback to ensure individual learners are assisted during the teaching and learning process using various strategies and questioning to measure the learning that has actually taken place. It is a continuous process that happens at all stages of the instructional process to monitor the progress of a learner and to offer feedback or change teaching strategies to achieve [performance standards of a lesson.

[2]Paul Black & Dylan Wiliam (1998) Assessment and Classroom Learning, Assessment in Education: Principles, Policy & Practice, 5:1, 7-74, DOI: 10.1080/0969595980050102

Assessment of Learning (AoL)

Assessment of learning provides a picture of the achieved standards of the teacher and performance of students at the terminal stage of the learning process. This information provides data for accountability and educational decisions such as grading, selection and placement, promotion and certification. Through AoL, stakeholders such as parents and guardians are informed about the extent students have attained expected learning outcomes at the end of their grade or program.

Assessment as Learning (AaL)

Assessment as Learning develops and supports students' sense of ownership and efficacy about their learning through reflective practices. This form of self-assessment helps in building the competencies of learners to achieve deeper understanding of what their own learning and what they are taught.

What do we assess?

Emphasis in assessment in the CCP is on the Common Core Learner Attributes, which are essential outcomes in the three domains of learning (i.e. cognitive, psychomotor and affective).

Knowledge and skills with emphasis on the 4Rs **in the learning areas**

Core competencies with emphasis on attitudes and values developed **through the learning and its context as well as the pedagogical approaches.**

The Process is illustrated diagrammatically in Figure 2.

How do we monitor progress?

School Based Assessments (SBA) covers all forms/modes of assessment including AfL, AaL and AoL (see Table 1), that can be undertaken by any school-level actor (learner, teacher, head teacher) to monitor the learner's achievement over a period of time. Data collection and keeping records of the data are central to the conduct of SBA.

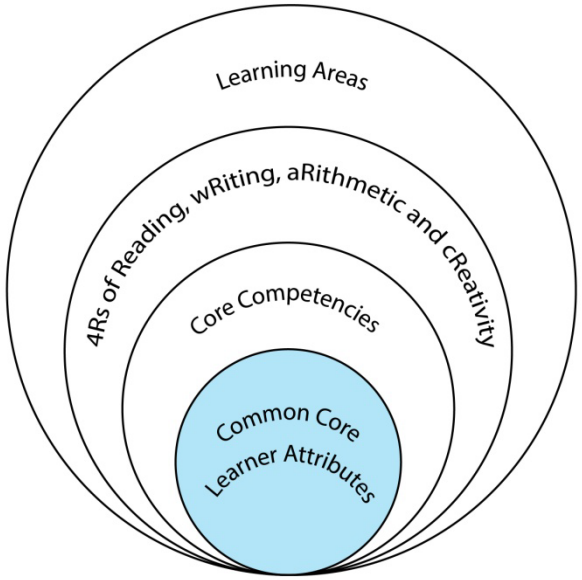


Figure 2. Essential Assessment Features

Table 1 Modes of Assessment

Assessment for Learning	Assessment of Learning	Assessment as Learning
Class exercises	Class Assessment Task (CAT)	Portfolio
Quizzes	End of term	Journal entries
Class tests (written, oral, aural and/or practical)	End of year	Project work
Class Assessment Task (CAT)		Checklist
		Questionnaire

The following are samples of relevant records that can be kept on the student's learning.

- Student's Progress Record (Cumulative Record)
- Student's Report Card
- School Based Assessment Termly Recording Register

Details of guidelines on SBA can be found in *the National Pre-tertiary Learning Assessment Framework (NPLAF)* document (Ministry of Education, 2020a)[3] and *the School-Based Assessment Guidelines* (Ministry of Education, 2020b)[4].

Reporting School-Based Assessment (SBA) in the CCP

The CCP uses a criterion-referenced model of presenting and reporting school-based assessment data. School-based assessment throughout the four-year duration of CCP, is done against criteria linked to performance standards and not against the work of other learners. The CCP provides levels of proficiency to be attained and descriptors for all grade levels of the programme (see Table 2). These levels and descriptors cannot be changed by individual schools and are, therefore, common to all learners as well as learning areas nationwide. For each assessment criterion or (benchmark for the level of proficiency), a number of descriptors are defined as shown in Table 2.

[3]Ministry of Education (2020a). National Pre-tertiary Learning Assessment Framework (NPLAF). Accra: Ministry of Education.
[4]Ministry of Education (2020b). School-Based Assessment Guidelines. Accra: Ministry of Education.

Table 2 Benchmarks, levels of proficiency and the grade level descriptors

Level of Proficiency	Benchmark	Grade Level Descriptor
1: Highly proficient (HP)	80% +	Learner shows high level of proficiency in knowledge, skills and values and can transfer them automatically and flexibly through authentic performance tasks.
2: Proficient (P)	68-79%	Learner demonstrates sufficient level of proficient knowledge, skills and core understanding; can transfer them independently through authentic performance tasks
3: Approaching Proficiency (AP)	54-67%	Learner is approaching proficiency in terms of knowledge, skills and values with little guidance and can transfer understanding through authentic performance tasks
4: Developing (D)	40-53%	Learner demonstrates developing level of knowledge, skills and values but needs help throughout the performance of authentic tasks
5: Emerging (E)	39% and below	Learner is emerging with minimal understanding in terms of knowledge, skills, and values but needs a lot of help.

The grading system presented, shows the letter grade system and equivalent grade boundaries. In assigning grades to pupils' test results, or any form of evaluation, the above grade boundaries and the descriptors may be applied. The descriptors (Highly Proficient [HP], Proficient [P], Approaching Proficiency [AP], Developing [D], Emerging [E]), indicate the meaning of each grade.
In addition to the school-based assessment (SBA), a national standards assessment test is conducted in Basic 8 to provide national level indicators on learners' achievement.

CREATIVE PEDAGOGICAL APPROACHES

The CCP emphasizes creative and inclusive pedagogies that are anchored on authentic and enquiry-based learning, collaborative and cooperative learning, differentiated learning, holistic learning, cross disciplinary learning (i.e. the 4Rs across the Curriculum) as well as developing the core competencies. This section describes some of the creative pedagogical approaches required for the CCP.

The creative pedagogical approaches include the approaches, methods and strategies for ensuring that every learner benefit from appropriate and relevant teaching and learning episodes which are timely assessed and feedback provided to the learner and other stakeholders such as parents and education authorities. It includes the type and use of appropriate and relevant teaching and learning resources to ensure that all learners make the expected level of learning outcomes. The curriculum emphasises:

- the creation of learning-centred classrooms through the use of creative approaches to teaching and learning as strategies to ensuring learner empowerment and independent learning.
- the positioning of inclusion and equity at the centre of quality teaching and learning.
- the use of differentiation and scaffolding as teaching and learning strategies for ensuring that no learner is left behind
- the use of Information Communications Technology (ICT) as a pedagogical tool.
- the identification of subject specific instructional expectations needed for making learning in the subject relevant to learners
- the integration of assessment for learning, as learning and of learning into the teaching and learning process and as an accountability strategy
- use questioning techniques that promote deepen learning

Learning-Centred Pedagogy

The learner is at the centre of learning. At the heart of the curriculum is learning progression and improvement of learning outcomes for Ghana's young people with a focus on the 4Rs – Reading, wRiting, aRithmetic and cReativity. It is expected that at each curriculum phase, learners would be offered the essential learning experiences to progress seamlessly to the next phase. Where there are indications that a learner is not sufficiently ready for the next phase, a compensatory provision through differentiation should be provided to ensure that such a learner is ready to progress with his/her cohort. At the high school, the progression phases are: B7 - B9, and B10 – B12.

The curriculum encourages the creation of a learning-centred classroom with the opportunity for learners to engage in meaningful "hands-on" activities that bring home to the learner what they are learning in school and what they know from outside of school. The learning centred classroom is a place for the learners to discuss ideas and through the inspiration of the teacher actively engage in looking for answers through working in groups to solve problems. This also includes researching for information and analysing and evaluating the information obtained. The aim of the learning-centred classroom approach is to develop learner autonomy so that learners can take ownership of their learning. It provides the opportunity for deep and profound learning to take place.

The teacher should create a learning atmosphere that ensures:

- Learners feel safe and accepted.
- Learners are given frequent opportunities to interact with varied sources of information, teaching and learning materials and ideas in a variety of ways.
- The teacher assumes the position of a facilitator or coach who helps learners to identify a problem suitable for investigation via project work.
- Problems are connected to the context of the learners' world so that it presents authentic opportunities for learning.
- Subject matter around the problem, not the discipline
- Learners responsibly define their learning experience and draw up a plan to solve the problem in question.
- Learners collaborate whilst learning.
- Demonstrate the results of their learning through a product or performance.

It is more productive for learners to find answers to their own questions rather than for teachers to provide the answers and their opinions in a learning-centred classroom.

Inclusion

Inclusion entails access and learning for all learners especially those disadvantaged. All learners are entitled to a broad and balanced curriculum in every school in Ghana. The daily learning activities to which learners are exposed should ensure that the learners' right to equal access to quality education is being met. The curriculum suggests a variety of approaches that address learners' diversity and their special needs in the learning process. These approaches when used in lessons, will contribute to the full development of the learning potential of every learner. Learners have individual needs and different learning styles, learning experiences and different levels of motivation for learning. Planning, delivery and reflection on daily learning episodes should take these differences into consideration.

The curriculum therefore promotes:

- learning that is linked to the learner's background and to their prior experiences, interests, potential and capacities;
- learning that is meaningful because it aligns with learners' ability (e.g. learning that is oriented towards developing general capabilities and solving the practical problems of everyday life); and
- the active involvement of the learners in the selection and organisation of learning experiences, making them aware of their importance in the process and also enabling them to assess their own learning outcomes.

Differentiation

This curriculum is to be delivered through the use of creative approaches. Differentiation and Scaffolding are pedagogical approaches to be used within the context of the creative approaches.

Differentiation is a process by which differences between learners (learning styles, interest and readiness to learn etc.) are accommodated so that all learners in a group have best possible chance of learning. Differentiation could be by task, support and outcome. Differentiation as a way of ensuring each learner benefits adequately from the delivery of the curriculum can be achieved in the classroom through:

- Task
- One-on-one support
- Outcome

Differentiation by task involves teachers setting different tasks for learners of different ability e.g. in sketching the plan and shape of their classroom some leaners could be made to sketch with free hand while others would be made to trace the outline of the plan of the classroom.
Differentiation by support involves the teacher providing a targeted support to learners who are seen as performing below expected standards or at risk of not reaching the expected level of learning outcome. This support may include a referral to a Guidance and Counselling Officer for academic support.
Differentiation by outcome involves the teacher allowing learners to respond at different levels. In this case, identified learners are allowed more time to complete a given task.

Scaffolding

Scaffolding in education refers to the use of a variety of instructional techniques aimed at moving learners progressively towards stronger understanding and ultimately greater independence in the learning process.
It involves breaking up the learning episode, experience or concepts into smaller parts and then providing learners with the support they need to learn each part. The process may require a teacher assigning an excerpt of a longer text to learners to read, engage them to discuss the excerpt to improve comprehension of its rationale, then guiding them through the key words/vocabulary to ensure learners have developed a thorough understanding of the text before engaging them to read the full text. Common scaffolding strategies available to the teacher include:

- giving learners a simplified version of a lesson, assignment, or reading, and then gradually increasing the complexity, difficulty, or sophistication over time.
- describing or illustrating a concept, problem, or process in multiple ways to ensure understanding.
- giving learners an exemplar or model of an assignment, they will be asked to complete.
- giving learners a vocabulary lesson before they read a difficult text.
- clearly describing the purpose of a learning activity, the directions learners need to follow, and the learning goals they are expected to achieve.
- explicitly describing how the new lesson builds on the knowledge and skills learners were taught in a previous lesson.

Information Communications Technology

ICT has been integrated into this curriculum as a teaching and learning tool to enhance deep and independent learning. Some of the expected outcomes that this curriculum aims to achieve through ICT use for teaching and learning are:

- Improved teaching and learning processes.
- Improved consistency and quality of teaching and learning.
- Increased opportunities for more learner-centred pedagogical approaches
- Improved inclusive education practices by addressing inequalities in gender, language, ability.
- Improved collaboration, creativity, higher order thinking skills.
- Enhanced flexibility and differentiated approach of delivery.

The use of ICT as a teaching and learning tool is to provide learners an access to large quantities of information online. It also provides the framework for analysing data to investigate patterns and relationships in a geographical context. Once learners have made their findings, ICT can then help them organize, edit and present information in many different ways.

Learners need to be exposed to the various ICT tools around them including calculators, radios, cameras, phones, television sets and computer and related software like Microsoft Office packages – Word, PowerPoint and Excel as teaching and learning tools. The exposure that learners are given at the Primary School level to use ICT in exploring learning will build their confidence and will increase their level of motivation to apply ICT use in later years, both within and outside of education. ICT use for teaching and learning is expected to enhance the quality and learners' level of competence in the 4Rs.

CORE COMPETENCES

The competences for mathematics describe a body of skills that educators in mathematics at all levels should seek to develop in their learners. They are ways in which practitioners and learners in the mathematics discipline engage with the subject matter as they learn the subject throughout the various phases in their education. The competences presented here describe a connected body of core skills that are acquired throughout the processes (explore, explain, extend/elaborate, and evaluate) of teaching and learning.

Critical Thinking and Problem Solving (CP)

Developing learners' cognitive and reasoning abilities to enable them analyse issues and situations leading to the resolution of problems. This skill enables learners to draw on and demonstrate what they have learned and from their own experiences analyse situations and choose the most appropriate out of a number of possible solutions. It requires that learners embrace the problem at hand, persevere and take responsibility for their own learning. In studying mathematics, assessing evidence and interpreting these sources are particularly important in developing critical thinking and problem-solving skills.

Creativity and Innovation (CI)
This competence promotes in learners, entrepreneurial skills through their ability to think of new ways of solving problems and developing technologies for addressing problems at hand. It requires ingenuity of ideas, arts, technology and enterprise. Learners who possess this competency are able to think independently and creatively as well.

Communication and Collaboration (CC)
This competence promotes in learners, skills in making use of language, symbols and texts to exchange information about themselves and their life experiences. Learners actively participate in sharing their ideas, engage in dialogue with others by listening to and learning from others in ways that respect and value the multiple perspectives of all persons involved.

Cultural Identity and Global Citizenship (CG)
Developing learners who put country and service foremost through an understanding of what it means to be active citizens by inculcating in them a strong sense of social and economic awareness. Learners make use of the knowledge, skills, attitudes acquired to contribute effectively towards the socio-economic development of the country and on the global stage. They build skills to critically analyse cultural and global trends, identify and contribute to the global community.

Personal Development and Leadership (PL)
Improving self-awareness, self-knowledge, skills, building and renewing self-esteem; identifying and developing talents, fulfilling dreams and aspirations, learning from the mistakes and failures of the past and developing other people or meeting other people's needs. It involves recognising the importance of values such as honesty and empathy; seeking the well-being of others; distinguishing between right and wrong; fostering perseverance, resilience and self-confidence; exploring leadership, self-regulation and responsibility and developing a love for lifelong learning.

Digital Literacy (DL)
Developing learners to discover, acquire and communicate through ICT to support their learning and to make use of digital media responsibly.

INSTRUCTIONAL EXPECTATIONS

The following are the major are roles the teacher is expected to undertake in the implementation of the curriculum.

1. Guide and facilitate learning by generating discourse among learners and challenging them to accept and share responsibility for their own learning, based on their unique individual differences.
2. Select mathematics content, adapt and plan lessons to meet the interests, knowledge, understanding, abilities, and experiences of learners. (It should be noted that in standards-based curriculum, lessons are not expected to be limited to only specific objective(s) but should broadly cover the processes of learning for the learners to cumulatively engage in activities/experiences to demonstrate what they know and can do (i.e. the indicators) as well as develop such core competences).
3. Work together as colleagues within and across disciplines and grade levels to develop communities of STEM[5] learners who exhibit the STEM skills including mathematical inquiry, attitudes and social values conducive to mathematics learning.
4. Use multiple methods and systematically gather data about learner understanding and ability to guide mathematics teaching and learning, with arrangements to provide feedback to both learners and parents.
5. Design and manage learning environments that provide learners with the time, space, and resources needed for learning mathematic.
6. Aid learners to make sense of problems and persevere in solving them, including using higher order reasoning and problem-solving skills.
7. Get learners to think critically about tasks and their solutions by asking questions and challenging each other's views until a consensus is reached.
8. Encourage learners to present their own ideas in ways that make sense to others and critique each other's reasoning.
9. Enable learners to work together to represent real-life situations mathematics in multiple ways (e.g. oral, text, pictures, diagrams, equations, etc.).
10. Support learners to use appropriate technologies to solve problems embedded in their culture and the larger society.
11. Provide opportunities for learners to realize that it is necessary to be precise when sharing mathematical ideas. Also, allow them to support each other to improve on their precision.

[5]STEM Education is an approach to teaching and learning that integrates the content and skills of the STEM disciplines (i.e. Science, Technology, Engineering and Mathematics) and other disciplines to answer complex questions, investigate global issues, solve real-world problems and challenges, and in the process, address the development of a set of personal attributes and transversal competencies needed for success in the 21st century. As well as working scientifically, STEM involves students working mathematically, working digitally (or technologically), and working like an engineer.

12. Guide learners to look for and express patterns or regularity in repeated reasoning.
The remaining part of the document presents the details of the standards and indicators for each grade level.

ORGANIZATION AND STRUCTURE OF THE CURRICULUM

The curriculum is organised under key headings and annotations.
Strands are the broad areas/sections of the mathematics content to be studied.
Sub-strands are the topics within each strand under which the content is organised.
Content standard refers to the pre-determined level of knowledge, skill and/or attitude that a learner attains by a set stage of education.
Indicator is a clear outcome or milestone that learners have to exhibit in each year to meet the content standard expectation. The indicators represent the minimum expected standard in a year.
Exemplar – support and guidance which clearly explains the expected outcomes of an indicator and suggests what teaching and learning activities could take to support the facilitators/teachers in the delivery of the curriculum.

A unique annotation is used to label the class, strands, sub-strands, content standards, learning indicators and exemplars in the curriculum for the purpose of easy referencing. The annotation is defined in Figure 1:

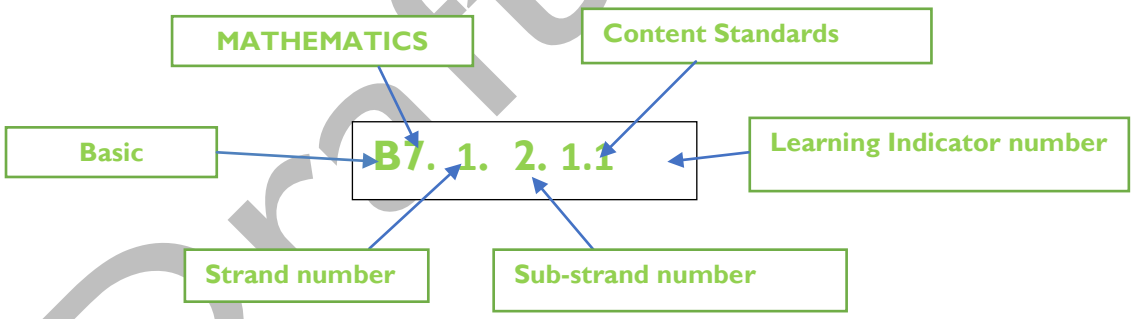
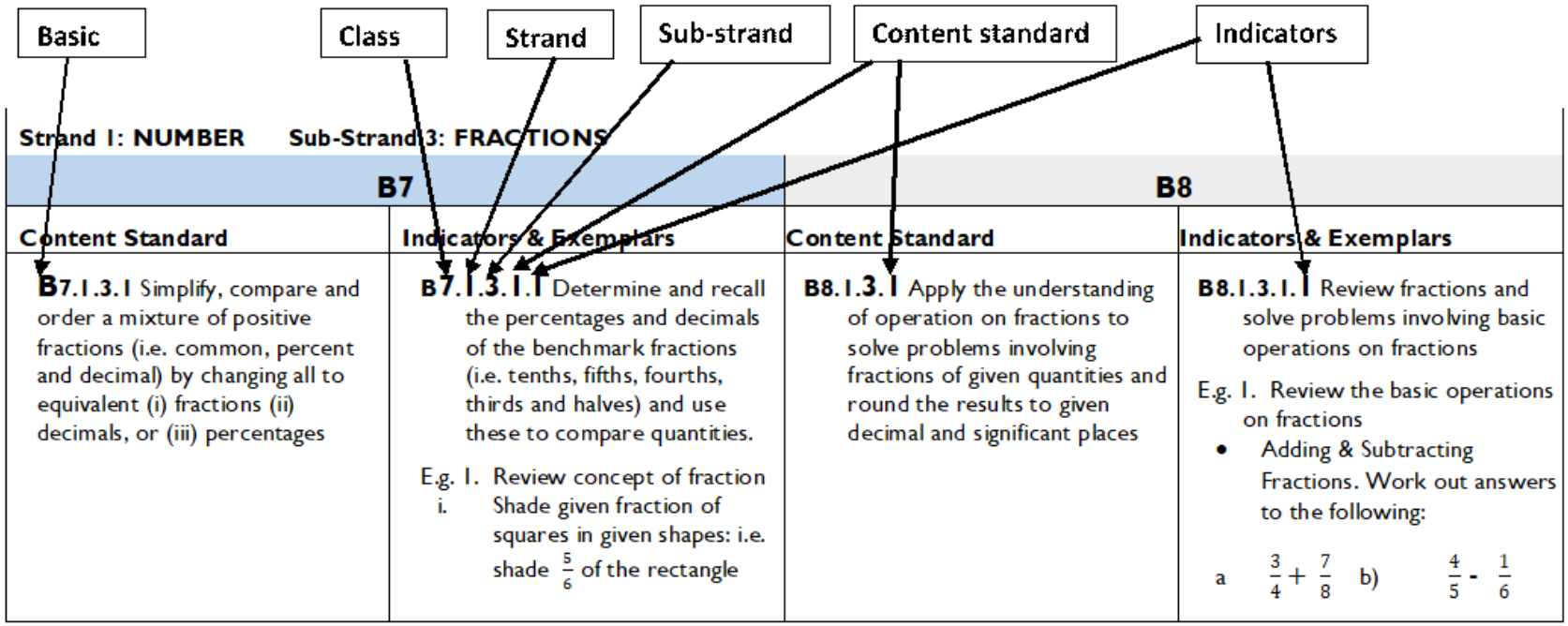


Figure 1: Curriculum Reference Numbers



The Standards in mathematics are organized under the following four strands:
1. Number
2. Algebra
3. Geometry and Measurement
4. Data.

Table 1 shows Strands, sub-strands, Scope and Sequence of the B7 – B10

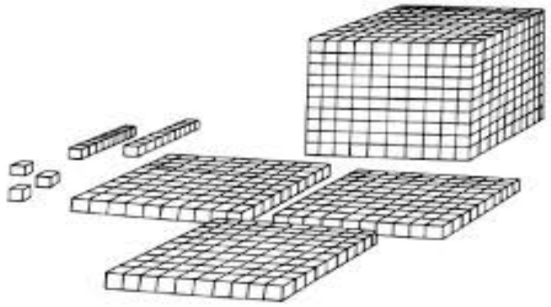
Table 1 Strands, sub-strands, Scope and Sequence of the B7 – B10

S/N	STRAND	SUB-STRAND	EXPECTED CONTENT STANDARDS			
			B7	B8	B9	B10
1.	**Number**	Number and Numeration Systems	3	3	3	3
2.		Number Operations	3	3	3	3
3.		Fractions, Decimals and Percentages	1	1	1	1
4.		Ratios and Proportion	1	1	1	1
5.	**Algebra**	Pattern and Relationships	1	1	1	1
6.		Algebraic Expressions	1	1	1	1
7.		Variables and Equations	2	2	2	2
8.	**Geometry and Measurement**	Shapes and Space	1	1	1	1
9.		Measurement and Construction	2	2	2	2
10.		Position and Transformation	1	1	1	1
11.	**Handling Data**	Data	2	2	2	2
12.		Chance or Probability	1	1	1	1
13.		**Total**	20	20	20	20

BASIC 7

Strand 1: NUMBER

SUB-STRAND 1: Number and Numeration Systems

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
	B7.1.1.1 Demonstrate understanding and the use of place value for expressing quantities recorded as base ten numerals as well as rounding these to given decimal places and significant figures.	**B7.1.1.1.1 Model number quantities more than 1,000,000,000 using graph sheets, isometric papers and multi-base blocks** E.g.1. Model number quantities up to 1,000,000,000 (one billion) using graph sheets or multi-base materials. For instance, with multi-base blocks one cube = 100,000, one rod = ten of the cubes (1,000,000) and a flat =10,000,000, and a block =100,000,000 as shown below.  i. Determine how many blocks will make a billion. E.g.2. Use multiples of 10s, 50s, 100s and 200s to represent numbers in multiples of ways (make sure each figure is used) i. 5,560 = 20×200 + 10×100 +11×50 + 1×10; or = 15×200 + 20×100 +10×50 + 6×10; etc	Show a strong sense of belongingness to one's culture **Ability to combine Information and ideas from several sources to reach a conclusion**

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td></td><td>E.g.3. Use token (or paper made currency notes) such as GH¢20, GH¢50, GH¢100 and GH¢200 to work out how many of each denomination would be required to model given amount up to one billion.
i. Workout how many GH¢200 will make GH¢185, 000,000, GH¢1,890,750,000, etc
ii. Determine combinations of GH¢50, GH¢100 or GH¢200 notes that make GH¢1,000,000 (make sure each denomination is used);</td><td></td></tr>
<tr><td>1.
2.</td><td></td><td>B7.1.1.2 Compare and order whole numbers more than1,000,000,000andrepresentthecomparison using ">, <, or="
E.g.1.Skipcountforwardsandbackwardsin 25s,50sand250s beginning from 1000.
E.g.2. Learners identify numbers which are for instance, 500,000 more than or less than a given 8-digit or 9-digit number.
Example, 1,296,300,000 is 500,000 more than 1,295,800,000 and 1,295,300,000 is 500,000 less than 1,295,800,000
E.g.3. Use phrases such as “is equal to”, “is greater than” and “is less than' as well as their symbols such as “>”, “<” and “=” to compare any two numbers.
Example: 1,300,850,700 = 1,300,850,700
5,223,487,637 >5,113,487,637 etc
E.g.4. Identify, read and write numbers in given positions in a number chart.
<table>
<tr><td>187,500</td><td>687,500</td><td>1,187,500</td><td>1,687,500</td></tr>
<tr><td>2,187,500</td><td>2,687,500</td><td>3,187,500</td><td>3,687,500</td></tr>
<tr><td>4,187,500</td><td>4,687,500</td><td>5,187,500</td><td>5,687,500</td></tr>
</table>
For example, which number is on the right of 3,187,500? Write the number in words.</td><td>Identify and analyse different points of views of speakers
Ability to combine Information and ideas from several sources to reach a conclusion</td></tr>
</table>

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr>
<td>3.

4.</td>
<td></td>
<td>
B7.1.1.1.3 Round (off, up, down) whole numbers more than 1,000,000,000 to the nearest hundred-thousand, ten-thousands, thousands, hundreds and tens

E.g. 1. Round off whole numbers up to over 1,000,000,000 to the nearest hundred-thousands, ten-thousands, thousands, hundreds, etc.

Example, 1,879,653 is 1,900,000 to the nearest hundred thousand and 1,880,000 to the nearest ten thousand

E.g. 2. Explain the differences between the" round up" and "round down" concepts.

When rounding up, we consider the larger number, while when rounding down, we consider the smaller of the two. The table below may bring out the meaning of the concept.

<table>
<tr><th>2,846,655</th><th>Round up</th><th>Round down</th><th>Round off</th></tr>
<tr><td>To the nearest thousand</td><td>2,847,000</td><td>2,846,000</td><td>2,847,000</td></tr>
<tr><td>To the nearest ten thousand</td><td>2,850,000</td><td>2,840,000</td><td>2,850,000</td></tr>
<tr><td>To the nearest hundred thousand</td><td>2,900,000</td><td>2,800,000</td><td>2,800,000</td></tr>
</table>

E.g.3. Express whole numbers of significant figures
(i) 857386321
-five significant figures
-four significant figures

-three significant figures etc.
</td>
<td>Ability to monitor team members to ascertain progress

Reflect on work and explore thinking behind thoughts and processes</td>
</tr>
</table>

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>5.
6.
7.
8.</td><td></td><td>B7.1.1.1.4 Rounddecimals to the nearest tenth, hundredth, thousandths, etc.
E.g.1 Round (off, up and down) decimals to the nearest tenths, hundredths, thousandths…….
i. Round 486.3685 as indicated in the table below
<table>
<tr><td>Number</td><td>Round to the nearest tenths</td><td>Round to the nearest hundredths</td><td>Round to the nearest thousandths</td></tr>
<tr><td>486.3685</td><td>486.4</td><td>486.37</td><td>486.369</td></tr>
<tr><td>0.0605368</td><td>0.1</td><td>0.06</td><td>0.061</td></tr>
</table>
<table>
<tr><td>78.4604783</td><td>Round up</td><td>Round off</td><td>Round down</td></tr>
<tr><td>nearest tenths</td><td>78.5</td><td>78.5</td><td>78.4</td></tr>
<tr><td>nearest hundredths</td><td>78.47</td><td>78.46</td><td>78.46</td></tr>
<tr><td>nearest thousandths</td><td>78.460</td><td>78.460</td><td>78.460</td></tr>
</table></td><td>Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem</td></tr>
<tr><td>9.
10.
11.
12.</td><td></td><td>B7.1.1.1.5 Express decimal numerals to given significant and decimal places
E.g.1 Explain when zero (0) is significant in a decimal numeral
i. 0.360 (3sf)
ii. 7.021 (4sf)
E.g.2. Round the following numbers to
0.00234567 and 84.40995000
i. 3sf
ii. 4sf
iii. 6sf
E.g.3. Express decimal numbers to a given number of decimal places
(i) 745.9674 correct to
-three decimal places
-two decimal places
-one decimal place
ii. Musa measured the lengthof his teacher's table and corrected his measurement to 2 decimal places as 0.76m. State the possible actual readings Musa might have obtained.
iii. Investigate similar problems on significant figures.</td><td>Exhibit strong memory, intuitive thinking; and respond appropriately
Preparedness to make better decision with information at hand</td></tr>
</table>

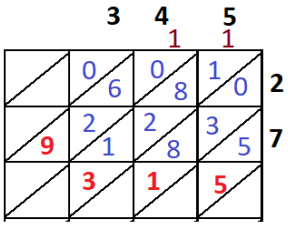
Strand 1: NUMBER

SUB-STRAND 2: Number Operations

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
13. 14. 15. 16.	**B7.1.2.1 Apply mental mathematics strategies and number properties used to solve problems**	**B7.1.2.1.1 Multiply and divide given numbers by multiples of 10 including decimals and benchmark fractions** E.g.1. Recall multiplication facts up to 144 and related division facts. E.g.2. Recall decimal names of given benchmark fractions converted to decimals or percentages (and vice versa) E.g. 3. Find the product of a given decimal number when it is multiplied by 10, 100, 1000, $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, etc. i. 105.25 × 1000 ii. 105.25 × $\frac{1}{100}$	**Exhibit strong memory, intuitive thinking; and respond appropriately** **Ability to merge simple/ complex ideas to create novel situation or thing**
17. 18. 19.		**B7.1.2.1.2 Apply mental mathematics strategies and number properties used to do calculation** E.g. 1. Apply the halving and doubling technique to determine the product of two given numbers. i. 28 x 5, think 14 x 10=140 ii. 125 x 4, think (125 x 2) x 2 = 250 x 2 = 500 E.g. 2. Apply the distributive property to determine a given product of two numbers i. 7 x 15, think 7 × (10 + 5) = 70 + 35 = 105 ii. 18 × 6, think (20 − 2) × 6 = 20 × 6 − 6 × 2 = 120 −12 = 108	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
20. 21. 22.		**B7.1.2.1.2 Apply mental mathematics strategies to solve word problems.** E.g. 1. Play mental mathematics games: - should engage learners to use mental strategies to do; i. addition through words like - plus, add, calculate the sum, increase a number by, and find the total; ii. subtraction from words like - minus, from a number take, minus, find the difference, and what must be added to make; iii. multiplication through words like - times, multiply, find the product, square, and what must be divided by … to give …; iv. division through words like - divide, share, how many times does it go into? and what must be multiplied by … to give … E.g.2. Play mental mathematics games: Find the cost of three 5 kg bags of rice at ¢2 per kg. i. What is the cost of 1 dozen of eggs at 80 pesewas each? ii. 8 x 99. iii. 28 x 25. iv. How many 21cm pieces can I cut off a string one metre long? v. What fraction of a litre is 250ml? vi. The area of a square board is 81 cm^2. What is its perimeter? vii. Two angles of a triangle add up to 98°. What is the size of the third angle? viii. How many minutes from 10.15 a.m. to noon? *ix.* 60 pesewas as a decimal of ¢2.40?	**Exhibit strong memory, intuitive thinking; and respond appropriately** **Ability to merge simple/ complex ideas to create novel situation or thing** **Ability to try alternatives and fresh approaches**

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
23.	**B.7.1.2.2 Demonstrate an understanding of addition, subtraction, multiplication and division of (i) whole numbers, and (ii) decimal numbers, to solve problems.**	**B7.1.2.2.1 Add and subtract up to four-digit numbers.** E.g.1. Use partitioning (or expanded form) and place value system to add and subtract whole and decimal numbers i) Add 785 and 9,342 785 = 700+80+5 + 9,342 = 9000+300+40+2 10,127 = 9000+1000+120+7 ii) Add 327.6 and 54.13 327.60 = $300 + 20 + 7 + \frac{6}{10} + \frac{0}{100}$- --- + 54.13 = $50 + 4 + \frac{1}{10} + \frac{3}{100}$ 381.73 = $300 + 70 + 11 + \frac{7}{10} + \frac{3}{100}$ iii) Subtract 7.85 from 93.6 93.60 = $90 + 3 + \frac{6}{10} + \frac{0}{100}$- --- − 7.85 = $7 + \frac{8}{10} + \frac{5}{100}$ 85.75 = $80 + 5 + \frac{75}{100}$----	**Ability to combine Information and ideas from several sources to reach a conclusion** **Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation**

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
24.		**B71.2.2.2 Multiply or divide multi-digit numbers by 1- and 2- digit numbers** E.g.1 Use partitioning/expanded form to multiply and divide efficiently i) Multiply 584 by 8 584 = (500+ 80+4) × 8 = x8 4,000+640+32 4,672 = 4,672 E.g.2. Multiply whole numbers using the vertical place value method or lattice method: i. Place value method 345x27 = 345 x 27 2,415 + 6,900 9,315 Lattice method: Draw a 2 by 3 lattice for solving 345 × 27.  E.g.3 Use the distributive property to multiply 325x 15 =325 x (10 + 5) = 325 x 10 +325 x 5 =3,250 + 1,625 =4,875	**Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation**

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
25.		E.g.4 Investigate and determine basic division facts including divisibility test (i) determine how a given number is divisible by 2,3, 4, 5, 6, 7 8, 9,10, etc For example, a number is divisible by 3 if the sum of its digits is divisible by 3. So, 72 is divisible by 3 because 7+2 = 9. Hence since 9 is divisible by 3, then 72 is divisible by 3. Also, to find out if a number is divisible by 7, take the last digit in the number then double it and subtract from the rest of the number. If the answer is 0 or a multiple of 7, then the number is divisible by 7. So, 595 is divisible by 7 because 5 x 2 =10. 59 – 10 = 49. Therefore, 595 is divisible by 7.	**Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem** **Create simple logic trees to think through problems**
26. 27.		**B7.1.2.2.3. Create and solve story problems involving decimals on the four basic operations.** E.g. 1. Solve word problems (i) A group of two hundred and fifteen men and seven hundred and eighty-four women went to watch a musical concert. An amount of GH¢25 was collected at the gate from each person. How much money was collected all together? (ii) Mrs Adamu bought 13.6kg of meat. Mrs Anderson bought 2.4kg of meat less than Mrs Adamu. How many kilograms of meat did they buy all together? (iii) Ebo weighs 28.6kg. His father weighs four times as heavy. What is the total weight of Ebo and his father? (iv) Mrs Armah bought 45.75 metres of linen for her five children. If they share the material equally, how many metres of linen did each receive?	**Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem**

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>28.

29.</td><td></td><td>E.g.2 Solve word problems on data presented in a table

(i) In preparation towards an open day anniversary, a school's Management Committee approved the following budget on some projects.

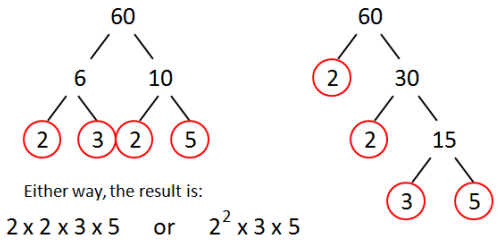
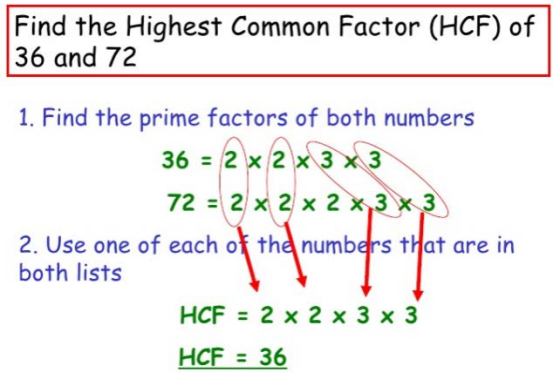
<table><tr><td>Activity</td><td>Cost (GH¢)</td></tr><tr><td>Painting school building</td><td>4,580</td></tr><tr><td>Mending cracks on the basketball pitch</td><td>3,050</td></tr><tr><td>Restock the library with new books</td><td>2,690</td></tr><tr><td>Buying of choir robes</td><td>5,340</td></tr><tr><td>Buying prizes for awards</td><td>4,270</td></tr></table>
(a) How much was approved for painting the school building and buying choir robes?

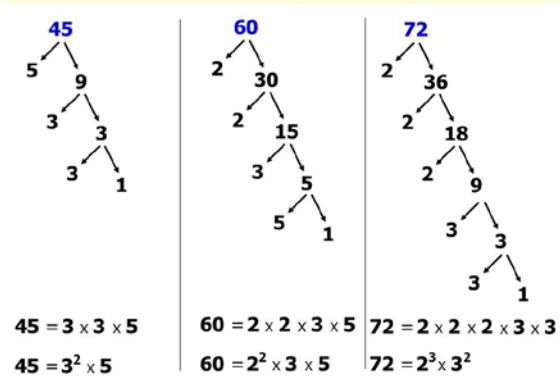
(b) How much more was to be spent on mending the cracks on the basketball pitch than restocking the library with new books?

(c) How much was spent on buying prizes for awards if twice the amount approved was spent on this activity?</td><td></td></tr>
</table>

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1. 2. 3. 4.	**B7.1.2.3 Demonstrate understanding and the use of powers of natural numbers in solving problems.**	**B7.1.2.3.1 Illustrate with examples the meaning of repeated factors using counting objects such asbottle tops or bundle sticks.** **E.g.1:** Model repeated factors using counters or bottle tops. E.g. 3×3×3, is repeated factors, and each factor is 3. **E.g.2** Explain what is meant by a power of a number. E.g. $2\times2\times2\times22 = 2^5=32$ **E.g.3** Explain the features of power 2^3 The 2 in 2^3 is the base, while the 3 in 2^3 is the exponent or index	**Exhibit strong memory, intuitive thinking; and respond appropriately** **Ability to serve group members effectively** **Ability to visualise alternatives, seeing possibilities, problems and challenges**
5. 6.		**B7.1.2.3.2 Express a given number as a product of a given number or numbers, as well as, inthe form of a power or two such numbers as product of powers** **E.g. 1)** $32 = 2\times2\times2\times2\times2 . = 2^5$ **2)** $81 = 3\times3\times3\times3 = 3^4$ **3)** $49 = 7\times7 = 7^2$ **4)** $16 \times 27 = 2\times2\times2\times2 \times 3\times3\times3 = 2^4 \times 3^3$	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
7.		**B7.1.2.3.3 Show that the value of any natural number with zero as its exponent or index is 1 and use it to solve problems.** **E.g.1** Verify why the value of any natural number with exponent zero is 1. Verification:. $\frac{x}{x} = 1$, but from indices, $\frac{x}{x} = x^0$, hence $x^0 = 1$ for any natural number Thus: if we have $\frac{4}{4}$, the result is 1. This can also be done using powers of numbers. That is, $\frac{4}{4} = 2^2 \div 2^2 = 2^{2-2} = 2^0 = 1$. Therefore, any natural number with an exponent of 0 is 1. Also, if we have $\frac{27}{27}$, the result is 1. This can also be done using powers of numbers. That is, $\frac{27}{27} = 3^3 \div 3^3 = 3^{3-3} = 3^0 = 1$. Therefore, any natural number with an exponent of 0 is 1.	**Look and think about things differently and from different perspective**
8. 9.		**B7.1.2.3.4 Find the value of a number written in index form.** **E.g.1)** $5^3 = 5\times5\times5 = 25 \times 5 = 125$ **2)** $3^4 = 3\times3\times3\times3 = 9 \times 9 = 81$ **3)** $6^3 = 6\times6\times6 = 36 \times 6 = 216$ **4)** $\frac{1}{2^5} = \frac{1}{2\times2\times2\times2\times2} = \frac{1}{32}$	**Interpret and apply learning in new context**

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
10. 11.		**B7.1.2.3.5 Apply the concept of powers of numbers (product of prime) to find HCF.** **E.g.1** Expand a given number using product of prime  Either way, the result is: $2 \times 2 \times 3 \times 5$ or $2^2 \times 3 \times 5$  	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
12.		**E.g.2** Find the HCF using prime factorisation So the highest common factor for 36 and 72 = 36  So the highest common factor for 45, 60 and 72 = 3	

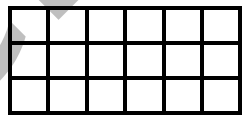
STRAND 1: Number

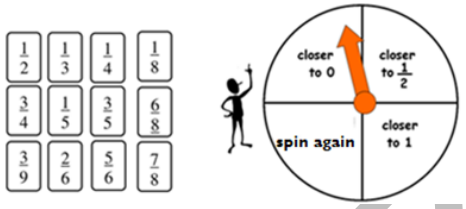
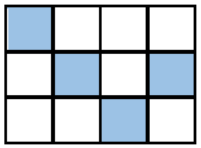
SUB-STRAND 3: Fractions, Decimals and Percentages

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr>
<td>1.

2.
3.

4.

5.</td>
<td>B7.1.3.1 Simplify, compare and order a mixture of positive fractions (i.e. common, percent and decimal) by changing all to equivalent (i) fractions (ii) decimals, or (iii) percentages</td>
<td>
B7.1.3.1.1 Determine and recall the percentages and decimals of given benchmark fractions (i.e. tenths, fifths, fourths, thirds and halves) and use these to compare quantities.
E.g. 1. Review the concept of fraction
i. Shade given fraction of squares in given shapes: i.e. shade $\frac{5}{6}$ of the rectangle

ii. Write down 3 fractions equivalent to $\frac{2}{3}$
iii. Express the fraction $\frac{6}{10}$ in its simplest form: $\frac{6}{10} = \frac{3}{5}$
iv. Convert to mixed numbers: $\frac{12}{5}$
v. Convert to improper fractions: $2\frac{5}{9}$
E.g. 2. Work out common, anddecimal fractions and percent equivalences of given benchmark fractions to complete a table.
<table>
<tr><td>Common</td><td>$\frac{1}{10}$</td><td>A</td><td>$\frac{1}{4}$</td><td>$\frac{1}{3}$</td><td>B</td><td>C</td><td>$\frac{2}{3}$</td></tr>
<tr><td>Percent</td><td>10%</td><td>20%</td><td>D</td><td>E</td><td>50%</td><td>F</td><td>G</td></tr>
<tr><td>Decimal</td><td>0.1</td><td>H</td><td>I</td><td>J</td><td>K</td><td>0.4</td><td>L</td></tr>
</table>
</td>
<td>Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation</td>
</tr>
</table>

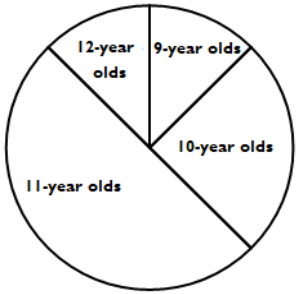
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
6.		E.g. 3. Identifying fractions which are (i) closer to half; (ii) closer to one; and (iii) closer to zero in games with fraction cards and fraction wheel. Spin the fraction wheel and pick the right fraction to win a fraction card. 	
7.		E.g. 4. Simplify, compare and order common fractions. i. Determine the fraction which is the simplest form of a given set of fractions. Example, What is the simplest form of the fraction represented by the diagram below?  $\frac{4}{10}$, $\frac{4}{12}$, $\frac{7}{8}$, $\frac{1}{3}$ and $\frac{1}{4}$. ii. Which symbol (<, = or >) makes the sentence "$\frac{3}{5}$ ... $\frac{2}{3}$" true? iii. Find which fraction is greater: $\frac{7}{12}$ and $\frac{8}{10}$.	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
8. 9. 10. 11. 12.		**B7.1.3.1.2 Compare and order fractions (i.e. common, percent and decimal fractions up to thousandths) limit to the benchmark fractions.** E.g. 1. Arrange in descending order, the following fractions $\frac{5}{6}, \frac{3}{4}$ and $\frac{7}{8}$. E.g. 2. Find which decimal fractions is greater: 0.99 is greater than 0.977. E.g. 3. Order the decimal numbers 0.098, 0.985 and0.123 from least to greatest. E.g. 4. Compare and order common and decimal fractions and percent, and express them in one form (i.e. either common, decimal or percent). For instance, to order 0.832, $\frac{3}{8}$and 38% from least to largest; we have $0.832 = \frac{832}{1000}$ = 83.2%, $\rightarrow \frac{3}{8} = \frac{375}{1000}$ = 37.5%, $38\% = \frac{38}{100}$ = 0.38%, Hence the order from least to the largest is $\frac{3}{8}$, 38% and 0.832.	Ability to work with all group members to complete a task successfully Ability to combine Information and ideas from several sources to reach a conclusion
13. 14. 15.	**B7.1.3.2 Demonstrate an understanding of the process of addition and/or subtraction of fractions and apply this in solving problems**	**B7.1.3.2.1 Explain the process of addition and subtraction of two or three unlike and mixed fractions** E.g. 1. To add mixed fractions, i.e. $2\frac{2}{5}$ and $1\frac{2}{3}$, we first add the whole numbers and then add the fractions; i.e. $2 + 1 + \frac{2}{5} + \frac{2}{3} = 3 + \frac{6}{15} + \frac{10}{15} = 3\frac{6+10}{15} = 3\frac{16}{15} = 4\frac{1}{15}$ E.g. 2. To subtract mixed fractions, i.e. $2\frac{4}{5}$-$1\frac{2}{3}$, we first subtract the whole numbers and then subtract the fractions; i.e. $(2 - 1) + \frac{4}{5} - \frac{2}{3} = 1\frac{12-10}{15} = 1\frac{2}{15}$ Alternatively, we may change the mixed fractions to improper fractions first.	Understand and use interpersonal skills Ability to combine Information and ideas from several sources to reach a conclusion

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
16.		**B7.1.3.2.2 Solve problems involving addition or subtraction of fractions.** E.g. 1. Solve word problems involving addition or subtraction of fractions. i. $3\frac{1}{3}$ feet are cut off a board that is $12\frac{1}{4}$ feet long. How long is the remaining part of the board? ii. The Musa family decided to hike to a waterfall, approximately 8⅝ kilometres away. After an hour the lake was still 5⅓ kilometres away. How far did the group hike so far? iii. If you add 2 fractions and the sum is greater than ½, what can you say about the fractions.	Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
17. 18. 19.	**B7.1.3.3 Demonstrate an understanding of the process of multiplying and dividing positive fractions and apply this in solving problems**	**B7.1.3.3.1 Explain the process of multiplying a fraction (i.e. common, percent and decimal fractions up to thousandths) by a whole number and by a fraction** E.g. 1. To multiply a whole number by a fraction, the multiplication is read as 'times'. For instance, $3 \times 2\frac{2}{3}$ means 3 times $2\frac{2}{3}$ or 3 groups of $2\frac{2}{3}$; i.e. $3 \times (2 + \frac{2}{3})$ or $3 \times \frac{8}{3}$. The product can be obtained by (i) changing all into common fraction; (ii) multiplying all numerators and denominators; (iii) simplifying the results. Find 1. $15 \times \frac{2}{3}$ 2. $12 \times \frac{3}{8}$. E.g. 2. To multiply a fraction by a whole number, the multiplication is read as 'of'. for instance, $\frac{2}{3} \times 5$ means $\frac{2}{3}$ of 5 or i.e. $\frac{2}{3} \times \frac{5}{1} = \frac{2 \times 5}{3 \times 1} = \frac{10}{3} = 3\frac{1}{3}$. The product can be obtained by (i) changing all into common fraction; (ii) multiplying all numerators and denominators; (iii) simplifying the results. [Note: (ii) and (iii) can be alternated] Find (i)$\frac{2}{3} \times 240$ (ii). $\frac{3}{8} \times 480$	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation Implement strategies with accuracy

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
20.		E.g. 3. Calculate the following (when necessary, round your answer to the nearest tenth): a. 28% of 40 b. 234% of 8 c. 3½ % of 50 d. 0.2% of 15000 e. 8.25% of 62 E.g. 4. To multiply a fraction by a fraction, the multiplication is read as 'of'. For instance, $\frac{2}{3}\times\frac{1}{2}$ means $\frac{2}{3}$ of $\frac{1}{2}$ or i.e. $\frac{2}{3}\times\frac{1}{2}=\frac{2\times1}{3\times2}=\frac{2}{6}=\frac{1}{3}$. The product can be obtained by (i) changing all into common fraction; (ii) multiplying all numerators and denominators; (iii) simplifying the results. [Note: (ii) and (iii) can be alternated] Find (i)$\frac{2}{3}\times\frac{3}{5}(ii)\frac{3}{8}\times\frac{5}{6}$	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation Implement strategies with accuracy
21. 22. 23. 24.		**B7.1.3.3.2 Find a fraction of given quantity (i.e. money or given quantity of objects)** E.g. 1. To multiply a given quantity by afraction is just like multiplying by a whole number, so the multiplication is read as 'of'.For instance, $\frac{2}{3}\times$GH¢60 means $\frac{2}{3}$ of GH¢60, i.e. $\frac{2}{3}\times\frac{60}{1}=\frac{2\times60}{3\times1}=$GH¢40. E.g. 2. There are 132 pupils in a class. If $\frac{2}{3}$ of the pupils are girls, how many boys are in the class? E.g. 3. The graph shows the ages of pupils in a Primary 5 class. (i) Approximately, what fraction of the pupils are 10 years old? (ii) How many pupils are 11 years old if there are 32 pupils in the class? 	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
25. 26.		**B7.1.3.3.3 Explain the process of dividing a fraction (i.e. common, percent and decimal fractions up to thousandths) by a 1-digit whole number and by a fraction** E.g. 1. To divide a whole number by a fraction, the division means 'how many times the fraction goes into the whole number' or the product of the fraction and which number makes 3? For instance, $3 \div \frac{1}{4}$ means how many $\frac{1}{4}$s can be obtained in 3, or $3 = \frac{1}{4} \times \square$. The quotient can be obtained by multiplying both dividend by divisor the reciprocal of the divisor. For $3 \div \frac{1}{4}$, the reciprocal of the divisor is $\frac{4}{1}$, hence $3 \div \frac{1}{4} \rightarrow (3 \times \frac{4}{1}) \div (\frac{1}{4} \times \frac{4}{1}) = 12$, and for $\frac{1}{4} \div 3$, the reciprocal of the divisor is $\frac{1}{3}$, hence $\frac{1}{4} \div 3 \rightarrow (\frac{1}{3} \times \frac{1}{4}) \div (3 \times \frac{1}{3}) = \frac{1}{12}$ Divide: 1. $5 \div 1\frac{2}{3}$ 2. $\frac{5}{8} \div \frac{1}{2}$	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem Ability to explain plans for attaining goalso
27. 28.		**B7.1.3.3.4 Determine the result of dividing a quantity (i.e. money or objects) or a fraction by a fraction** E.g. 1. A set of stacked plates for serving snacks at a party weighs 10 kg. If each plate in the stack weighs $\frac{1}{4}$kg, how many plates are in the stack? To divide by a fraction, multiply both dividend by divisor the reciprocal of the divisor, hence $10 \div \frac{1}{4} \rightarrow (10 \times \frac{4}{1}) \div (\frac{1}{4} \times \frac{4}{1}) = 40$ $(10 \times \frac{4}{1}) \div (1) = (10 \times \frac{4}{1}) = 40$	Ability to combine Information and ideas from several sources to reach a conclusion

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
29. 30.		E.g. 2. A class was given $9\frac{1}{2}$ litres of fruit juice to share equally. If there are 36 pupils in the class, how many millilitres of fruit juice will each student get? E.g. 3. The graph shows the ages of pupils in a Primary 5 class. How many pupils are in the class if there are twelve 10-year-old pupils in the class?  	

STRAND 1: Number

SUB-STRAND 4: Number: Ratios and Proportion

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1. 2. 3. 4.	**B7.1.4.1 Demonstrate an understanding of the concept of ratios and its relationship to fractions and use it to solve problems that involve rates, ratios, and proportional reasoning**	**B7.1.4.1.1 Find ratio and use ratio language to describe relationship between two quantities.** **E.g. 1** Determine ratio of given quantities. i. There are 60 boys and 120 girls in a school. So the ratio of boys to girls in the school is $\frac{60}{120} = \frac{1}{2}$= 1:2) **E.g.2** Express two quantities as ratio. i. The ratio of wings to beaks in the bird house at the Kumasi Zoo is 2:1, because for every 2 wings there is 1 beak. **E.g.3** Describe quantities with ratio language i. The ratio of Musa to Alhasan's age is 1:2. If Alhasan is 50 years old and his son, Musa is 25 years old, we can say that • Alhasan is twice as old as his son. • Musa is half the age of his father.	Ability to combine Information and ideas from several sources to reach a conclusion Can vary the level of detail and the language use when presenting to make it appropriate to the audience
5. 6.		**B7.1.4.1.2 Use the concept of a unit rate $\frac{a}{b}$ associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship.** **E.g.1** Write given ratios as unit rate $\frac{a}{b}$. i. This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is $\frac{3}{4}$ cups of flour for each cup of sugar. ii. Aisha polishes 8 square yards of floor tiles every 7 minutes, so there are $\frac{8}{7}$ square yards per minute.	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>7.</td><td></td><td>E.g.2 Work out rates and use them in solving problems.
i. If 2 litres of coke cost GH¢18, find the cost of (a) 1. 5 litres (b) 3 litres (c) 7 litres
E.g.3 Use tables/diagrams to explain the concept of rate that compares two different quantities measured in different units
i. The table shows the weight and cost of meat at Salaga Market. If 3kg of meat costs GH¢ 60,use the information to complete the table.
<table>
<tr><td>Meat (kg)</td><td>2</td><td>3</td><td>5</td><td>12</td></tr>
<tr><td>Cost (GH¢)</td><td></td><td>60</td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>8.

9.</td><td></td><td>B7.1.4.1.3 Make tables of equivalent ratios (written as common fractions) relating quantities that are proportional.
E.g.1 Kafui, Adoley and Jantuah shared an amount of money in the ratio of their ages. Kafui is 36 years old, Adoley is 48years and Jantuah is 24years old.If Jantuah received GH¢24000, how much money did they share?
Solution
<table>
<tr><th>Names</th><th colspan="4">Equivalent Ratios</th></tr>
<tr><td>Kafui</td><td>36</td><td>18</td><td>9</td><td>3</td></tr>
<tr><td>Adoley</td><td>48</td><td>24</td><td>12</td><td>4</td></tr>
<tr><td>Jantuah</td><td>24</td><td>12</td><td>6</td><td>2</td></tr>
</table>
Hint: any of these ratios can be used for the calculation.
$2 \rightarrow 24000$
$9 \rightarrow x$
$9 \times 24000 = 2x$
$9 \times 12000 = x$
x = 108,000,
Hence, the amount of money shared = ¢108,000</td><td>Ability to effectively define goals towards solving a problem
Ability to combine Information and ideas from several sources to reach a conclusion</td></tr>
</table>

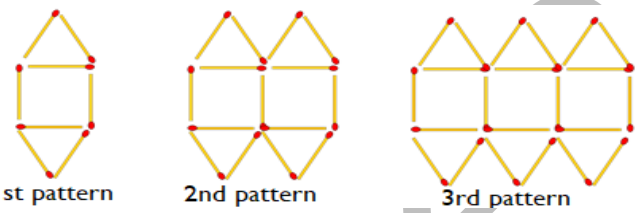
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
10. 11.		**B7.1.4.1.4 Use the proportional reasoning to find missing values in the tables, and plot pairs of values on the coordinate plane.** **E.g. 2** Find the missing value marked x in a table of equivalent ratios 3 | 10 6 | x 9 | 30 y | 40 $\frac{x}{6} = \frac{10}{3}$ *means the value of* $x = \frac{10}{3} \times 6 = \frac{60}{3} = 20$	Ability to combine Information and ideas from several sources to reach a conclusion
12. 13.		**B7.1.4.1.5Find a percent of a quantity as a rate per 100 (e.g. 30% of a quantity means $\frac{30}{100}$times the quantity);** i. A salesman gets paid 35% commissions. How much commission does he make on sales of GH¢700? ii. Yaw bought a shirt that was on sale for GH¢75 after a 10% discount. What was the original price? iii. A cell phone case which regularly sells for GH¢450 is on sale for 40% off. How much would you pay for the phone? iv. A woman put GH¢520 into a savings account for one year. The rate of interest on the account was 6%. How much was the interest for the year?	Ability to combine Information and ideas from several sources to reach a conclusion Preparedness to recognise and explain results after implementation of plans

STRAND 2: Algebra
SUB-STRAND 1: Patterns and Relations

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr>
<td>1.

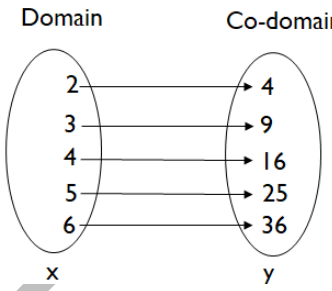
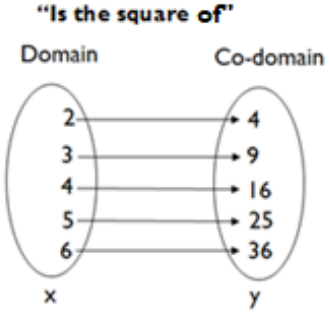
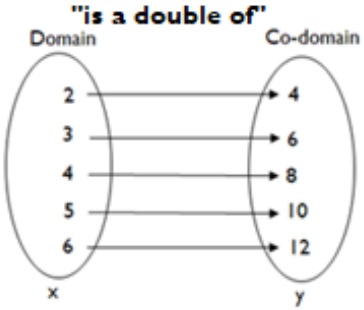
2.

3.</td>
<td>B7.2.1.1 Derive the rule for a set of points of a relation, draw a table of values to graph the relation in a number plane and make predictions about subsequent elements of the relation.</td>
<td>
B7.2.1.1.1 Extend a given relation presented with and without symbolic materials and explain how each element differs from the preceding one.

E.g.1 Extend a given symbolic relation

1st pattern 2nd pattern 3rd pattern
i. Study the pattern made with match sticks below and draw the fifth pattern.
ii. How does each pattern differ from the pattern that comes before it?
iii. Copy and complete the table for the number of sticks in each pattern.
<table>
<tr><td>Pattern No.</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Number of sticks</td><td>8</td><td>15</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
E.g.2 Study the pattern of numbers below and complete table.
<table>
<tr><td>Domain</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Co-domain</td><td>4</td><td>7</td><td>10</td><td></td><td>16</td><td></td><td></td></tr>
</table>
i. What are the missing numbers in the co-domain?
</td>
<td>Exhibit strong memory, intuitive thinking; and respond appropriately

Ability to look at alternatives in creating new things

Ability to visualise alternatives, seeing possibilities, problems and challenges</td>
</tr>
</table>

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
4.		E.g.3Extend a given number relation **i.** If the next number in the domain is 9, what will be the corresponding number in the co-domain?  	
5. 6.		**B7.2.1.1.2 Describe the rule for a given relation using mathematical language such as one more, one less, one more than twice, etc.** E.g.1 Describe given relations   	Imagining and seeing things in a different way

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>7.

8.</td><td></td><td>E.g.2 Describe rule for a relation using mathematics language

This table shows the pattern of cost of packed breakfast for workers on a field trip.

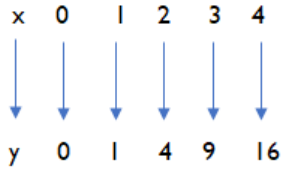
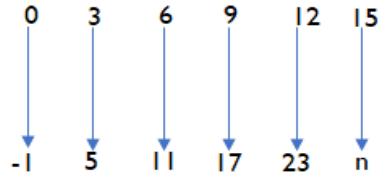
<table>
<tr><td>Number of workers</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>?</td></tr>
<tr><td>Cost of breakfast</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td><td>18</td><td>120</td></tr>
</table>

(i) Explain the pattern of how the cost of breakfast changes as more workers go on the trip(describe the rule);

(ii) Use the pattern to determine how many workers went on the trip if the cost of breakfasts is GH¢120.

E.g.3 State the rules in words to represent a given relation.

<table>
<tr><td>Term/Input (x)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>x</td><td>Rule for n in words</td></tr>
<tr><td>Result/Output A</td><td>5</td><td>10</td><td>15</td><td>20</td><td></td><td></td><td>x→5 times x</td></tr>
<tr><td>Result/Output B</td><td>0</td><td>4</td><td>8</td><td>12</td><td></td><td></td><td>x→4 times one less x</td></tr>
<tr><td>Result/Output C</td><td>4</td><td>7</td><td>10</td><td>13</td><td></td><td></td><td>x→1 more than thricex</td></tr>
<tr><td>Result/Output D</td><td>2</td><td>6</td><td>8</td><td>10</td><td></td><td></td><td>x→ twice 1more than x</td></tr>
<tr><td>Result/Output E</td><td>5</td><td>11</td><td>17</td><td></td><td></td><td></td><td>x→</td></tr>
</table>
</td><td>Exhibit strong memory, intuitive thinking; and respond appropriately</td></tr>
</table>

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
9. 10.		**B7.2.1.1.3 Identify the relation or rule in a pattern/mapping presented numerically or symbolically and predict subsequent elements** **E.g.1** Determine the rule for a given symbolic pattern  Shape number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 50 Number of matchsticks | 3 | 5 | 7 | 9 | 11 | | | | | | Rule for the pattern | Number of matchsticks = Shape number × _____ + _____	Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used
11. 12.		**E.g.2** Determine the rule for a given numerical pattern  i. Find the rule  ii. Find the rule and determine the value of n	Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation

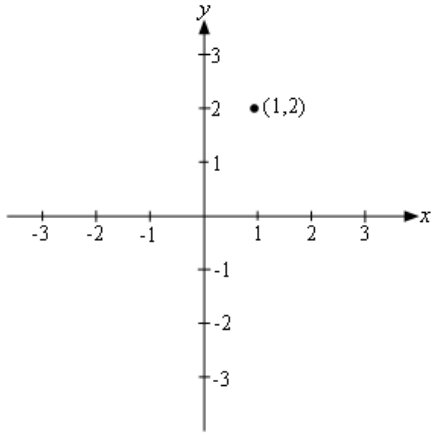
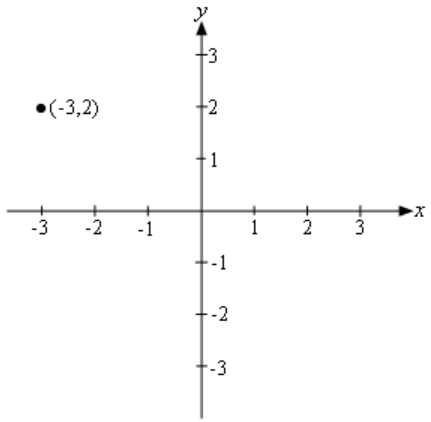
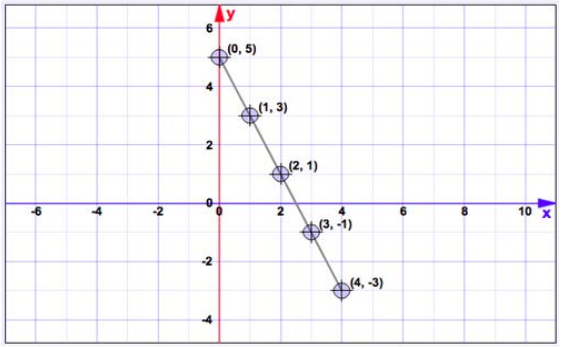
<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>13.

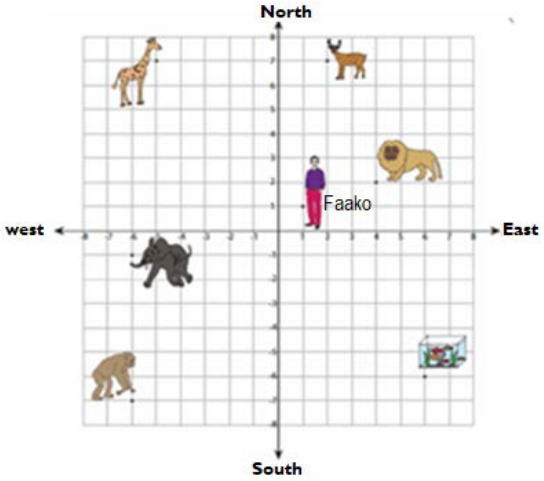
14.

15.</td><td></td><td>E.g.3Determine an element when given the rule
i. The result of x in the mapping $x \rightarrow 2x + 3$ is 3. Find the value of x.
ii. The result of x in the mapping $x \rightarrow -2x + 5$ is 45. Find the value of x.
iii. Copy the table and use the rule to find the missing values of n.
 
<table><tr><td>Shape number (x)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>50</td></tr><tr><td>Number of matchsticks</td><td>5</td><td>8</td><td>11</td><td>14</td><td>17</td><td></td><td></td><td></td><td></td><td></td><td>n</td></tr><tr><td>Rule for the pattern</td><td colspan="11">the rule is 3x + 2</td></tr></table></td><td>Recognise and generalise information and experience ; search for trends and patterns</td></tr>
<tr><td>16.

17.

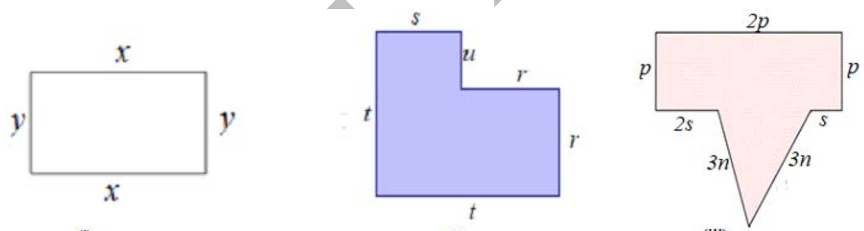
18.</td><td></td><td>B7.2.1.1.4 Locate points on the number plane, draw table of values of a given relation, draw graphs for given relations and use it to solve problems.
E.g.1 Make a table of values for a given rule
I. Draw a table for the mapping defined by the rule on the domain
{-2, -1, 0, 1, 2, 3}
Rule: $x \rightarrow 2x + 1$
<table><tr><td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y</td><td>-3</td><td></td><td></td><td></td><td>5</td><td></td></tr></table>ii. Draw a table for the mapping defined by the rule on the domain
{-2, -1, 0, 1, 2, 3}
Rule: $x \rightarrow x^2 + 2$
<table><tr><td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y</td><td>6</td><td></td><td></td><td>3</td><td></td><td></td></tr></table></td><td>Analyse and make distinct judgment about viewpoints expressed in an argument</td></tr>
</table>

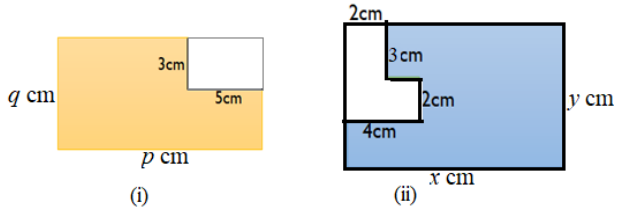
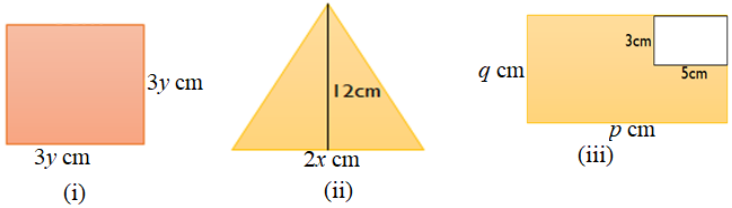
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
19.		**E.g.2**Locate points on the number plane – (1, 2) and (-3, 2)  	Analyse and make distinct judgment about viewpoints expressed in an argument
20.		**E.g.3** Draw graphs for given relations Plot the table of values on a number plane. | x	y | |---|---| | 0 | 5 | | 1 | 3 | | 2 | 1 | | 3 | -1 | | 4 | -3 | 	Analyse and make distinct judgment about viewpoints expressed in an argument

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
21.		**E.g.4** Use knowledge of identifying and plotting points in a number planeto solve problems. The number plane shows the location of animals.  Use the plane to answer the questions that follow. i. If Faako walks 7 units west and 8 units south, which animal does he see? ii. Which animal is closest to Faako? iii. Which animal is located at the point (2, 7)? What is point at which the giraffe'sis located	Analyse and make distinct judgment about viewpoints expressed in an argument

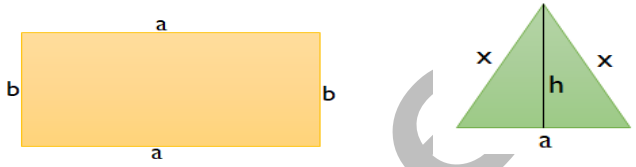
STRAND 2: Algebra
SUB-STRAND 2: Algebraic Expressions

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1. 2. 3.	**B7.2.2.1** **Simplify algebraic expressions involving the four basic operations and substituting values to evaluate algebraic expressions.**	**B7.2.2.1.1 Create simple algebraic expressions using simple logic to translate a set of instructions into an algebraic expression.** **E.g.1** Form algebraic expressions for given mathematical statements If x represents an unknown number, then i. 10 more than a number $x \rightarrow x + 10$ ii. 5 less than a certain number $x \rightarrow x - 5$ iii. 3 times a number $x \rightarrow 3x$ iv. Half of a certain number $x \rightarrow \frac{1}{2}x \; or \frac{x}{2}$ **v.** 2 more than 5 times a certain number $x \rightarrow 5x + 2$ vi. When 8 times a certain number x is subtracted from 5 and the result is multiplied by 2$\rightarrow 2(5 - 8x)$ **E.g.2** Form algebraic expressions from real life situations. i. Afrako is 3 years older than Maako. If Maako is now x years old, what is Afrako's age? ii. Agbolosu and Tetteh were given GH¢400.00 to share. Tetteh had GH¢35.00 more than Agbolosu. If Agbolosu's share is x, write an expression for Tetteh's share. iii. Find the profit a woman makes if she buys a basket of oranges for ¢x and sells it for ¢y? iv. Find the area of a rectangle which is t metres long and q metres wide? v. Find the perimeter of a rectangle which is x metres long and y metres wide?	Create simple logic trees to think through problems Ability to effectively define goals towards solving a problem

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
4.		**B7.2.2.1.2 Perform addition and subtraction of algebraic expressions with rational coefficients.**	Ability to combine Information and ideas from several sources to reach a conclusion
5.		**E.g.1 A**dd algebraic expressions i. Write each of these expressions in its simplest form. 1. $x + x$ 2. $y + y + y + y$ 3. $s + s + s + t + t + k + k + k$ ii. Simplify the following expressions. 1. $4x + 3x + x$ 2. $5x + 4x + 2x + 3x$ 3. $3abc + 4abc + 2abc$ iii. Write an expression for the perimeter of the following shapes  (i) (ii) (iii)	Ability to explain plans for attaining goals
6.		**E.g.2 S**ubtract algebraic expressions i. Write each of these expressions in its simplest form. *1.* $5x - 2x$ *2.* $3x - 4x - 2x$ *3.* $7x - 4x - x$	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
7. 8. 9. 10.		**E.g.3** Adding and subtracting algebraic expressions i. Simplify the following expressions: *1.* $5x + 4 - 9y + 3x + 2y - 7$ *2.* $2p - 3q + 3p + 5q$ *3.* $4x + 7 - 2x - 4$ **4.** $7xy + 5x - 4x + 2xy - 3$ ii. Write an expression for the perimeter of the shaded region  **B7.2.2.1.3 Perform multiplication and division of algebraic expressions with rational coefficients.** **E.g.1** Solve multiplication of algebraic expressions i. Simplify the following expressions *1.* $4p \times 8p^2$ *2.* $5xy^2 \times 4x^4y^3$ *3.* $-2a \times 4c \times 5b$ **4.** $-3xy \times 5y$  **ii.** Write an expression for the area of the following shapes	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem

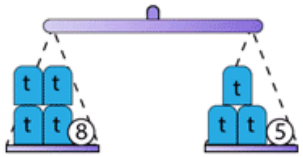
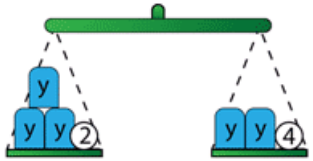
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
11.		**E.g.1** Solve division of algebraic expressions Simplify the following expression *1.* $\frac{12x^3y^2}{16xy^4}$ 2. $\frac{-30abc}{6ab^3c^{-2}}$ 3. $\frac{18x^5y^2}{24x^7y^2}$	Ability to combine Information and ideas from several sources to reach a conclusion
12.		**B7.2.2.1.4 Substitute values to evaluate algebraic expressions.** **E.g.1** *Simplify the following expressions and substitute the values to evaluate them, if* $x = 2, y = 4, p = 3 \text{ and } z = -1,$. *1.* $3xy \times 5y$ *2.* $7xy + 5x - 4x + 2xy - 3$ *3.* $4p \times 8z^2$ 4. $5x + 4 - 9y + 3x + 2y - 7$	
13.		**E.g.2** *Simplify the following expressions and substitute the values to evaluate them, if* $x = 2, y = 4, a = 3, b = 2, \quad z = 1 \text{ and } c = -1,$ *i.* $\frac{12x^3y^2}{16xy^4}$	Ability to combine Information and ideas from several sources to reach a conclusion
14.		ii. $\frac{-30abc}{6ab^3c^2}$ iii. $\frac{18x^5y^2}{24x^3y^2}$ iv. $\frac{8xyz}{16xy}$ v. $\frac{5ab^2}{ab}$ vi. $\frac{21x^7}{3x^4}$	

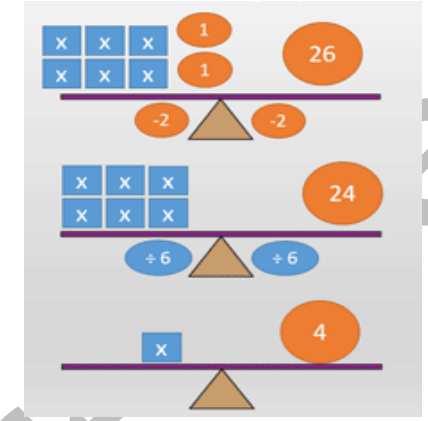
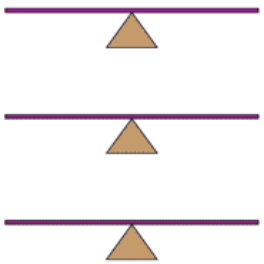
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
15. 16. 17. 18.		i. $If\ x = 5, a = 8,\ b = 3,\ \mathrm{h} = 6$,find the perimeter and area of the following ii. shapes.  **B7.2.1.1.5 Use properties of the four operations to simplify algebraic expressions with rational coefficients.** **E.g.1** Simplify algebraic expressions involving the four operations. i. $3xy \times 2 + \frac{6x^2y^3}{2y^2}$ *ii.* $\frac{7x+4x-2x}{3x}$ iii. $3\mathrm{x}^2\mathrm{y} + 2\mathrm{xy}^2 - 4\mathrm{x}^2\mathrm{y} - 6\mathrm{xy}^2$ iv. $(15p^3q^2 \times 12x^5y^3) \div (36pq \times 45xy)$ v. $\frac{7x^2+2x^2}{3x^2}$ **vi.** $7a - 7a^3 + 14a^4$	Ability to combine Information and ideas from several sources to reach a conclusion

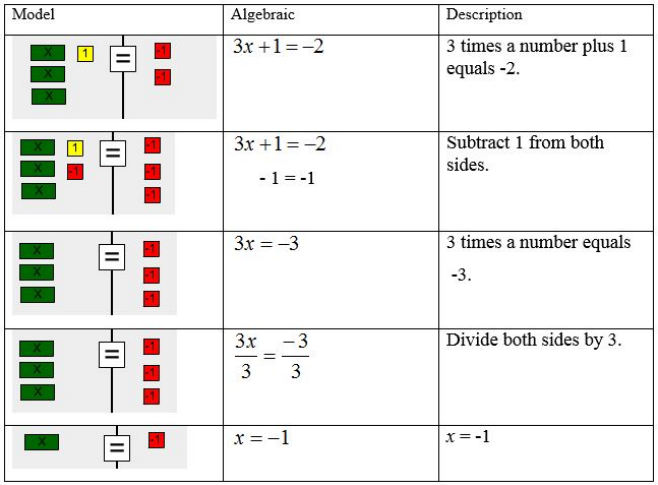
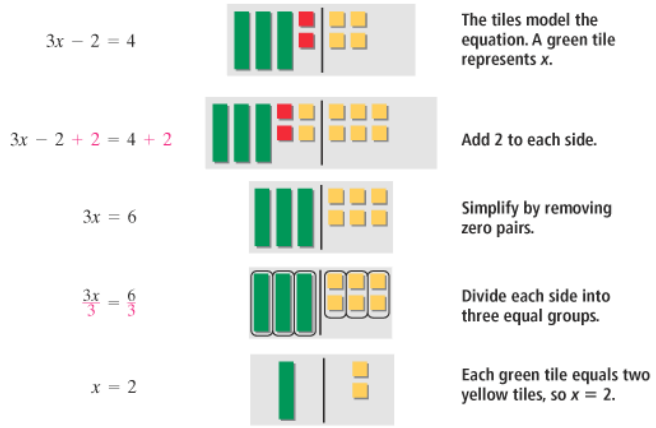
STRAND 2: Algebra

SUB-STRAND 3:– Equations and Inequalities

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1. 2.	**B7.2.3.1** **Demonstrate an understanding of linear equations of the form x + a = b (where a and b are integers) by modelling problems as a linear equation and solving the problems concretely, pictorially, and symbolically.**	**B7.2.3.1.1 Translate word problems to linear equations in one variable and vice versa** **E.g.1**: **Translate word problems to linear equations** i. The sum of the ages of two friends is 25, and the elder one is 4 times older than the younger one. Write this as a mathematical sentence? i.e. let the age of the younger one be x ∴ age of elder one = 4x 4x + x = 25 ii. Adaako and Afrakoma shared 40 oranges. Afrakoma had 6 more than Adaako. Write a mathematical sentence for this word problem. i.e. let x represent Adaako's share. ∴ Afrakoma's share is $x + 6$ and the two's share put together gives 40. $\therefore x + (6 + x) = 40$	Ability to effectively define goals towards solving a problem Ability to combine Information and ideas from several sources to reach a conclusion Implement strategies with accuracy
3.		**E.g. 2 Write word problems for given linear equations** i. x + x = 15 i.e. the sum of two equal numbers is 15 ii. $2x - 4 = 12$ i.e. when 4 is taken away from 2times a certain number, the result is 12. iii. $\frac{2}{3}x = 4$ *i. e*. two-thirds of a certain number is 4.	

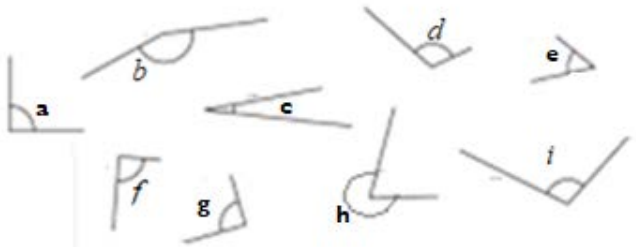
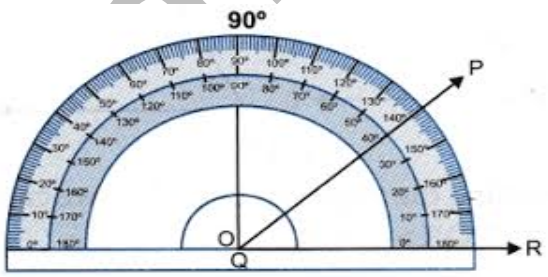
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
4.		**B7.2.3.1.2 Model and solve linear equations using concrete materials (e.g., counters and integer tiles) and describe the process orally and symbolically.** **E.g. 1 Model linear equations and solve** **i.** Write an equation for each balancing problem and solve ***Solution:*** $4t + 8 = 3t + 5$ $-3t \quad -3t$ $t + 8 = 5$ $t = -3$  	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem
5.		**ii.** Write an equation for each balancing problem and solve ***Solution:*** $3y + 2 = 2y + 4$ $-2y \quad -2y$ $y + 2 = 4$ $y = 2$  	

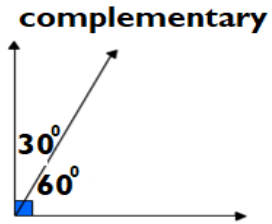
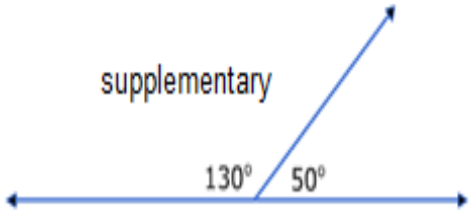
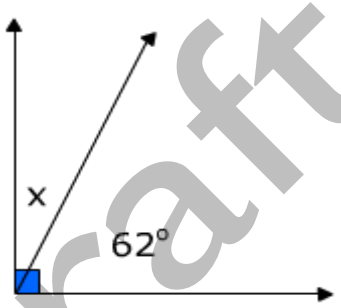
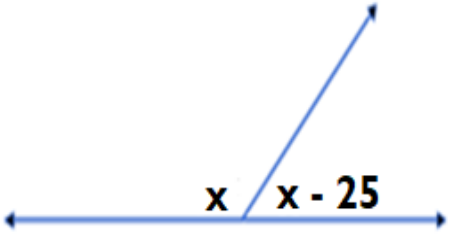
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
6.		**E.g.2Solve linear equations using diagrams** i. $solve\ for\ x$ in $6x + 2 = 26$ $i.e. 6x + 2 = 26$ $-2 \quad -2$ $6x = 24$ $\frac{6x}{6} = \frac{24}{6}$ $x = 4$ 	
7.		ii. Model the linear equation on the balance $\mathbf{2x + 4 = 32}$ 	

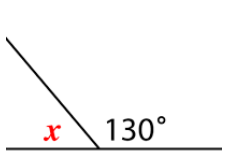
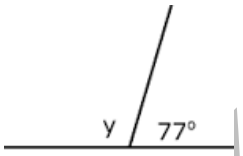
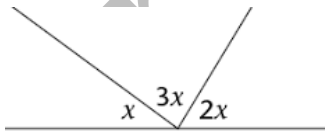
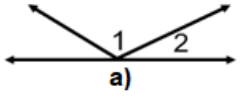
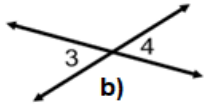
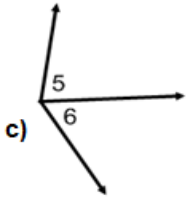
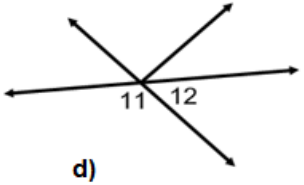
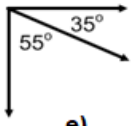
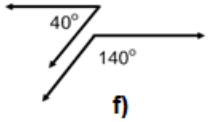
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
8.		**B7.2.3.1.3 Model linear equations, then write mathematical expression and describe the process of solving the equation.** **E.g.1**  Model / Algebraic / Description $3x+1=-2$ — 3 times a number plus 1 equals -2. $3x+1=-2$, $-1=-1$ — Subtract 1 from both sides. $3x=-3$ — 3 times a number equals -3. $\frac{3x}{3}=\frac{-3}{3}$ — Divide both sides by 3. $x=-1$ — $x=-1$	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation
9.		**E.g.2**  $3x-2=4$ — The tiles model the equation. A green tile represents x. $3x-2+2=4+2$ — Add 2 to each side. $3x=6$ — Simplify by removing zero pairs. $\frac{3x}{3}=\frac{6}{3}$ — Divide each side into three equal groups. $x=2$ — Each green tile equals two yellow tiles, so $x=2$.	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem

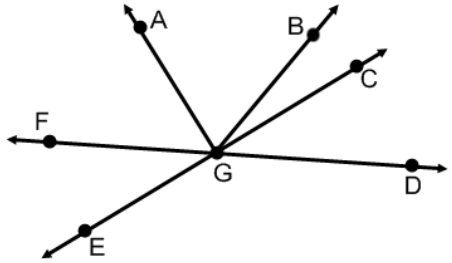
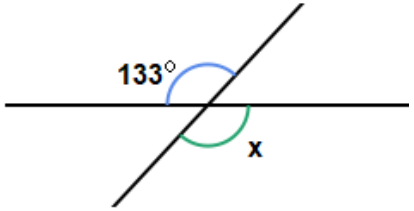
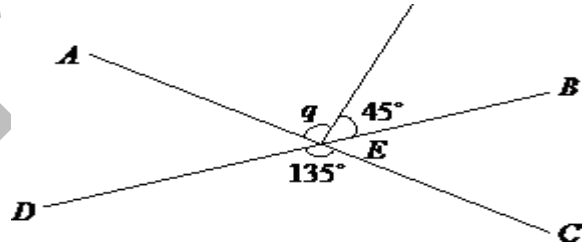
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS		COMPETENCIES
10.		**B7.2.3.1.4 Solve linear equations in one variable**		
11.		Using the idea of balance solve simple linear equations. E.g. 3x + 5 = 20 3x + 5 ± 5 = 20 ± 5 3x =15 x = 5	Solve the following simple linear equations i. $4x + 1 = 3x + 7$ ii. $7w + 3 = 2w + 18$ iii. $5r - 3 = r - 1$ iv. $20 - 3k = k + 12$ $6z + 4 = 28$	Ability to combine Information and ideas from several sources to reach a conclusion

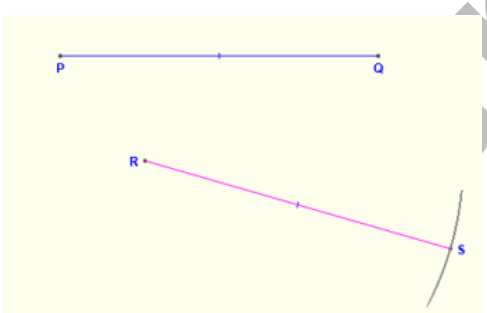
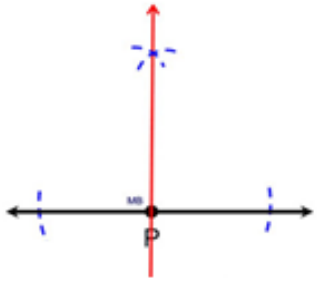
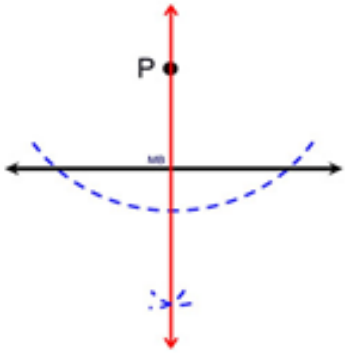
STRAND 3: Geometry and Measurement
SUB-STRAND 1:– Shape and Space

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
12. 13.	**B7.3.1.1** **Demonstrate understanding of angles including adjacent, vertically opposite, complementary, supplementary and use them to solve problems**	**B7.3.1.1.1 Measure and classify angles according to their measured sizes – right, acute, obtuse and reflex.** E.g. 1 Sort angles into those which are right, acute, obtuse or reflex angles from photocopied worksheets with several angles to measure. (Note: angles are not drawn to scale)  E.g. 2 Use a protractor to draw angles such as 30°, 45°, 60°, 75°, 90°, 120°, 150°, 270°, 300° etc.  	Exhibit strong memory, intuitive thinking; and respond appropriately

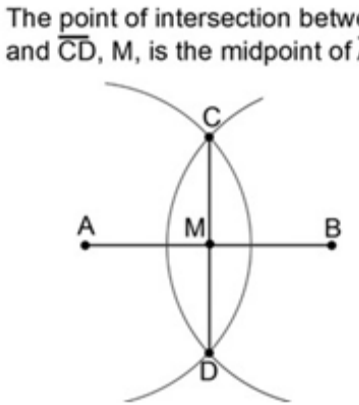
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
14.		**B7.3.1.1.2 Apply the fact that (i) complementary angles are two angles that have a sum of 90°, and (ii)supplementary angles are two angles that have a sum of 180° to solve problems.**  	Ability to merge simple/ complex ideas to create novel situation or thing Exhibit strong memory, intuitive thinking; and respond appropriately
15.		E.g.1 Determine the missing angle marked *x*. 	E.g.2 Determine the missing angle marked x. 	

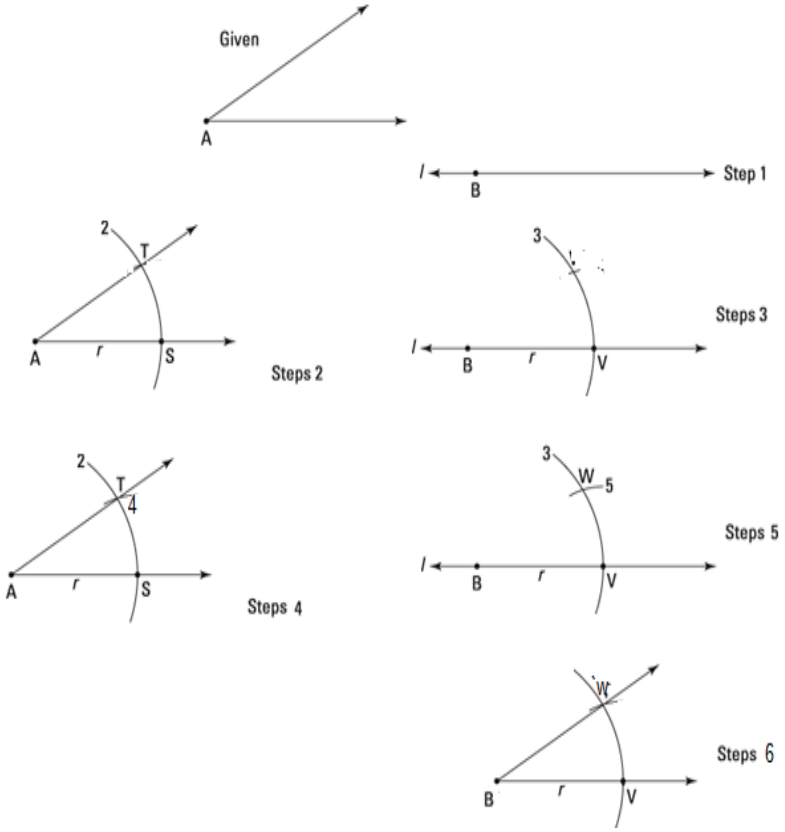
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
16. 17.		**B7.3.1.1.3 Use adjacent, supplementary and vertically opposite angles to solve problems** E.g. 1 Determine the angle(s) marked with letters in the adjacent and/or supplementary    angles below. E.g. 2 Identify each pair of angles as adjacent, vertically opposite, complementary or supplementary.  a)  b)  c)  d)  e)  f)	Exhibit strong memory, intuitive thinking; and respond appropriately

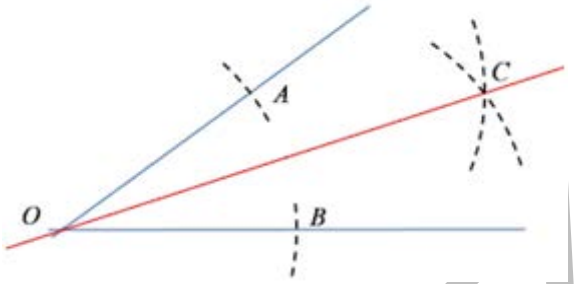
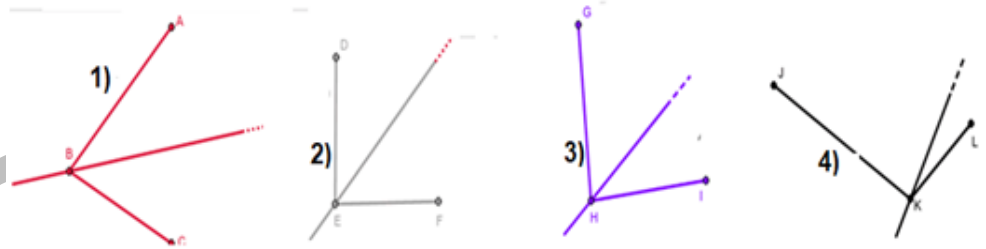
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
18.		E.g. 2 Use the figure at the right to identify and label the following angles **i.** two acute vertical angles. **ii.** two obtuse vertical angles. **iii.** a pair of adjacent angles **iv.** a pair of complementary angles. **v.** an angle supplementary to $\angle FGE$ 	Ability to try alternatives and fresh approaches
19.		E.g. 3 Use adjacent, vertically opposite, complementary or supplementary to solve problems. Determine the angle(s) marked with letters.  	Ability to try alternatives and fresh approaches

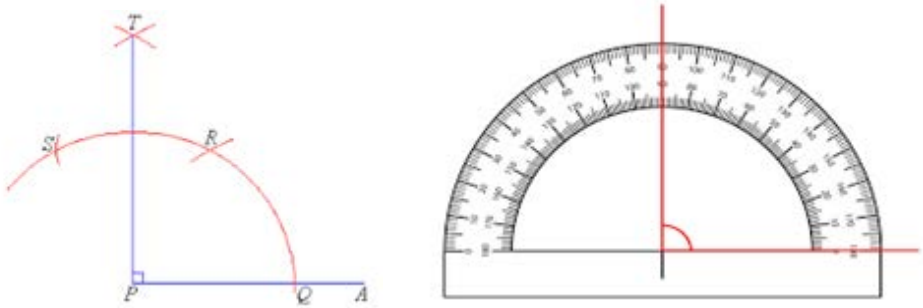
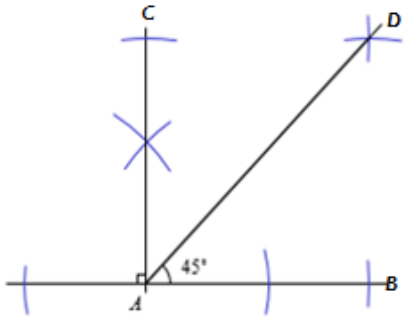
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1. 2. 3. 4.	**B7.3.1.2 Demonstrate how to construct a perpendicular to a line from a given point, bisect a line, bisect angles, and construct angles of the following sizes: 30˚, 45˚, 60˚, 75˚ and 90˚**	**B7.3.1.2.1 Construct a line segment perpendicular to another line segment.** E.g.1: Use a pair of compasses and a ruler to construct a copy of a given line segment. Line segment RS is a copy of PQ.  E.g.2: Use a pair of compasses and ruler to construct a perpendicular at a point on a line segment; and drop a perpendicular from a given point outside a line segment (i) a perpendicular at a point on a line segment  (ii) a perpendicular from a given point outside a line segment  	Implement strategies with accuracy Preparedness to recognise and explain results after implementation of plans

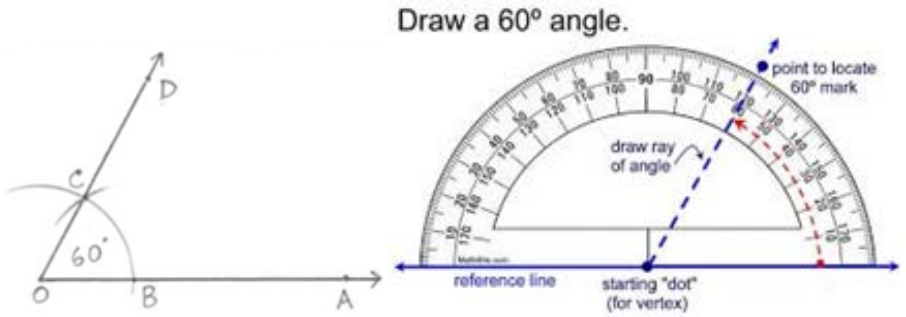
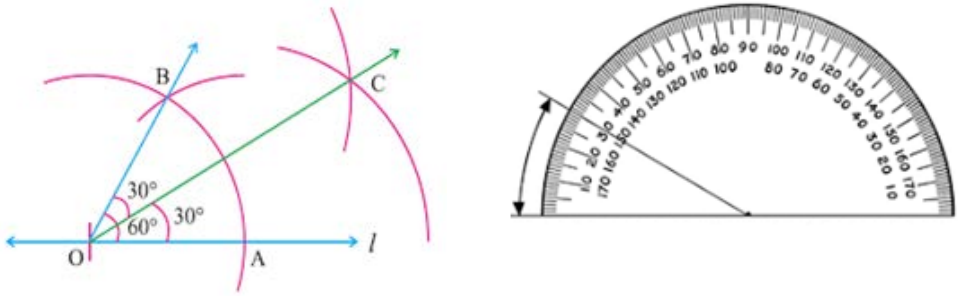
STRAND 3: Geometry and Measurement
SUB-STRAND 1:– Shape & Space

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		B7.3.1.2.2: Construct the perpendicular bisector of a line segment E.g.1: Use a pair of compasses and a ruler to construct a perpendicular bisector of a given line segment. (The line segment CD is a perpendicular bisector of AB)  E.g. 2:: Draw and bisect the following lines (i) $\overrightarrow{AB}$= 8cm (ii) $\overrightarrow{AB}$=5.5cm	**Ability to combine Information and ideas from several sources to reach a conclusion**

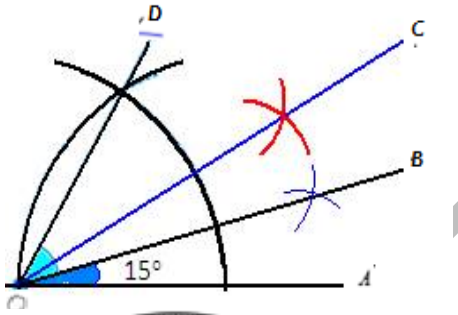
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		B7.3.1.2.3: Copy an and bisect angles E.g.1: Use a pair of compasses and a ruler to copy a given angle A, (i.e. draw a line and locate point B; copy the arc ST and transfer using B as the centre to obtain VW;join B and W to obtain the copied angle.  	**Implement strategies with accuracy**

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		E.g.2 Perform geometric construction to bisect a given angle($\angle BOA$) to obtain the two equal $\angle BOC$ and COA  (i) Sketch any acute angle and label it ABC; (ii) Copy the angle, measure and record its value **(iii)** Sketch any angle and ask a colleague to copy the angle;	**Implement strategies with accuracy**
		E.g. 3 Which of the angles has correct angle bisector  	**Implement strategies with accuracy**

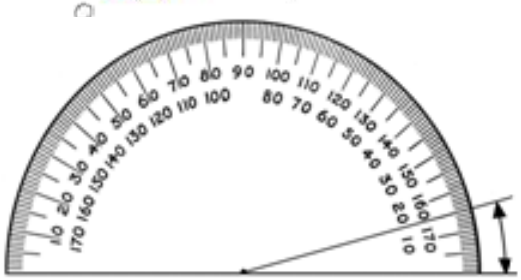
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		7.3.1.2.4: Construct angles of 90 and 45 E.g.1: Use a pair of compasses and a ruler toconstruct an angle of 90° (raise perpendicular at a point) on a given line segment and verify using the protractor. (The line segment PT is perpendicular to PA therefore $\angle APT = 90^\circ$)   E.g.2: Construct an angle of 45° by bisecting an angle of 90° (i.e. bisect $\angle BAC = 90^\circ$ to obtain $\angle BAD = 45^\circ$: line $\lvert AD \rvert$ is the angle bisector of the right angle) (i) Construct $\angle ABC = 45^\circ$ such that $\lvert AB \rvert = 5cm$ and $\lvert BC \rvert = 6cm$: bisect $\angle ABC = 45^\circ$ (ii) Construct $\angle ABC = 90^\circ$ and bisect it.	**Implement strategies with accuracy** **Ability to combine Information and ideas from several sources to reach a conclusion**

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		7.3.1.2.5: Construct angles of 60˚ and 30˚ E.g.1: Use a pair of compasses and a ruler to a) Construct an angle of 60˚ at a point on a given line segment $\angle AOD = 60^{\circ}$) and verify with the protractor  	**Implement strategies with accuracy** **Ability to combine Information and ideas from several sources to reach a conclusion** **Implement strategies with accuracy**
		E.g.2 Construct an angle of 30˚ by bisecting an angle whose measure is 60˚(i.e. bisect $\angle AOB = 60^{\circ}$ to obtain $\angle AOC = \angle COB = 30^{\circ}$: line $\lvert OC \rvert$ is the angle bisector)  	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		7.3.1.2.6: Construct angles whose measures are15˚ and 75˚, respectively.	



E.g.1: Construct an angle of 15˚ by bisecting an angle of30˚ (i.e. bisect $\angle AOD = 60^\circ$ to obtain $\angle AOC = 30^\circ$ and then bisect $\angle AOC = 30^\circ$ to obtain $\angle AOB = 15^\circ$)



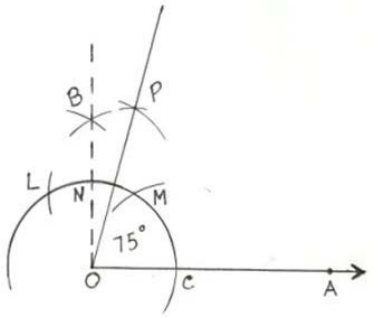
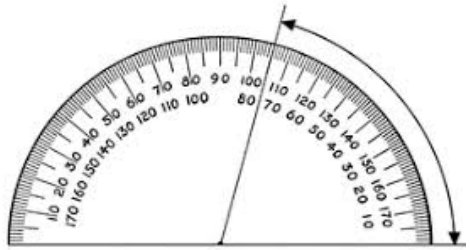
E.g..2 Construct the following:

(i) $\angle PQR = 7\frac{1}{2}^\circ$

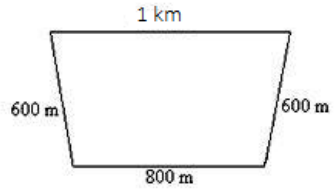
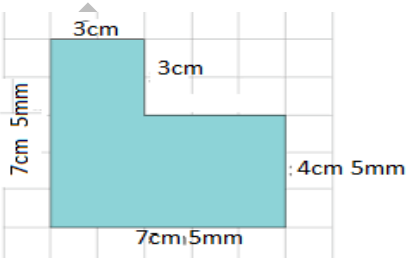
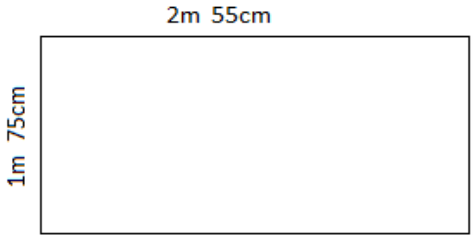
(ii) $\angle ABC = 60^\circ$

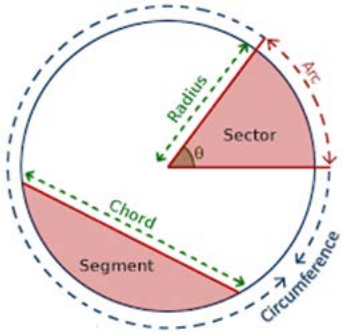
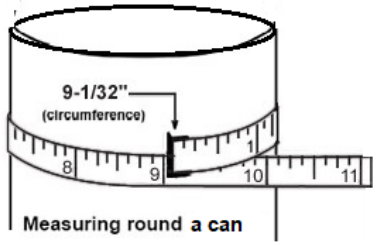
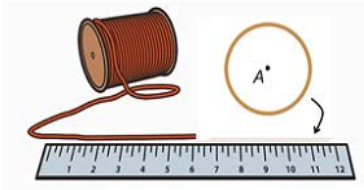
(iii) $\angle KLM = 30^\circ$

$\angle RST = 15^\circ$

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		E.g.3: Use a pair of compasses and a ruler to construct an angle of 75˚ at a point on a given line segment [i.e. construct a right angle $\angle AOB = 90^{\circ}$); bisect the arc MN and join O through $P$to obtain $\angle AOP$ 75°]   E.g.4: Construct and bisect $\angle PQR = 75^{\circ}$ **B7.3.1.2.7: Describe examples of perpendicular line segments, perpendicular bisectors and angle bisectors in the environment** E.g.1: Identify angle bisectors and perpendicular bisectors in structures and artefacts such as buildings, water tanks, boxes. etc in the environment E.g.2 Estimate the measure of the size of angles in artefacts, tools, and structures	**Preparedness to recognise and explain results after implementation of plans** **Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group**

STRAND: Geometry and Measurement
SUB-STRAND: Measurement

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1. 2. 3. 4.	**B.7.3.2.1** **Demonstrate the ability to find the perimeter of plane shapes including circles using the concept of pi (π) to find the circumference of a circle.**	**B.7.3.2.1.1 Calculate the perimeter of given shapes whose dimensions are in two units (i.e. cm and mm, m and cm, or km and m)** E.g. 1. Calculate the perimeter of a shape with dimensions given in km and m by converting to the smaller unit and adding the distance around the shapes.  E.g. 2 Calculate the perimeter of a shape with dimensions given in cm and mm by converting to decimal fractions in the larger unit (i.e. 7cm 5mm = 7.5cm).  E.g. 3 Calculate the perimeter of a shape with dimensions given in m and cm by converting to decimal fractions in the larger unit (i.e. 1m 75cm = 1.75m).  	Ability to combine Information and ideas from several sources to reach a conclusion Demonstrate behaviour and skills of working towards group goals

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
5.		**B7.3.2.1.2 Use the relationships between the diameter and circumference to deduce the formula for finding the circumference of a circle and use it to solve problems.** E.g.1: Identify name the parts of a circle – radius, diameter, circumference, arc, sector, etc.  	Ability to effectively define goals towards solving a problem Identify important and appropriate alternatives Exhibit strong memory, intuitive thinking; and respond appropriately
6.		E.g.2: Measure the radius, diameter and circumference of circular objects like base or cross section of cylindrical objects like cans, tyres, bowls, etc., roundabouts, etc. and describe the measuring tools used.    	Identify important and appropriate alternatives Exhibit strong memory, intuitive thinking; and respond appropriately

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>7.</td><td></td><td>E.g.3: Explain the relationship between the diameter and circumference of a circle by:
i. Recording the measured diameter and circumference of various circles;
ii. Completing the table for the measured values; and
iii. Observing the results of c ÷ d.
<table>
<tr><th>Circle</th><th>Circumference(c)</th><th>Diameter(d)</th><th>c ÷ d</th></tr>
<tr><td>Tin A</td><td>13</td><td>4</td><td>13 ÷ 4 =</td></tr>
<tr><td>Tin B</td><td>38</td><td>12</td><td>38 ÷ 12 =</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
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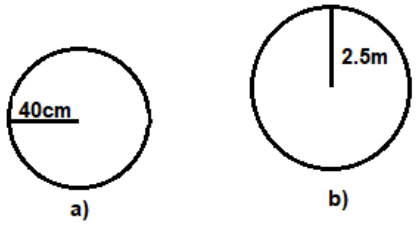
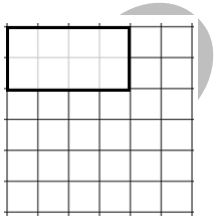
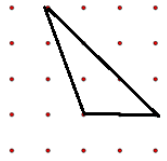
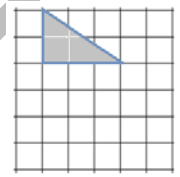
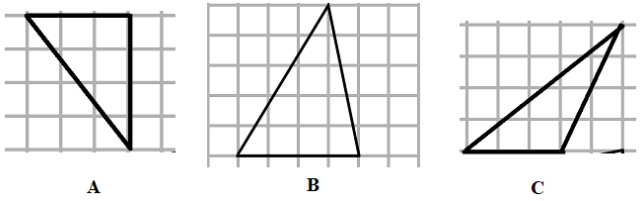
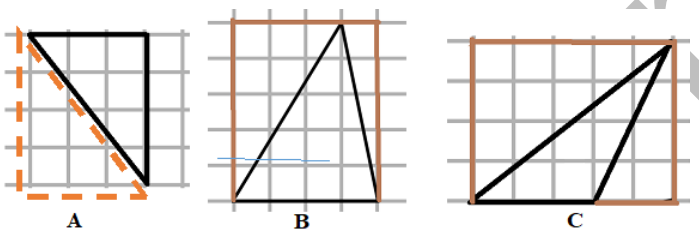
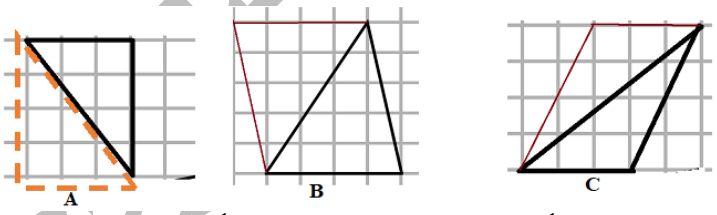
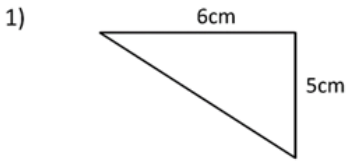
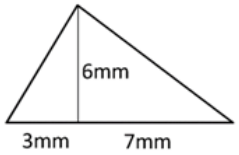
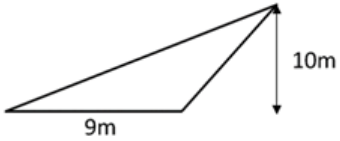
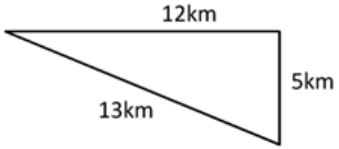
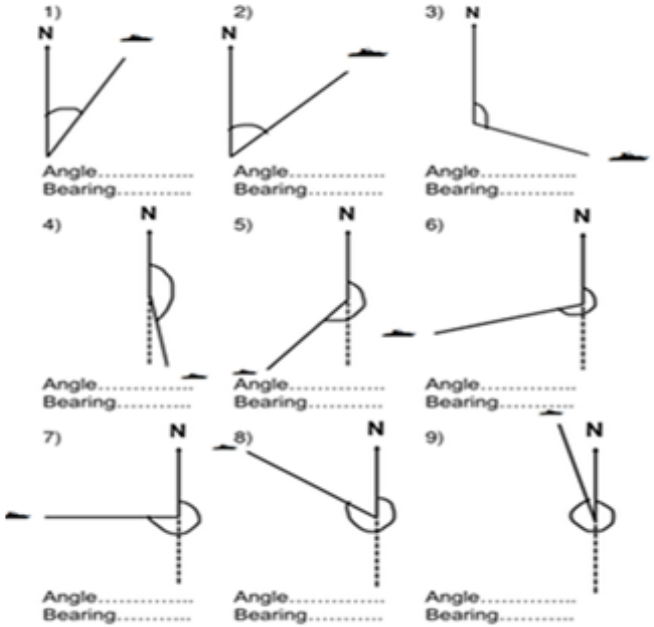
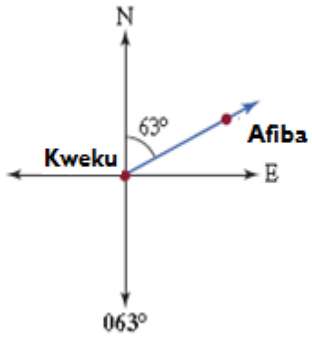
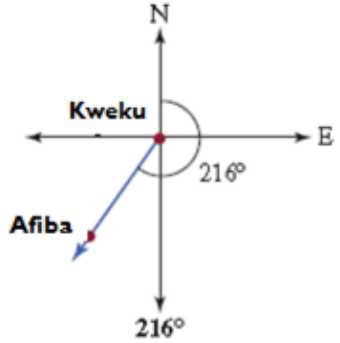
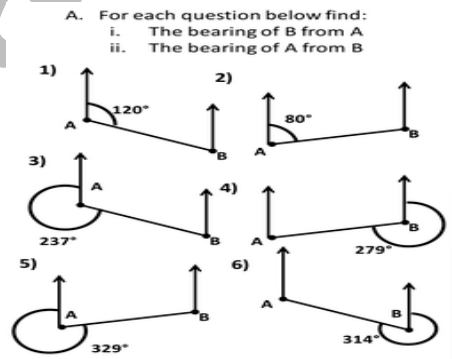
</table>
iv. Conclude that the result of c ÷ d or the ratio of the circumference of a circle to its diameter is named π (and pronounced pi). The ratio itself is approximately $\frac{22}{7}$ or 3.141592+. [Read more on the internet about the pi – who discovered it, and its value]</td><td></td></tr>
<tr><td>8.</td><td></td><td>E.g.4: Use the relationship between the diameter and circumference of a circle (i.e. $\pi = \frac{C}{D} = \frac{C}{2r}$) to solve problems.
i. The radius of a circle is 140 cm. What is the (a) diameter (b) circumference? [Take $\pi = \frac{22}{7}$]
ii. Find the circumference of the circles below whose radii are given and round to the nearest tenth [take π = 3.142]:
 
</td><td></td></tr>
</table>

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
9.		**B7.3.2.1.3 Draw in a square grid rectangles and triangles with given dimensions.** E.g. 1. (i) Draw a rectangle whose area is twice as large as the one drawn on the grid. (ii) Draw a rectangle which is twice as wide as and one and a half times as long as the one in the grid. 	Ability to select the most effective creative tools for working and preparedness to give explanations
10.			Exhibit strong memory, intuitive thinking; and respond appropriately
11.		E.g. 2. (i) Draw in the dot square grid another triangle whose area is 3 square units. E.g. 3. (i) What is the area of the triangle in the square grid? (ii) How many different triangles which have the same area as the one in the grid can you draw?  	
12.			Ability to select the most effective creative tools for working and preparedness to give explanations
13.	**B.7.3.2.2 Derive the formula for determining the area of a triangle and use it to solve problems**	**B7.3.2.2.1 Use the relationships between a triangle and a rectangle (or parallelogram) to deduce the formula for determining the area of a triangle.** E.g.1: Determine the number of unit squares enclosed by the triangles below. i. What is the perpendicular height of each triangle? ii. What is the area of each of the triangles? iii. How does the perpendicular heights of each triangle help you in calculating its area?  A B C	Understand roles during group activities
14.			Ability to combine Information and ideas from several sources to reach a conclusion Ability to explain plans for attaining goals

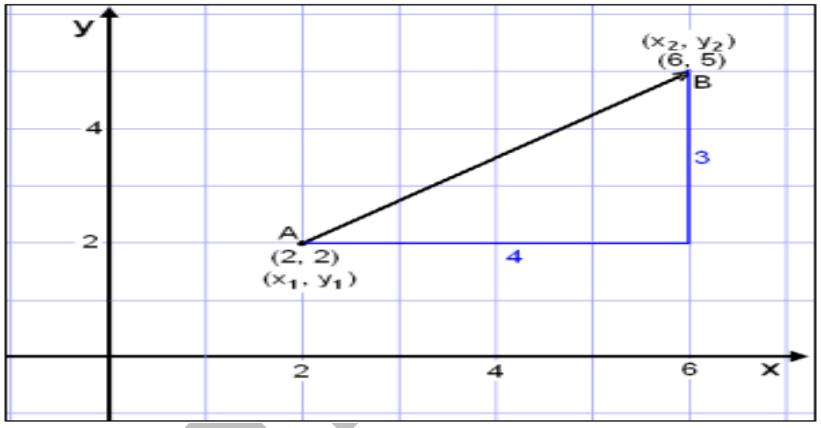
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
15.		E.g.2: Spot the *RECTANGLE* enclosing the triangles to find the unit squares in each triangle. Notice the base and height of the triangle.  Area of a triangle = $\frac{1}{2}$ (Areaof the rectangle = $\frac{1}{2}$ base × perpendicular height	Create simple logic trees to think through problems
16.		E.g.3: Spot the Parallelogram from which the triangle was formed.  Area of the triangle = $\frac{1}{2}$(Area of the parallelogram)= $\frac{1}{2}$ (base of parallelogram) × height = $\frac{1}{2}$b × h	

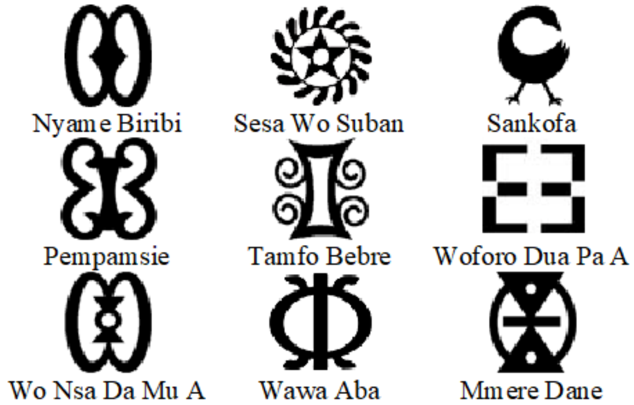
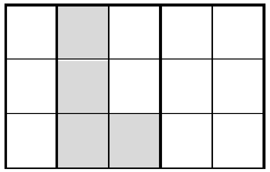
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
17.		**B7.3.2.2.2 Determine the area of a triangle.**	Ability to effectively define goals towards solving a problem
18.		E.g. 1. Calculate the area of the triangles. 1)  2) 	
19.		3)  4) 	

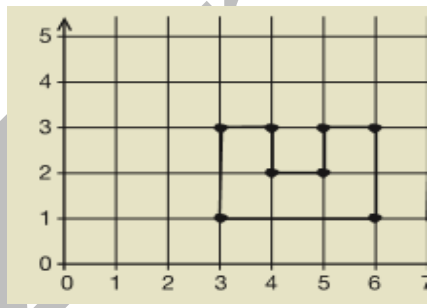
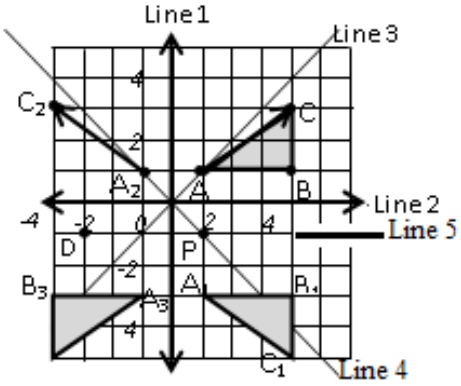
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
	B7.3.3.2 Demonstrate understanding of bearings, vector and its components using real life cases	B7.3.3.2.1 Describe the bearing of a point from another point E.g.2 Use protractor to find the marked angles. For each diagram, write the three digit bearing.  	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		.Recognise true bearings as the angle measured in the clockwise direction from the North E.g.3 Express the following vectors graphically(i) $\overrightarrow{PQ}=\binom{-3}{4}$ (ii) $\overrightarrow{BC}=\binom{2}{3}$ and measure each angle. E.g.4 Draw the following vectors (i)$\overrightarrow{AB}$=(3km,060) (ii) $\overrightarrow{QR}$=(5km,120) and measure each angle.. The bearing of Afiba from Kweku is 060°  The bearing of Kweku from Yaw is 216° 	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem Implement strategies with accuracy
		B7.3.3.2.2 Explain how to find the back bearing when the direction of travel has a bearing which is less than 180° and/ or greater than 180° E...g 1 	Ability to select alternative(s) that adequately meet selected criteria

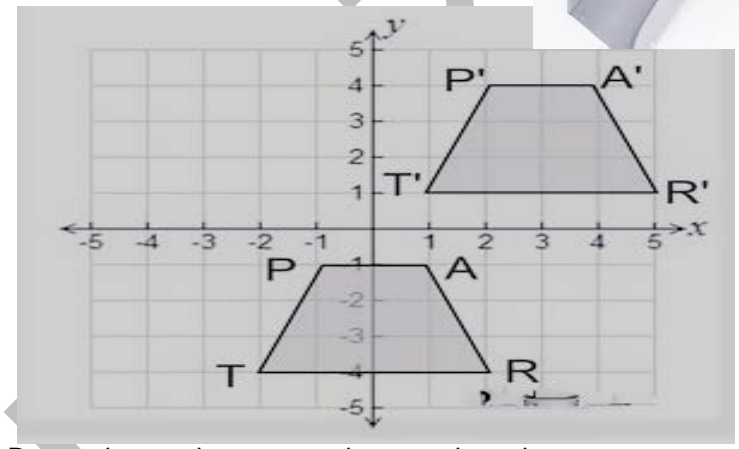
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		E.g2 The bearing of P from Q is 060°.What is the bearing of Q from P E.g.3 The bearing of P from Q is 145°.What is the bearing of Q from P	
		B7.3.3.2.3 Distinguish between scalar and vector quantities	
		E.g.1 Read on scalar quantity and vector quantity on the internet. E.g.2 Group these examples under scalar quantity and vector quantity ,weight, force, velocity time, speed ,distance, mass ,volume ,energy, work momentum etc… Eg.3 Identify a vector as a movement (distance) along a given bearing E.g.4Draw a vector given its length and bearing E.g. $\overrightarrow{TS}$ =. (6km,245°). E.g.5 Identify the distance along a vector as its magnitudeand the 3 – digit clockwise angle from the north as its bearing E.g.6 Identify a zero vector as a point where no magnitude and direction.	
		B7.3.3.2.4 Represent vector in the column (component) form $\begin{pmatrix} x \\ y \end{pmatrix}$ and determine its magnitude and direction.	
		E.g.1Write each of the following as column vectors using graph. (i) $\vec{a}$=(15km,030°), $\vec{b}$=(25km,150°) E.g.2 Use any other method apart from graph to write the following as column vectors (i) $\vec{a}$=(10km, 270°) (ii) $\vec{b}$=(20km, 090°) and find it magnitude and direction.	Ability to combine Information and ideas from several sources to reach a conclusion Ability to work with all group members to complete a task successfully
		B7.3.3.2.5 Convert vectors in the column (component) form $\begin{pmatrix} x \\ y \end{pmatrix}$ to the Magnitude–Bearing form (a, θ) and vice versa	

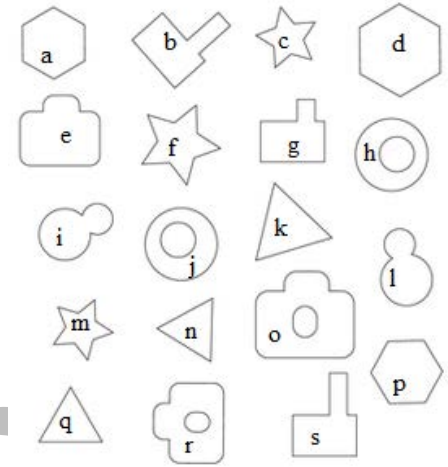
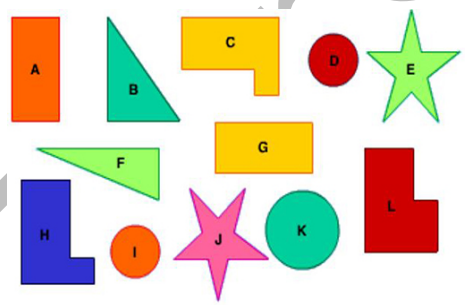
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		E.g.1 Use the Pythagorean theorem to find the length or the magnitude of a vector. $\|\overrightarrow{AB}\| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$  Eg.2 Find the magnitude and the direction of the following vectors (i) $\vec{v} = \begin{pmatrix} 12 \\ 5 \end{pmatrix}$ (ii) $\vec{v} = \begin{pmatrix} 15 \\ 9 \end{pmatrix}$	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
20. 21. 22.	**B7.3.3.3** **Perform a single transformation (i.e. reflection and translation) on a 2D shape using graph paper (including technology) and describe the properties of the image under the transformation (i.e. congruence, similarity, etc.)**	**B7.3.3.3.1 Determine shapes in real life that have reflectional (or fold) symmetries.** E.g. 1: Identify examples of designs (or objects) in everyday life that have reflectional (or  fold) symmetries (e.g. adinkra symbols). E.g. 2: How many different ways can one more square be shaded in this shape so that it can have a line of symmetry? 	Create simple logic trees to think through problems Identify important and appropriate alternatives Preparedness to recognise and explain results after implementation of plans Imagining and seeing things in a different way Recognise and generalise information and experience ; search for trends and patterns

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
23. 1.		**B7.3.3.3.2 Plot points and shapes (i.e. plane figures) on a coordinate plane and draw their images under reflection in given lines** E.g. 1: Plot points and shapes (i.e. plane figures) with given coordinates in the number plane. i. Plot the points A (3, 1), B (3, 3), C (4, 3), D (4, 2), E (5, 2), F (5, 3), H (6, 3), and I (6, 1).  	Reflect on work and explore thinking behind thoughts and processes Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
2.		E.g. 2: Identify points with given coordinates and lines (i.e. constant lines parallel to the x-axis or y-axis) in the number plane. Draw and label the axes of the coordinate plane and label the lines such as Line 1 is y-axis or x=0; Line 2 is x-axis or y=0; Line 3 is y=x; Line 5 is $\square -1$, etc.  	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
		E.g. 3: Plot given points (or shape) the number plane and draw its images under reflection in (i) the x-axis, (ii) y-axis and (iii) y=x i. Draw point (a) A_2 (-1, 1) as the image of point A (1, 1) under a reflection in the y axis (or line x=0) (b) Draw point P (1, -1) as the image of point A (1, 1) under a reflection in the x axis (or line y=0) and (c) Draw point A2 (-1, 1) as the image of point P (1, -1) under a reflection in the line y=x. **ii.** Draw triangle A'B'C' as the image of triangle ABC under the reflection x=0, y=0, y=x and any other line.	
3.		iii. Compare the images E.g. 4: Derive the coordinate rules i. If (a, b) is reflected on the x-axis, its image is the point (a, -b) ii. If (a, b) is reflected on the y-axis, its image is the point (-a, b) iii. If (a, b) is reflected on the line y = x, its image is the point (b, a) iv. If (a, b) is reflected on the line y = -x, its image is the point (-b, -a) **NB:** Reflection can occur over a line and/ or in a point	Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem Preparedness to make better decision with information at hand

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
4.		**B7.3.3.3.3Plot points and shapes (i.e. plane figures) on a coordinate plane and draw their images under translation by a given vector** E.g. 1: As people go down a slide, they undergo a translation E.g. 2: Plot point(s) and shapes (i.e. plane figures) in coordinate plane using a translating vector and describe the changes in the vertices as well as the direction of the movement   i. Draw a shape and its image under a translation by a given vector. ii. Describe a single movement or transformation that takes the shape PART to the image P'A'R'T	**Preparedness to make better decision with information at hand** Preparedness to make better decision with information at hand Exhibit strong memory, intuitive thinking; and respond appropriately

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
5. 6. 7. 8.		**B7.3.3.3.4 Verify the concept of congruent and similar shapes in coordinate plane using properties of both the object(s) and image(s); and in real life situations (carpet designs, fabric pattern)** E.g. 1: Verify which shapes are similar and which are congruent. E.g. 2. Which of the following shapes are congruent?   	Ability to select the most effective creative tools for working and preparedness to give explanations

STRAND: Data
SUB-STRAND: Data and Probability

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1. 2. 3.	**B7.4.1.1 Select, justify, and use appropriate methods to collect data (quantitative and qualitative), display and analyze the data (grouped/ungrouped) presented in frequency tables, line graphs, pie graphs, bar graphs or pictographs and use these to solve and/or pose problems**	**B7.4.1.1.1- Select and justify a method to collect data (quantitative and qualitative) to answer a given question.** E.g. 1. In small groups, learners discuss and write down how they would make decisions in the following situations, what facts they would take into account and how they would collect these 'facts. (a) The type of drinks to buy for a class party. (b) The make of football boots to buy for the school team (c) Do people who eat more fufu develop pot belly? (d) The number of desks in each classroom (e) The amount of money B6 students spend on bus fare to school every month. (g) Buy a mobile phone from an online shop E.g. 2. Lead a discussion on the methods of data collection below and ask them to identify which method they will use to gather the facts for each situation (i.e. in E.g. 1. above) ▪ questionnaires, ▪ interview, ▪ observation, ▪ experiments, ▪ survey ▪ databases, ▪ electronic media or internet	Ability to work with all group members to complete a task successfully Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem Ability to combine Information and ideas from several sources to reach a conclusion Identify important and appropriate alternatives

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr>
<td>4.

5.

6.</td>
<td></td>
<td>
B7.4.1.1.2- Design and administer a questionnaire for collecting data to answer a given question(s) and record the results.

E.g. 1. Do a survey (within a small group of learners) by producing a question form (such as the one below) and collecting real information.

Class Survey Question Form
<table>
<tr><td>1)</td><td>Hello, What's your name? _____</td></tr>
<tr><td>2)</td><td>How old are you? _____</td></tr>
<tr><td>3)</td><td>What's your favourite school subject? _____</td></tr>
<tr><td>4)</td><td>What's your worst subject? _____</td></tr>
<tr><td>5)</td><td>What's the most important school subject? _____</td></tr>
<tr><td>6)</td><td>What is your favourite hobby _____</td></tr>
<tr><td>7)</td><td>What's your favourite day of the week? _____</td></tr>
<tr><td>8)</td><td>How much do you spend on bus fare to school every day? _____</td></tr>
</table>

E.g. 2. Use a table (like the one below) to organize the data obtained with the question form (or questionnaire).
<table>
<tr><td>Name</td><td>Age</td><td>Favourite subject</td><td>Worst subject</td><td>Important subject</td><td>Favourite hobby</td><td>Favourite week day</td><td>Daily bus fare (cedis)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Demonstrate behaviour and skills of working towards group goals

Effectively perform multiple roles within the group

Ability to combine Information and ideas from several sources to reach a conclusion

Identify important and appropriate alternatives</td>
</tr>
</table>

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr>
<td>7.

8.</td>
<td></td>
<td>
B7.4.1.1.3- Organise and present data from a survey into a table and/or chart, and analyse it to solve and/or pose problems.

E.g. 1. Use tallies to organize into frequency table marks obtained in a mathematics test by students in a class.
10 7 4 5 6 8 7 6 7 5 3 4 6
5 4 5 4 6 5 6 7 6 3 4 5 8
6 7 5 9 4 6 6 1 7 7 9 5 1
5 2 7 10 8 6 7 4 1 6 6

Complete the frequency table below for the data recorded in the mathematics test.
<table>
<tr><th>Marks</th><th>Tally</th><th>Frequency</th></tr>
<tr><td>1</td><td>///</td><td>3</td></tr>
<tr><td>2</td><td>/</td><td>1</td></tr>
<tr><td>3</td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Total</td><td></td><td></td></tr>
</table>
Draw bar graph to illustrate the data in the frequency table.
Write your conclusion about the students' achievement in the test and/or pose questions on the graph.
</td>
<td>Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation

Implement strategies with accuracy

Demonstrate sense of feeling or belongingness to a group

Preparedness to make better decision with information at hand</td>
</tr>
</table>

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>9.</td><td></td><td>E.g. 2 Use tallies to organize into a frequency table the data below which was obtained by a group oflearners for the number of people living in households around their houses.

3 4 2 4 3 2 2 5 4 3 2 6 3 5
4 1 2 6 3 5 5 2 4 1 5 4 2
4 3 4 2 4 4 6 2 4 3 4 2 4

i. Complete the frequency table below for the data recorded from the survey of people living in households around their houses.

<table>
<tr><th>No./ Household</th><th>Tally</th><th>Frequency</th><th>Angle of sector</th></tr>
<tr><td>1</td><td>//</td><td>2</td><td>$\frac{2}{40} \times 360 = 18°$</td></tr>
<tr><td>2</td><td>//// ////</td><td>10</td><td></td></tr>
<tr><td>3</td><td>//// //</td><td>7</td><td></td></tr>
<tr><td>4</td><td>//// //// ///</td><td>13</td><td></td></tr>
<tr><td>5</td><td>////</td><td>5</td><td></td></tr>
<tr><td>6</td><td>///</td><td>3</td><td></td></tr>
</table>

ii. Draw a pie chart to illustrate the data in the frequency table (i.e. in E.g. 1 above).

iii. Write your conclusion about the number of people living in the households and/or pose questions in the pie chart.</td><td>Implement strategies with accuracy</td></tr>
</table>

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>10.

11.</td><td></td><td>E.g. 3. Draw a graph or chart for data organized in a frequency table and use it to answer and/or pose questions. For instance,

i. The table below shows how a Fakor spends his day. Complete the blanks in the table with information on how you spend your day. Then draw a double bar graph to compare how you spend your day with Fakor.

<table>
<tr><td>Activity</td><td>School</td><td>Sleeping</td><td>Homework</td><td>Eating</td><td>Other</td></tr>
<tr><td>No. of hours</td><td>8</td><td>8</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>No. of hours</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

ii. The table below shows the amount of rainfall recorded in millimetres per month in the two towns in Ghana. Draw a double bar chart to represent the data, write your conclusion and/or pose questions based on the chart.

<table>
<tr><td></td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td><td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td></tr>
<tr><td>Kumasi</td><td>5</td><td>10</td><td>15</td><td>20</td><td>50</td><td>45</td><td>55</td><td>35</td><td>40</td><td>50</td><td>35</td><td>10</td></tr>
<tr><td>Oda</td><td>3</td><td>10</td><td>13</td><td>25</td><td>40</td><td>50</td><td>60</td><td>50</td><td>40</td><td>45</td><td>35</td><td>8</td></tr>
</table>
</td><td>Evaluate the quality and validity of information

Interpret and apply learning in new context</td></tr>
</table>

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
12. 13. 14.	**B7.4.1.2 Determine the measures of central tendency (mean, median, mode) for a given ungrouped data and use it to solve problems**	**B7.4.1.2.1 Calculate the mean for a given ungrouped data and use it to solve problems** E.g. 1 Find the **mean** for a data set by dividing the sum of all the items in the data set by the by the number of items. i. The mean for the data set {8, 9, 7, 6, 8,10} is $\frac{8+9+7+6+8+10}{6} = 8$ ii. Find the mean for the data set below which is the marks obtained out of a total of 5 in a mathematics class test. 3 4 2 4 3 2 2 5 4 3 4 1 2 6 3 5 5 2 4 1 E.g. 2 Find the **mean** for a data set (in a frequency table) by dividing the sum of all the items in the data set by the by the number of items. i. Find the mean for the marks obtained out of a total of 5 in a mathematics class test presented in the frequency table: <table><tr><td>Score</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Frequency</td><td>2</td><td>6</td><td>4</td><td>5</td><td>3</td></tr></table>ii. Find the mean of the ages of children at a party presented in the frequency table: <table><tr><td>Ages (x):</td><td>1</td><td>3</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td>Frequency (f):</td><td>2</td><td>5</td><td>6</td><td>10</td><td>8</td><td>5</td><td>3</td><td>1</td></tr></table>	 Implement strategies with accuracy

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
15. 16.		E.g. 3 Solve problems involving calculating the mean or average. i. A shop keeper sold the following loaves of bread over the last 6 days: 25, 48, 25, 33, 57, 50. What was the average number of loaves sold each day? ii. Sena has had the following scores in five of the common core subjects this term: 75, 87, 90, 88, 79. If she wishes to have an average score of 85, what must she score on the sixth test? i.e. *Set up the problem like this: (75 + 87 + 90 + 88 + 79 + □) ÷ 6 = 85* iii.	Ability to effectively define goals towards solving a problem Ability to explain plans for attaining goals
17. 18.		**B7.4.1.2.2 Calculate the median for a given ungrouped data and use it to solve problems** E.g. 1 Find the **median** for a data set by arranging the items in the set in an array and identifying the middle item. *i.* Find the median of 19, 29, 36, 15, and 20. (i.e. the middle item in the array 15, 19, 20, 29, 36 is 20). *NB. since there are 5 values (odd number), 20 is the median (middle number)* *i.* Find the median for the data set 8, 9, 7, 6, 8, and 10. (i.e. the middle item in the array 6, 7, 8, **8**, 9, and 10 is 8). *NB.since there are 6 values (even number), we must average those two middle numbers to get the median value*	Ability to effectively define goals towards solving a problem Ability to combine Information and ideas from several sources to reach a conclusion

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>19.</td><td></td><td>E.g. 2 Find the median for a data set (in a frequency table).
iii. Find the median mark obtained in a mathematics class test presented in the frequency table:
<table><tr><td>Score</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Frequency</td><td>2</td><td>6</td><td>4</td><td>5</td><td>3</td></tr></table>NB.Since there are 20 values, the 10th and 11th scores are the middle numbers and they are both 3, so the median value is 3.
iv. Find the median ages of children at a party presented in the frequency table:
<table><tr><td>Ages (x):</td><td>1</td><td>3</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr><tr><td>Frequency (f):</td><td>2</td><td>5</td><td>6</td><td>10</td><td>8</td><td>5</td><td>3</td></tr></table>NB.since there are 39 values, the 20th age is 6, so the median value is 6.</td><td>Implement strategies with accuracy</td></tr>
<tr><td>20.

21.</td><td>B7.4.2.1 Identify the sample space for a probability experiment involving single events and express the probabilities of given events as fractions, decimals, percentages and/or ratios to solve problems</td><td>B7.4.2.1.1 Demonstrate understanding of likelihood of a single outcome occurring by providing examples of events that are impossible, possible, or certain from personal contexts.
E.g. 1. Describe each outcome using words like: impossible, possible, or certain.
1. The dog will fly tomorrow (impossible)
2. Someone in the class would be a teacher in the future (possible)
3. Ghana will still be an African Country tomorrow (certain)
E.g. 2. Ask learners to work in groups to discuss the outcome of the following events using words like: impossible, possible, or certain
A. A coin lands Heads side up
B. The day after Monday will be Tuesday
C. A new born baby will be a girl
D. It will rain in Winneba in the first week of January</td><td>Implement strategies with accuracy
Ability to combine Information and ideas from several sources to reach a conclusion
Demonstrate sense of feeling or belongingness to a group
Analyse and make distinct judgment about viewpoints expressed in an argument</td></tr>
</table>

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
22.		**B7.4.2.1.2Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible, or certain**  **E**.g. 1 Ask learners to work in groups to discuss the following outcomes of throwing a die using words like: impossible, possible, or certain A. Obtaining the number 1 B. Obtaining the number 7 C. Obtaining the number 4 D. E.g. 2 Ask learners to work in groups to discuss the following outcomes of throwing two dice using words like: impossible, possible, or certain  A. Obtaining a total of 12 B. Obtaining a total of 2 C. Obtaining a total of 13	Implement strategies with accuracy Can see the importance of including all team members in discussions and actively encourage contributions from their peers in their team 1 Identify words or sentences in context or appropriately

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>23.

24.</td><td></td><td>B7.4.2.1.3Calculate the probability of the event and express the probability as fractions, decimals, percentages and/or ratios.

E.g. 1 Use the worksheet to calculate the probabilities

<table>
<tr><td colspan="3">Name:</td><td colspan="3">Score:</td></tr>
<tr><td colspan="6">Probability with a single die  </td></tr>
<tr><td>The probability of rolling:</td><td>Fractions</td><td>Decimals</td><td>Percentages</td><td>Ratios</td></tr>
<tr><td>1. factors of 60</td><td>1</td><td></td><td></td><td></td></tr>
<tr><td>2. a multiple of 3</td><td>$\frac{1}{3}$</td><td></td><td></td><td></td></tr>
<tr><td>3. factors of 2</td><td>$\frac{1}{3}$</td><td></td><td></td><td></td></tr>
<tr><td>4. divisors of 12</td><td>__</td><td>0.83</td><td></td><td></td></tr>
<tr><td>5. a 3 or greater</td><td>$\frac{2}{3}$</td><td></td><td></td><td></td></tr>
<tr><td>6. factors of 8</td><td>__</td><td></td><td></td><td>1:2</td></tr>
<tr><td>7. factors of 6</td><td>$\frac{2}{3}$</td><td></td><td></td><td></td></tr>
<tr><td>8. divisors of 30</td><td>$\frac{5}{6}$</td><td></td><td></td><td></td></tr>
<tr><td>9. a 3 or smaller.</td><td>__</td><td></td><td>50</td><td></td></tr>
</table>
</td><td>Implement strategies with accuracy</td></tr>
</table>

BASIC 8

Strand 1: NUMBER
SUB-STRAND 1: Number and Numeration Systems

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
	B.8.1.1.1 **Demonstrate understanding and the use of place value for expressing quantities in standard form and rounding numbers and decimals to significant figures and a given number of decimal places**	**8.1.1.1.1.1 Apply the understanding pf place value to read and write in number quantities up to over 1,000,000,000** E.g.1. Read and write numbers in words and vice versa (i) 2408321: Two million, four hundred and eight thousand, three hundred and twenty-one (ii) the numeral part of the serial number on a currency note TD1567451, i.e., 1567451: One million, five hundred and sixty-seven thousand, four hundred and fifty-one	Demonstrate behaviour and skills of working towards group goals
		8.1.1.1.2. Skip count forward and backwards in 10,000s, 100,000s, 500,000s, etc	Ability to select alternative(s) that adequately meet selected criteria
		E.g.1 Count forward in 500000s up to the fifth number (i) 200,000, 700,000, ...	
		E.g 2. Count backwards in 100,500s up to the fifth number (I) 1,800,000, 1699500, 1599000, ...	Ability to manage time effectively
		8.1.1.1.3. Compare and order whole numbers using ">, <, and ="	
		E.g. 1 Identify numbers which are 100,000, 1500,000, etc more or less than given 8 to 9-digit number.	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1.		**8.1.1.1.4 Express integers of any size into standard form**	Ability to identify important and appropriate criteria to evaluate each alternatives
		E.g.1 Write integers a power of 10 (i) $1 = 10^0$ $10 = 10^1$ $100 = 10^2$ $1000 = 10^3$	
		E.g. 2. Write multiples of 10 in standard form (I) $10 = 1 \times 10$ $100 = 1 \times 10^1$ $1000 = 1 \times 10^3$ etc.	
		E.g.3. Write integers in standard form (i) $26 = 2.6 \times 10$ (ii) $375 = 3.75 \times 10^2$ (iii) $8,765,049 = 8.765049 \times 10^6$	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
2.		**8.1.1.1.5 Express integers in a given number of significant and decimal places**	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used
		E.g.1. Express any given integer to a given number of significant figures (i) express 56734 correct to two significant figures as 57000	
		E.g 2. Express 975.8674, correct to (i) two decimal places (ii) three decimal places	
		8.1.1.1.6 Create and solve word or real life problems on place values	
		E.g. 1 Solve word or story problems (i) Adom earns Gh₵2500 a month after tax and his elder brother Arko earns three times as much. How much is their total income after five years if there are no increases in their earnings?	

Strand 1: NUMBER

SUB-STRAND 1: Number and Numeration Systems

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
1.	**B8.1.1.2** **Apply the concepts and vocabulary of sets on sets of factors of numbers to identify perfect squares, determine their square root and solve real life problems involving union and intersection of two sets**	**B8.1.1.2.1.Use the concept of sets to identify perfect squares and determine the square roots. Use the knowledge on sets and sets of factors of numbers to solve problems**	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation Ability to select alternative(s) that adequately meet selected criteria
		E.g. 1. Identify perfect squares or perfect numbers (i) List sets of multiples of numbers and identify a set of perfect numbers among them 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, … 2, 4, 6, 9, 12, 16, 18, … 4, 8, 12, 16, 20, 24, … Perfect squares 4, 9, 16, 25, 36, …..	
		E.g. 2. Use the knowledge on odd numbers to determine the square root of perfect numbers (i) Determine the square root of 49 Think subtract the consecutive odd numbers starting from 1 from 49 until the remainder is zero. Then count how many odd numbers subtracted as the square root of the number.	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
2.		**B8.1.1.2.2. Use the knowledge on sets and sets of factors of numbers to solve real life problems involving union and intersection**	
		E.g. 1. Identify the set of factors of given numbers (i) list the factors of 42 and 36 and determine their common factors: 42: 1,2,3,6,7,14,21 and 42 36: 1,2,3,4,6,9,12,18 and 36 The common factors: 1,2,3, and 6.	
		E.g. 2. Solve story and real-life problems involving union and intersection of sets (i) There are 80 farmers in a certain village who grow maize and rice or both. Out of the 80 farmers, 50 grow maize and 60 grow rice. (a) represent the information on a Venn diagrams (b) if X of them grow both crops, write an equation in X and solve	

Strand 1: NUMBER

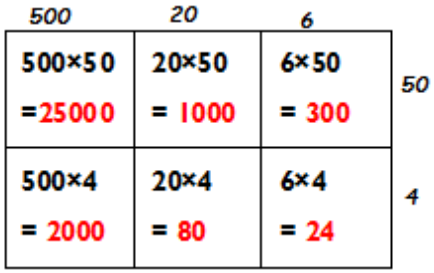
SUB-STRAND 2: Number Operations

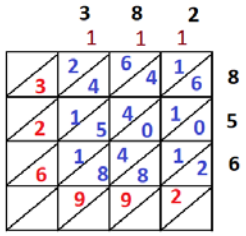
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
3. 4.	**B8.1.2.1 Apply mental mathematics strategies and number properties used to solve problems**	**B8.1.2.1.1 Multiply and divide by multiples of 10 including decimals and the benchmark fractions** E.g.1. Recall multiplication facts up to 144 and related division facts. E.g.2. Recall decimal names of the benchmark fractions converted to decimals or percentages (and vice versa) E.g. 3. Determine a product when a decimal number is a multiple of 10, 100, 1000, $\frac{1}{10}, \frac{1}{100}, \frac{1}{1000}$, etc.	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation
5. 6. 7. 8. 9.		**B8.1.2.1.2 Apply mental mathematics strategies and number properties to do calculation** E.g. 1. Apply halving and doubling to determine a the product given product of two given numbers. **B8.1.2.1.3 Apply mental mathematics strategies to solve word problems.** E.g. 1. Play mental maths word games: - should engage learners to use mental strategies to do E.g.2. Play mental maths word games: - should provide opportunities for learners to use mental strategies, short methods and sundry tables to develop fluency in solving problems	

Strand 1: NUMBER

SUB-STRAND 2: Number Operations

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
30.	**B8.1.2.2** **Apply the understanding of the addition, subtraction, multiplication and division of (i) whole numbers within 10,000, and (ii) decimals up to 1/1000, to solve problems and round answers to given decimal places.**	**B8.1.2.2.1 Add and subtract up to four-digit numbers.** E.g.1. Use partitioning (or expanded form) and place value system to add and subtract whole and decimal numbers i) Add 896854 and 76329 896854 = 800,000+90000+6000+800+50+4 +76329 = 70000+6000+300+20+9 973183 = 900000+70000+3000+100+80+3 ii) Add 3627.6 and 854.13 3627.60 = 3000+600 + 20 + 7 + $\frac{60}{100}$ + 854.13 = + 800+50 +4 + $\frac{1}{10}+\frac{3}{100}$---- = 3000+800 +600+ 20+ 50 + 7+ 4 + $\frac{60}{100}+\frac{1}{10}+\frac{3}{100}$---- = 3000+1400+ 70+ 11+$\frac{7}{10}+\frac{3}{100}$ = 3000+(1000+400)+ 70+ (10+1)+$\frac{70}{100}+\frac{3}{100}$ 4481.73 = 4000+400+80+1+$\frac{73}{100}$ Iii) Subtract 37.85 from 193.6 193.60 = 100 + 90 + 3+$\frac{6}{10}+\frac{0}{100}$ − 37.85 = - (30 + 7+ $\frac{85}{100}$) = 100 + 90 + 3+$\frac{60}{100}$−30-7−$\frac{85}{100}$ = 100+ 90 – 30 + 3−7 +$\frac{60}{100}-\frac{85}{100}$ = 100+ 60 −7 +3+ $\frac{60}{100}-\frac{85}{100}$ = 100 + 53 + 2 + $\frac{160}{100}-\frac{85}{100}$ 155.75 = 155 + $\frac{75}{100}$	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
31.		**B8.1.2.2.2 Multiply or divide multi-digit numbers by 1- and 2- digit numbers** E.g.1 Use the area model (Expand and Box method) to multiply and divide efficiently $526 \times 54 =$  $\therefore \mathbf{526 \times 54 = 25,000 + 2,000 + 1,000 + 300 + 80 + 24}$ $\mathbf{= 28,404}$ E.g.2. Multiply whole numbers using the vertical place value method: (i.e. $657 \times 27 =$) 657 x 27 2,415 + 6,900 9,315	Implement strategies with accuracy

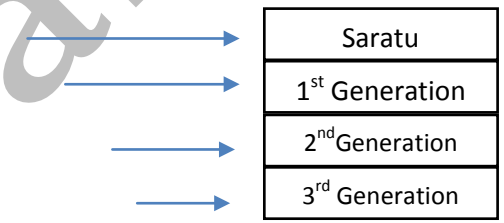
S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
32.		E.g.3 Multiply whole numbers using the lattice method That is to solve 382 × 856: Draw Make a 3 by 3 lattice and set up the solution as follows: 382 × 856 = 326,99  	
33.		E.g.3 Use the distributive property to multiply 325x 15 =325 x (10 + 5) = 325 x 10 +325 x 5 =3,250 + 1,625 =4,875	
34.		E.g.4 Investigate and determine basic division facts including divisibility test (i) Determine how a given number is divisible by 3,4,5, 6, 7, 8,9,10, etc.	

S/N	CONTENT STANDARD	INDICATORS AND EXEMPLIFICATIONS	COMPETENCIES
35. 36.		**B8.1.2.2.3. Create and solve story problems involving decimals on the four basic operations.** E.g. 1. Solve word problems (v) A group of two four hundred and twelve women and eight hundred and forty-four men went to watch a football match. An amount of GH¢40 was collected at the gate from each person. How much money was collected all together? (vi) Mr Alidu bought 33.2kg of meat. Mrs Ansu bought 3.8kg of meat less than Mr Alidu. How many kilograms of meat did they buy all together? (vii) Eno weighs 38.1kg. Her mother weighs 3 times as heavy. What is the total weight of Eno and her mother? (viii) Mrs Yaboi bought 25.25 metres of cloth for her five children. If they share the material equally, how many metres of cloth did each receive?	Exhibit strong memory, intuitive thinking; and respond appropriately Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech.

<table>
<tr><th>S/N</th><th>CONTENT STANDARD</th><th>INDICATORS AND EXEMPLIFICATIONS</th><th>COMPETENCIES</th></tr>
<tr><td>37.</td><td></td><td>E.g.2 Solve word problems on data presented in a table
(i) In preparation towards a speech day celebration, a school's Management Committee approved the following budget on some projects.
<table><tr><td>Activity</td><td>Cost (GH¢)</td></tr><tr><td>Painting school building</td><td>2,940</td></tr><tr><td>Mending cracks on the netball pitch</td><td>4,250</td></tr><tr><td>Restock the computer laboratory with new computers</td><td>9,990</td></tr><tr><td>Buying of a new cadet uniforms</td><td>8,740</td></tr><tr><td>Buying prizes for awards</td><td>5,270</td></tr></table>(a) How much was approved for painting the school building and buying of cadet uniforms?
(b) How much less was to be spent on mending the cracks on the netball pitch than restocking the computer lab with new computers?
(c) How much was spent on buying prizes for awards if twice the amount approved was spent on this activity?</td><td></td></tr>
</table>

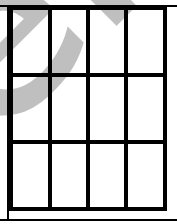
B8 Strand 1
Sub-Strand 2: Number Operations

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B8.1.2.3 Demonstrate understanding and the use the laws of indices in solving problems (including real life problems) involving powers of natural numbers	**B8.1.2.3.1 Identify and explain the laws of indices** **E.g.1** State the Laws of Indices For real numbers *m, n* and valid bases *a, b*, the following basic laws hold I. Law1: $a^m \times a^n = a^{(m+n)}$ II. Law 2: $\frac{a^m}{a^n} = a^{(m-n)}$ For applying the above Law, if we choose both *m = 1* and *n = 1*, then we get: $\frac{a^1}{a^1} = a^{(1-1)} = a^0 = 1$ i. Law 3: $(a^m)^n = a^{m \times n} = a^{mn}$ ii. iii. Law 4: $(ab)^n = a^n b^n$	Ability to combine Information and ideas from several sources to reach a conclusion Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation
		B8.1.2.3.2 Apply the laws of indices to simplify and evaluate numbers involving powers of numbers. (PEDMAS)	
		E.g.1 Use the laws of indices to solve problems involving powers of number. i) Simplify $2^5 \times 16^2$ ii) Simplify $\frac{27}{3^2}$ iii) Simplify the expression $y = x^{a-b} \times x^{b-c} \times x^{c-a} \times x^{-a-b}$ iv) Simplify and evaluate $(\frac{16}{81})^{-\frac{3}{4}}$ v) Evaluate $(5^2)^3$	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.1.2.3.3 Solve exponential equations E.g. Solve these equations i. $25 = 5^{2x}$ ii. $2^{x+2} = 16$ iii. $\frac{2^5}{2^3} = 2^{2x}$ **iv.** $\frac{1}{27} = 3^x$	Develop and defend a logical plausible resolution to a confusion, uncertainty or contradiction surrounding an event
		B8.1.2.3.4 Solve real life problems involving powers of natural numbers.	Exhibit strong memory, intuitive thinking; and respond appropriately
		E.g.1: Solve real-life problems on populations. While studying her family's history. Saratu discovers records of ancestors 12 generations back. She wonders how many ancestors she has had in the past 12 generations. She starts to make a diagram to help her figure this out. The diagram soon becomes very complex.  i. Make a table and a graph showing the number of ancestors in each of the 12 generations. ii. Write an equation for the number of ancestors in a given generation n.	Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech.

STRAND 1: Number

SUB-STRAND 3: Fractions, Decimals and Percentages

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1.	**B8.1.3.1 Apply the understanding of operation on fractions to solve problems involving fractions of given quantities and round the results to given decimal and significant places**	**B8.1.3.1.1 Review fractions and solve problems involving basic operations on fractions**	Create simple logic trees to think through problems
2.		E.g. 1. Review concept of fraction 	
3.		i. Shade given fraction of squares in a shape or find the fraction shaded in the shape: i.e. shade $\frac{3}{54}$ of the rectangle ii. Write down 3 fractions equivalent to $\frac{2}{3}$ iii. Cancel Express the fraction $\frac{6}{10}$down toin its simplest form: $\frac{6}{10}$ iv. Convert Express $\frac{12}{5}$ as a to mixed numbers: $\frac{12}{5}$ v. Convert Express $2\frac{5}{9}$t as an o improper fractions: $2\frac{5}{9}$	Can effectively evaluate the success of solutions they have used to attempt to solve a
4.		E.g. 2. Review the basic operations on fractions	
5.		i. Adding & Subtracting Fractions. Work out answers to the following: a) $\frac{3}{4}+\frac{7}{8}$ b) $\frac{4}{5}-\frac{1}{6}$ ii. Multiplying & Dividing Fractions. Work out answers to the following: a) $\frac{2}{3}\times\frac{3}{4}$ b) $\frac{5}{8}\div 2\frac{1}{2}$	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
6.		**B8.1.3.1.2 Add and/or subtract, multiply and/or divide given fractions, by using the principle of the order of operations including the use of the (the rule of BODMAS or PEMDAS) rule, and apply the understanding to solve problems**	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem
7.		E.g. 1. Use the order of operations (BODMAS or PEDMAS) to simplify whole number expressions with more than two operations. PEDMAS is Parenthesis, Exponents, Multiply/Divide (going from left to right), 4: Add/Subtract (going from left to right). i. $21 \div 3 + (3 \times 9) \times 9 + 5$ ii. $18 \div 6 \times (4 - 3) + 6$ iii. $3^4 \div 9 + 40 - 2^3 \times 3^2 \div 9$	
8.		E.g. 2. Use the order of operations (BODMAS or PEDMAS) to simplify whole number expressions with more than two operations. a) $\frac{3}{4} + \frac{5}{8} \times \frac{4}{5} - \frac{1}{6}$ b) $\frac{3}{4} \div \frac{3}{8} + (\frac{4}{5} - \frac{1}{2})$ c) $(\frac{3}{4} + \frac{5}{8}) \times \frac{4}{11} - \frac{1}{2}$	
9.		**B8.1.3.1.3. Review word problems involving basic operations on fractions and related concepts**	
10.		E.g. 1. Solve fraction word problems involving fractions. i. Determine the (i) perimeter and (ii) area. of A a rectangle whose sides measureis $1\frac{1}{3}$ cm by $3\frac{3}{4}$cm. Calculate its (i) perimeter and (ii) area.	Develop and defend a logical plausible resolution to a confusion, uncertainty or contradiction surrounding an event

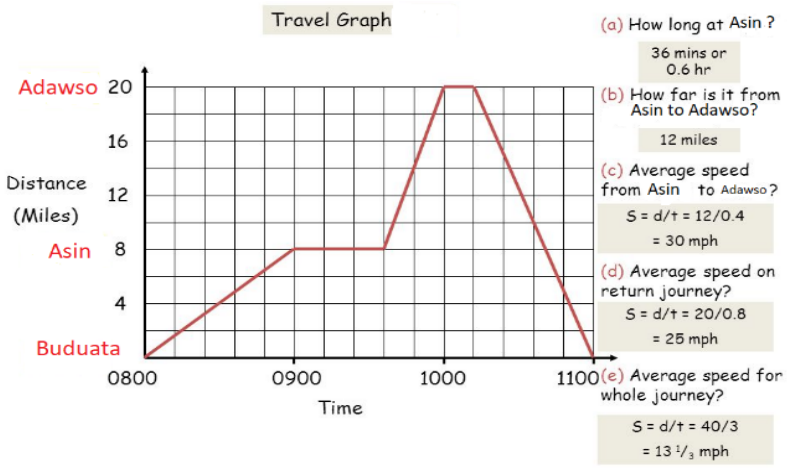
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
11.		ii. Faako answers 42 out of 60 questions correctly. What **percent** of her answers are correct? iii. In a school $\frac{2}{3}$ of the students eat from the school feeding programme, $\frac{1}{4}$ bring their packed lunch, and the rest go home to eat. What fraction of the students go home for lunch? iv. Esi and Fusena made orange drink by mixing orange squash and water. Esi'sdrink was made of $\frac{2}{7}$ orange squash and Fusena's was made up of $\frac{1}{4}$ orange squash. Whose drink tastes stronger of orange?	

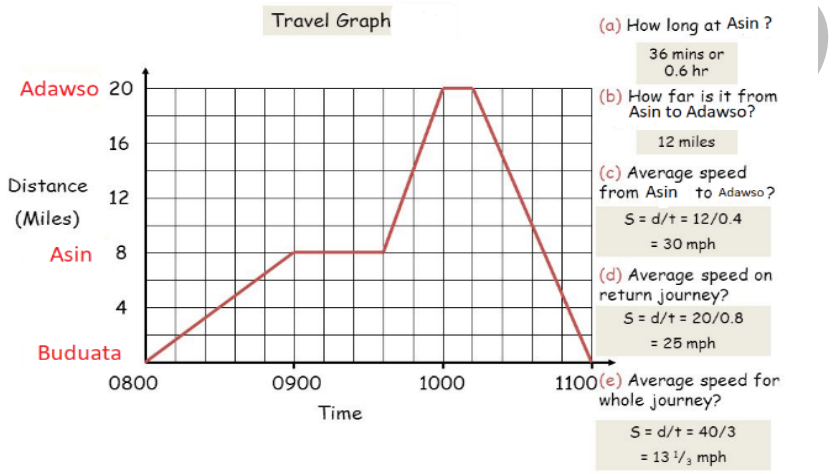
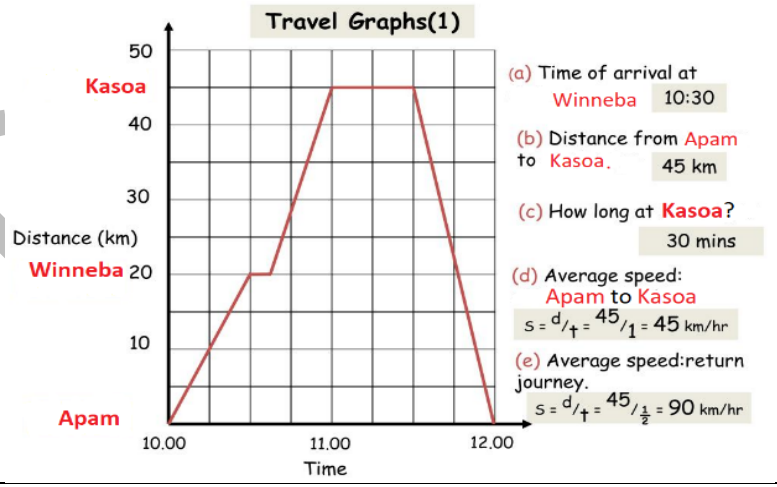
B8 Strand 1

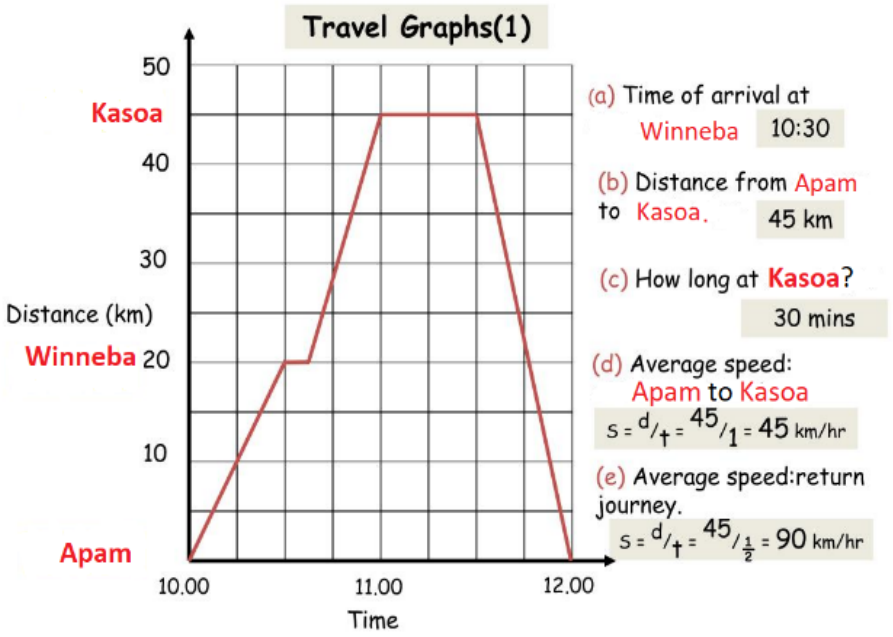
Sub-Strand 4: Number: Ratios and Proportion

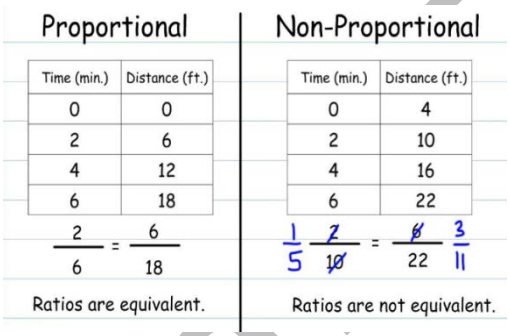
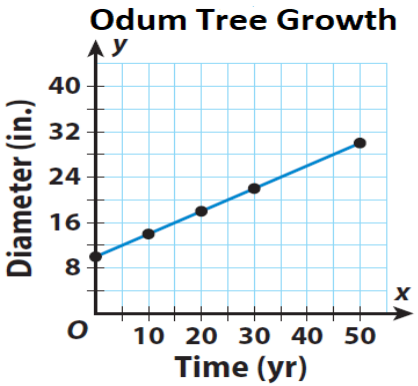
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B8.1.4.1 Demonstrate an understanding of ratio, rate and proportions and use it these to solve real-world mathematical problems	**B8.1.4.1.1 Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.**	
		E.g.1 Convert (cm to m; km to m; ml to cm; etc.) one unit of measure to another using ratio reasoning. • 1m = 100cm is a conversion factor, and we can write from it the ratios $\frac{1\ m}{100\ cm}1m/100cm$and $\frac{100\ cm}{1\ m}100cm/1m$, with each being equivalent to which both equal 1. Then, to convert a measurement in metres into centimetres, we can multiply it by the ratio 1m/100cm.	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation
		E.g.2 Manipulate and use units appropriately to solve problems • Agbo walks 4km to school every day. He uses 60minutes. Rukiya uses 45minutes to cover 4200m. Which of the two pupils is faster?	
		B8.1.4.1.2 Solve unit rate problems including those involving unit pricing and constant speed; and speed translation.	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation
		E.g.1 If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		• **E.g.2** Salamatu is a drummer for a band. She burns 756 calories while drumming for 3 hours. She burns the same number of calories each hour. How many calories does Salamatu burn per hour? **Solution** • How many calories does Salamatu burn per hour? • The ratio of calories burned to hours drumming is 756:3. • Let's find an equivalent ratio that shows how many calories are burned in 1 hour • A ratio where one of the terms is 1 is called a unit rate. We can divide the number of hours by 3 to get to 1 hour.	
		7563 **÷3÷ 3** **?1** 756 ÷ 3 = 252 Calories burned hours **7563** **÷3÷ 3** **2521** Salamatu burns 252 calories per hour of drumming.	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.1.4.1.3 Apply the knowledge of speed to draw and interpret travel graphs or distance-time graphs.	Implement strategies with accuracy
	Notes: put a passage for the graph	**E.g.1** Draw a graph for a passage on a distance time graph. A trader travels in a car from Buduata to Adawso. The distance between the two towns is 20miles. After 6036minutes, the trader makes a stop at Assin which is 8miles from Buduata. 30 36 minutes later, he continues his journey to Adawso in 24 minutes. After resting for 6 12 minutes, he makes a return journey to Buduata in 48 minutes.  	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
			
			

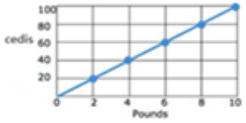
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.2 Interpret a given travel graph  	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.1.4.1.4 Recognize and represent proportional relationships between quantities by deciding whether two quantities are in a proportional relationship. **(e.g. by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin).**	Ability to monitor team members to ascertain progress
		E.g.1 Use given tables to check proportional relationship  **E.g.2** Use graphs to check proportional a non-proportional relationship  The graph shows a non-proportional relationship because the straight line does not go through the origin.	Ability to try alternatives and fresh approaches

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td rowspan="2"></td><td>B8.1.4.1.5 Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.</td><td rowspan="2">Implement strategies with accuracy</td></tr>
<tr><td></td><td>E.g.1
We can find the constant of proportionality from a table of values, equation and a graph.

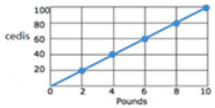
In a table, simplify any one of the ratios.

<table>
<tr><td>Chaperones</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Students</td><td>12</td><td>24</td><td>36</td><td>48</td><td>60</td></tr>
</table>

$k = \frac{y}{x} = \frac{36}{3} = 12$</td></tr>
<tr><td></td><td></td><td>E.g.2 An ant travels $\frac{9}{8}$inches in 45 seconds and $\frac{27}{8}$ inches in 2 minutes and 15 seconds. What is the constant of proportionality?</td><td></td></tr>
<tr><td></td><td></td><td>E.g.3
 

Ratio is constant for all points on the graph 1:10. so the constant of proportinality (k)=10

Create a table using the points from the graph:
<table>
<tr><td>cedis (y)</td><td>20</td><td>40</td><td>60</td><td>80</td><td>100</td></tr>
<tr><td>Total pounds (x)</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr>
<tr><td>Divide total price by total pounds</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
</table></td><td></td></tr>
</table>

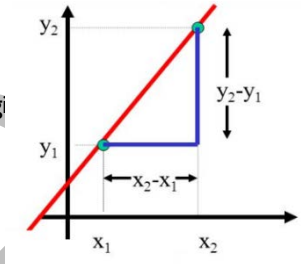
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		 Ratio is constant for all points on the graph 1:10. so the constant of proportinality (k)=10	

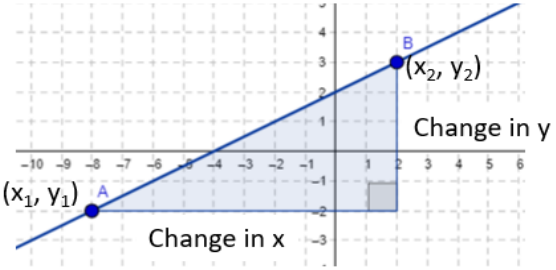
Create a table using the points from the graph:

Total price (y)	20	40	60	80	100
Total pounds (x)	2	4	6	8	10
Divide total price by total pounds	10	10	10	10	10

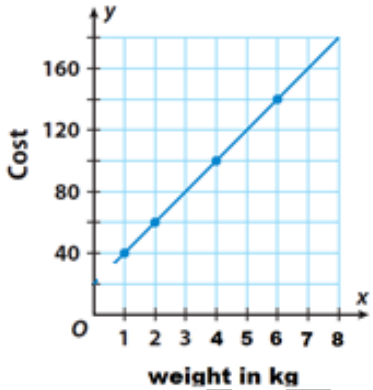
B8 Strand 2

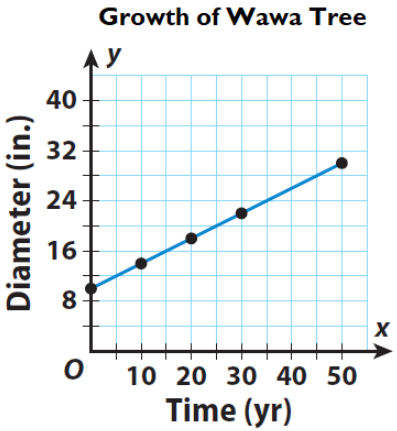
Sub-strand 1 Patterns and Relations

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B8.2.1.1 Demonstrate the ability to draw table of values for a linear relation, graph the relation in a number plane, determine the gradient of the line and use it to write equation of a line of the form y = mx + c.	**B8.2.1.1.2 1 Calculate the gradient of a line and use it to write equation of a line of the form y = mx + c.**	Generate hypothesis to help answer complex problems
		E.g.1 Explain the concept of gradient using real life examples and to discover the practical meaning of gradient   The gradient is the measure of how steep slopped the hill the the rider is climbing is. The gradient is the slope (or steepness) of the roofing of the building.	
		E.g.2 Determine the formula for calculating the gradient of a line  is gi The formula for calculating the gradient of a straight line $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.3 Determine the gradient when given two coordinates Find the gradient of a line which passes through the point; i. $A(1,1)$ and $B(7,2)$ ii. $P(-2,4)$ and $Q(3,5)$ iii. $C(3,-2)$ and $D(-3,4)$	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem
		E.g.4 Determine the gradient of a straight line when given the its equation given of a straight line Find the gradient from the equation of the straight line below i. $y = 5x + 13$ ii. $2x - 8y + 3 = 0$ iii. $y = -3x + 12$ y=mx+c gradient y-axis intercept	
		E.g.5 Determine the gradient from a graph.	
		 Gradient = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{Change in y}}{\text{Change in x}}$	Determine the gradient of the line in the graph. From the graph, the coordinates are A (-8,-2), B (2,3). $m = \frac{-2-3}{-8-2} = \frac{-5}{-10} = \frac{1}{2}$ The gradient of the line is $\frac{1}{2}$

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.6 Determine the slope-intercept form of the equation of a straight line **Hint: the equation of a straight line in slope-intercept form is $y = mx + c$** i. Find the equation of a line with slope 2 and y-intercept -3. Hence find the value of y when x is 4. ii. Find the equation of a line in slope-intercept form having y-intercept $\frac{7}{2}$ and slope $-\frac{5}{2}$. iii. Find the equation of a line with slop $\frac{1}{2}$ and y-intercept 4.	
		E.g.7 Determine the point-slope form of the equation of a straight line **Hint:** the point-slope form of the equation of a straight line is $y - y_1 = m(x - x_1)$ i. Find the equation of a line with slop $\frac{2}{3}$ that passes through the point (3, -1). ii. Find the equation of a line that passes through the point (3, -7) and has the slop $m = \frac{5}{4}$. iii. Find the equation of a line which passes through the points (5, 4) and (-10,-2). iv. Write the equation $5x + 4y - 3 = 0$ in the form form$y = mx + c$. Hence state the gradient and the intercept.	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.2.1.1.3 2 Use graph of a linear relation to determine subsequent missing elements in the ordered pairs of the relation.	
		E.g.1 Use information from a graph to find missing elements  The graph represent the relation $y = 20x$, where y is the cost (in Ghana cedis) of the weight (in kilograms) of meat sold in a market. Use the graph to find i. the cost of 3.5kg of meat ii. the weight of meat that can be bought with GH¢80. iii. Using the relation from the graph, how many kilograms of meat can be bought at a cost of GH¢240.	

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th colspan="2">INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td></td><td>E.g.2 Use information from a graph to find missing elements
 
</td><td>The diameter of a Wawa tree is currently 10 inches when it is measured at chest height. After 50 years, the diameter is expected to increase by an average growth rate of $\frac{2}{5}$ inch per year. The equation $y = \left(\frac{2}{5}\right)x + 10$ gives you y, the diameter of the tree in inches, after x years.

i. Use the graph to complete the table below.
<table><tr><td>X (years)</td><td>0</td><td>10</td><td>20</td><td>30</td><td>50</td></tr><tr><td>Y(diameter in inches)</td><td></td><td></td><td></td><td></td><td></td></tr></table>
ii. What will be the diameter of the tree in 100 years?</td><td></td></tr>
<tr><td></td><td></td><td colspan="2">B8.2.1.1.4 3 Use graphs of linear relations to solve real life problems.

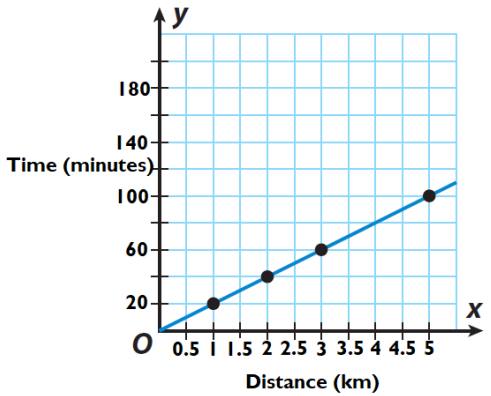
E.g.1 Draw graphs for real life problems

i. Every morning, you go for a walk. The distance you walk can be modeled modelled by the equation $d = \frac{1}{3}h$,where d is the distance walked in kilometers and h is the number of hours you've walked. Make a table for the relation and draw a graph with the values to see how far you've walked after 6hours.</td><td>Preparedness to recognise and explain results after implementation of plans

Ability to monitor team members to ascertain progress</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		Copy and complete the table for the relation **Hint**: the graph should look like the one shown.	

Distance	**1**	**2**	**3**	**4**	**5**
Time					



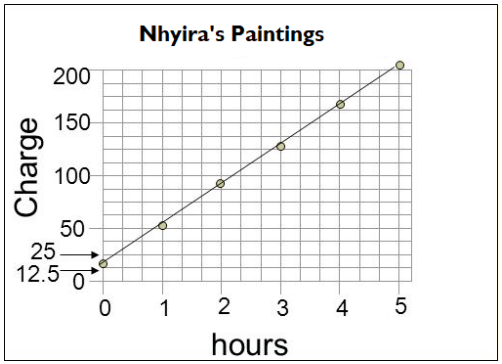
E.g.2

Nhyira paints portraits of people for a living. The graph below shows how much she charges based on how long it takes her to paint the portrait. Use the graph to answer the questions that follow.

i. How much does she charge for a portrait that takes 3 hours to paint?

ii. Is she charges GH¢175, how many hours did she use to paint the portrait?

iii. How many hours will she require to paint a portrait that cost Gh¢300?



B8 Strand 2
Sub-strand 2 Algebraic Expressions

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B8.2.2.1 **Solve problems involving algebraic expressions (including multiplication of binomial expressions) factorize given expressions and substitute values to evaluate algebraic expressions.**	**B8.2.12.1.1 Use the distributive property to remove brackets and solve multiplication of binomial expression.** **E.g.1** Remove Expand the brackets in these expressions	Ability to identify important and appropriate criteria to evaluate each alternative.
		• $6(\square+3)$ • $-5(3\square+4)$ • $3(\square+4)-2(\square-5)$ • $2(6-5\square)+3(2+2\square)+4(3\square-1)$ • $8-(4-\square)+(6-\square)$ • $(\square+\square)+(\square+\square)$	
		E.g.2 Multiply binomial expressions **Simplify** i. $(\square+2)(\square+3)$ ii. $(2\square+\square)(2\square-\square)$ iii. $(3\square+2)(\square+2)$ iv. $(2\square+3)^2$ v. $(\square-2)^2$ vi. $(\square+2)^2$	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem
		B8.2.12.1.2 Perform addition, subtraction, multiplication and division of algebraic expressions including fractions.	
		E.g.1 Solve problems based on multiplication and division of algebraic fractions Simplify: a. $\frac{a}{7}\times\frac{b}{8}$ b. $\frac{p}{14}\times\frac{6}{p}$ c. $\frac{x-3}{8}\times\frac{12}{x-3}$ d. $\frac{5x^2}{x^2-2x}\times\frac{x^2-4}{x^2+2x}$	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		Simplify: a. $\frac{3x-3}{4x-4}$ b. $\frac{4x-8}{6} \div \frac{x-2}{3}$ c. $\frac{x+1}{x+2}$ d. $\frac{2x}{3} \bullet \frac{y}{5}$	
		E.g.2 Solve problems based on addition and subtraction of algebraic fractions	
		Simplify the following: i. $\frac{x}{3} + \frac{3}{2}$ ii. $\frac{2}{3} - \frac{x}{2}$ iii. $\frac{5}{6x} - \frac{3}{4x}$ iv. $\frac{2x}{3} - \frac{x}{2}$ v. $\frac{3x}{4} + \frac{x}{8}$ vi. $\frac{2}{6x} + \frac{2x}{3} - \frac{x}{2}$	
		B8.2.12.1.3 Substitute values to evaluate algebraic expressions including fractions and use it these to solve problems.	
		f = 2, = −2, = 3, = 1 Simplify, then substitute in the value to evaluate the following expressions i. $\frac{3}{x} - \frac{2}{x} \div \frac{3x}{15x} \times \frac{10}{9x}$ ii. $\frac{1}{x} + \frac{2}{x} \div \frac{x^2-2x}{5x} \times \frac{5x^2}{3x}$ iii. $\frac{12x}{7} \times \frac{4x}{20} \div 7x^2 - 4x + 3x^2$	Demonstrate sense of feeling or belongingness to a group Ability to identify important and appropriate criteria to evaluate each alternatives

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.2.12.1.4 Factorize given expressions involving the four operations and use it the experiences gained to solve problems.	Ability to merge simple/ complex ideas to create novel situation or thing
		E.g.1 Factorize the following expressions i. Common factors • $3x + 6$ • $54 - 81y$ • $100 - 25z^2$ ii. Method of grouping • $2ax + 2ay + bx + by$ • $ax + ay + x + y$ • $3x^2 + 2x - 12x - 8$	

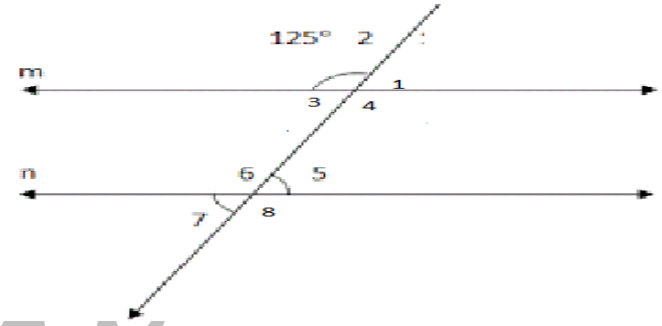
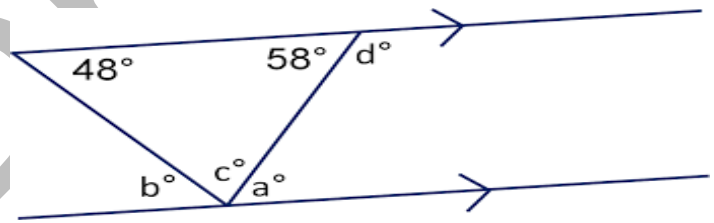
Sub-strand 2 Equations and Inequalities

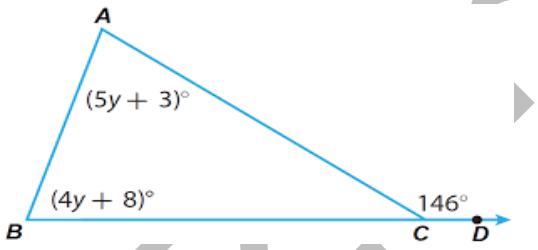
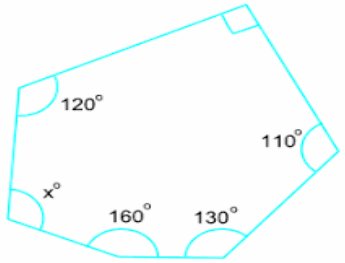
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS		COMPETENCIES
	B8.2.3.1 **Demonstrate an understanding of linear inequalities of the form x + a ≥ b (where a and b are integers) by modelling problems as a linear inequalities and solving the problems concretely, pictorially, and symbolically.**	**B8.2.3.1.1 Translate word problems to linear inequalities in one variable and vice versa** **E.g.1** Make mathematical sentences involving linear inequalities from word problems i. Think of a whole number less than 17 i.e. x < 17 ii. Eight less than the product of -3 and a number is greater than -26. Write and solve an inequality to represent this relationship. iii. □□−3□8 > −26 iv. Kwaakye's March profit of GH¢ 32 was at least GH¢ 12 less than his February profit. What was his February profit? v. **I.e.** *March profit was at least GH¢12 less than February's profit.* *GH¢23≥ -12 +p*		Ability to visualise alternatives, seeing possibilities, problems and challenges. Ability to combine Information and ideas from several sources to reach a conclusion. Analyse and make distinct judgment about viewpoints expressed in an argument
		B8.2.3.1.2 Solve simple linear inequalities **E.g.1** Use the idea of balancing to solve simple linear inequalities		
		i. □□□□29	**v.** □ □ 1	
		ii. □□□ −5	**vi.** □□□ 12	
		iii. □□8□− 2□	**vii.** □ □ □	
		iv. □□□ □	**viii.** □□□ □□□	

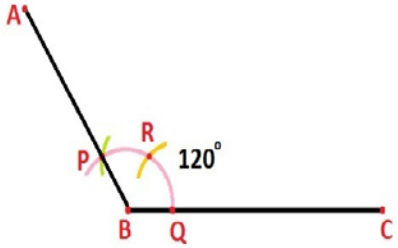
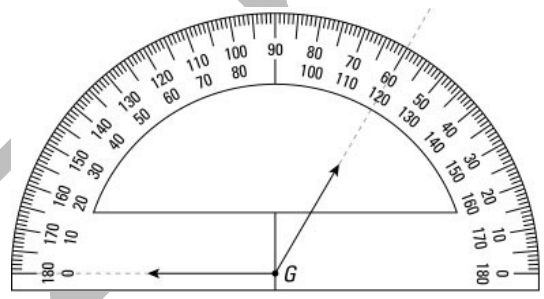
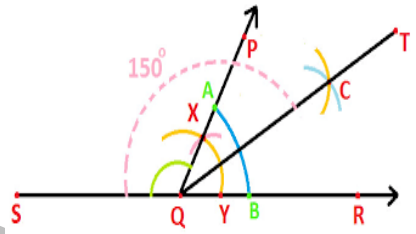
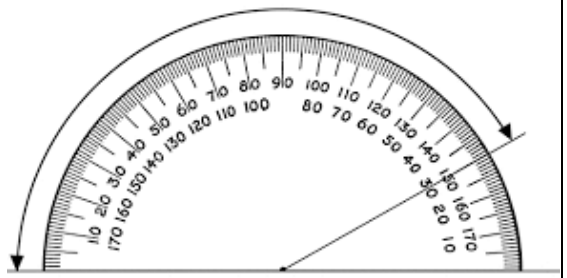
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.2.3.1.3 Determine solution sets of simple linear inequalities in given domains	
		E.g.1 Find solution sets for the following linear inequalities i. if x < 4 for whole numbers, then the domain is whole numbers and the solution set **= {0, 1, 2, 3}** ii. $2 \boxtimes 24$ iii. $\boxplus 4 \leq 3 \boxminus 16$ iv. $9 - 5 \boxtimes 6$	Analyse and make distinct judgment about viewpoints expressed in an argument

Strand 3: Geometry and Measurement

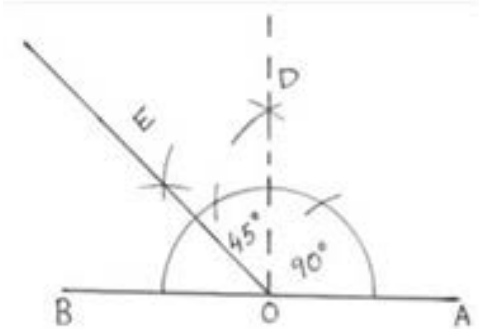
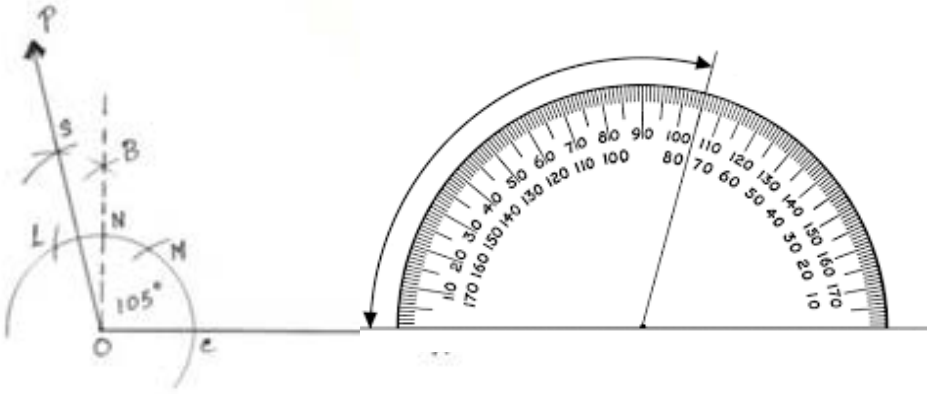
Sub-strand 1: Lines and Shapes

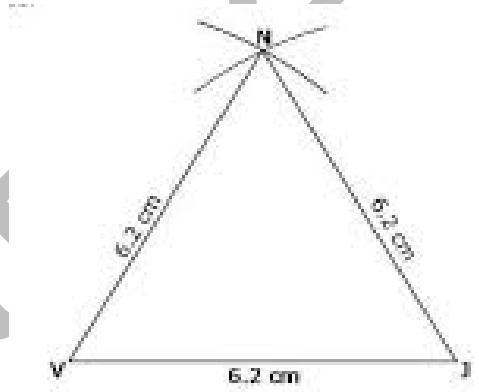
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1.	**B8.3.1.1 Demonstrate understanding and use of the relationship between parallel lines and alternate and corresponding angles and use the sum of angles in a triangle to deduce the angle sum in any polygon**	**B8.3.1.1** **Demonstrate understanding and use of the relationship between parallel lines and alternate and corresponding angles and use the sum of angles in a triangle to deduce the angle sum in any polygon** **B8.3.1.1.1 Draw and determine the values of alternate and corresponding angles** E.g.1. Draw the diagram and calculate the values of angles marked 1, 3,4,5,6,7,8  E.g. 2 Calculate the value of angles a, b, c, and d  	Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used Ability to select the most effective creative tools for working and preparedness to give explanations Imagining and seeing things in a different way

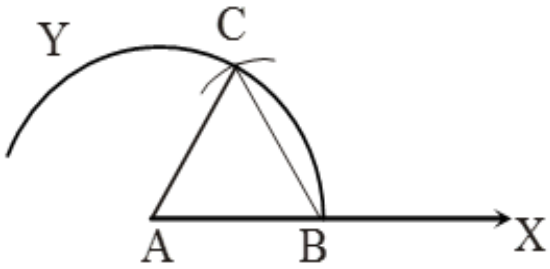
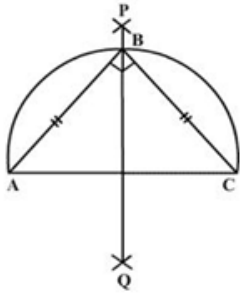
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
2.		**B8.3.1.1.2 Determine the values of sum ofgiven angles in a triangle using knowledge of the sum of interior angles in a triangle and other properties** E.g. 1 Calculate the values of y and the angles in the triangle  E.g. 2 Deduce the formula for sum of interior angles in a polygon determine the value of an angle in a regular hexagon. E.g. 3 Use the formula for finding the sum of interior angles in a polygon (n-2)180 to determine the value of x in the hexagon.  	

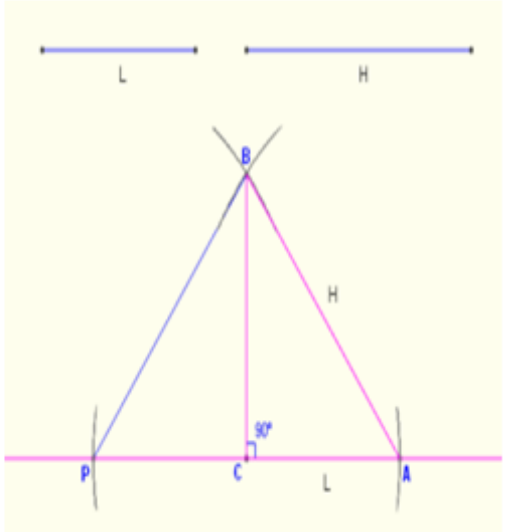
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B8.3.1.2 Demonstrate the ability to perform geometric constructions of the angles (75˚, 105˚, 60˚, 135˚ and 150˚), and construct triangles and find locus of points under given conditions	**B8.3.1.2.1 Construct and bisect angles of 120˚, 105˚, 135˚ and 150˚** **E.g.1**: Use a pair of compasses and a ruler to perform geometric construction of an angle $(\angle CBA)$ =120˚ (draw a semi-circle over the point B to meet $\overline{BC}$ in Q and using the same radius and Q as centre to make the arcs R and P respectively) and confirm the value using protractor  	Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used
		E.g.2: Use a pair of compasses and a ruler to perform geometric construction of an angle of (∠SQC) 150˚ and measure with a protractor to confirm  	Reflect on work and explore thinking behind thoughts and processes

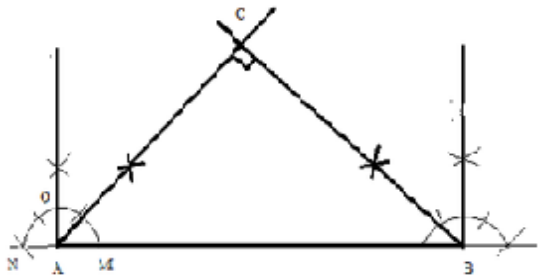
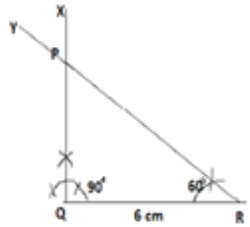
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES

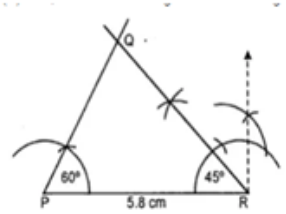
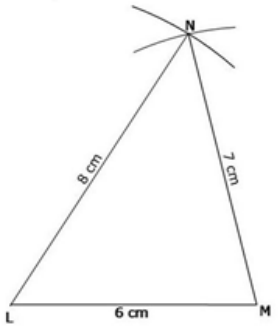
		E.g.3: Use a pair of compasses and a ruler to perform geometric construction of an angle (∠135°) and measure with a protractor to confirm  	
		E.g.4: Use a pair of compasses and a ruler to perform geometric construction of an angle of 105° and measure with a protractor to verify 	

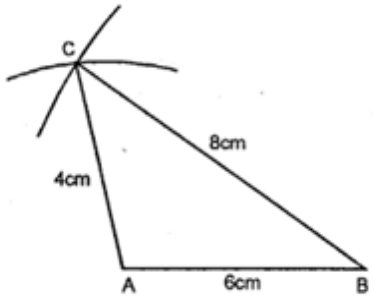
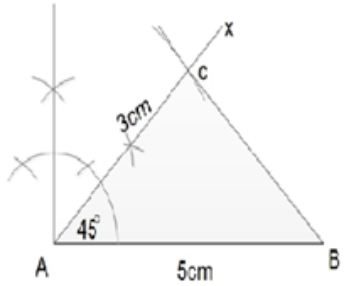
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.3.1.2.2: Construct scalene triangles, isosceles triangles, equilateral triangles, obtuse-angled triangle, acute-angled triangles in different orientations under given conditions. E.g.1: Use a pair of compasses and a ruler to construct an equilateral triangle when a side is given and justify why it is an equilateral triangle (i.e. draw the line [illegible] this radius at V and J respectively to strike arcs to intersect in N. Verify the measure of the size of the angle with a protractor) 	Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used. Reflect on work and explore thinking behind thoughts and processes.

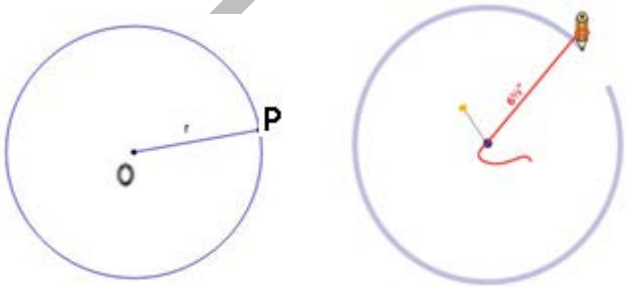
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.2 : Use a pair of compasses and a ruler to construct an equilateral triangle by using point A as a centre and constructing an arc to meet $\overrightarrow{AB}$, and then using the same radius to describe an arc (construct 60 degrees) at point C and joining AC A to C and B to C.  	
		E.g.3: Use a pair of compasses and a ruler to perform geometric construction of an isosceles right-angled triangle when the base line is given In triangle ABC, PQ is a perpendicular bisector of AC=7cm, ABC is a semi-circle and BC=BA  	

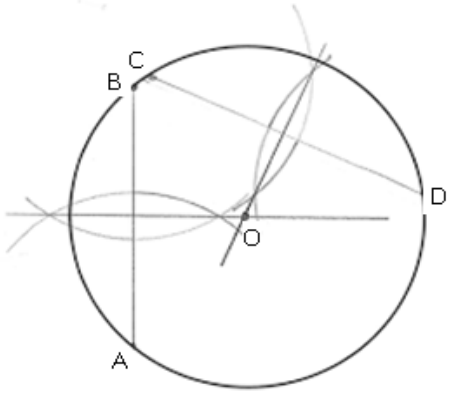
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.4: Use a pair of compasses and a ruler to perform geometric construction of an isosceles an isosceles triangle when all the sides are given i.e. construct Triangle PAB, such that CA=CP=L= 3.5cm. CB is a perpendicular bisector of PA. AB=PB=H=9cm. What can you say about <BAP and <BPA? 	

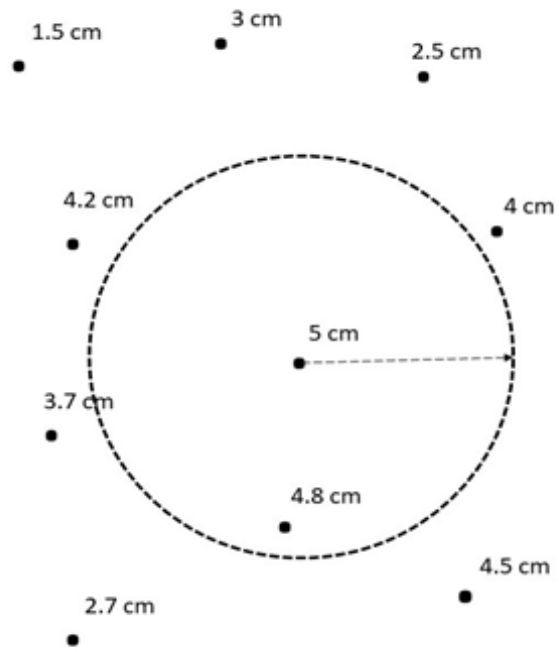
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.4: Use a pair of compasses and a ruler to perform geometric construction of an isosceles triangle when the base angles and base side are known In triangle ABC, $< CAB = < CBA = 45^{\circ}$, $AB = 7cm$, find the length of AC and BC  	
		E.g.5: Use a pair of compasses and a ruler to construct acute-angled triangles, obtuse-angled triangles and right-angled triangles when a side and two angles are given (In Triangle PRQ, $QR = 6cm$, $< PRQ = 60^{\circ}$ and $< PQR = 90^{\circ}$; Triangle PRQ is a Right-angled triangle or a scalene triangle)  	

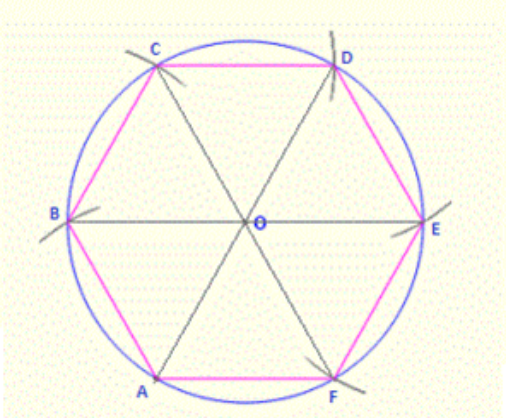
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		(In Triangle PRQ, $PQ = 5.8cm$, $< QPR = 60^{\circ}$ and $< QRP = 45^{\circ}$; Triangle PRQ is an acute angled triangle or a scalene triangle) 	
		E.g.6: Use a pair of compasses and a ruler to construct triangles when all the sides are given Steps of construction: 1. Draw $\overline{LM}$ of length 6 cm. 2. Taking a radius of 8 cm, draw an arc of circle with centre L. 3. Draw another arc of circle with centre M and radius 7 cm to intersect the first arc. Name the point of intersection N. 4. Join the points L and N. Join the points M and N. Hence, ΔLMN is the required triangle. 	

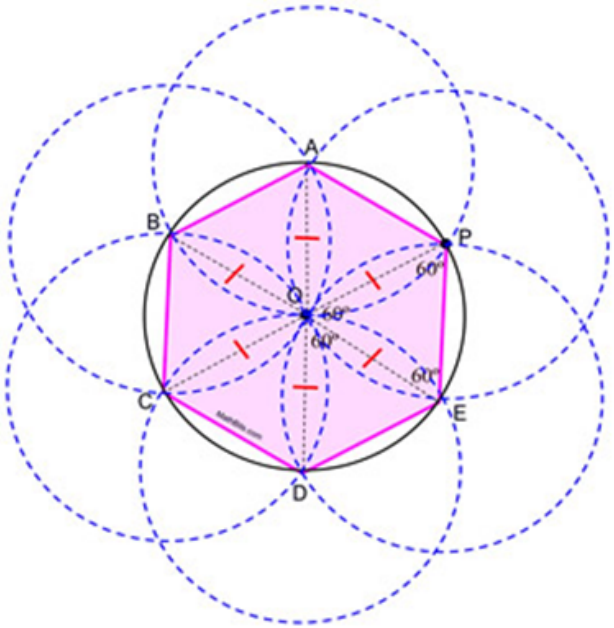
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		In triangle ABC, AC = 4cm, AB= 6cm and BC = 8cm. Measure the value of the angles (what is the name of this triangle?)  	
		E.g.7: Use a pair of compasses and a ruler to construct triangles when two sides and one angle are given In triangle ABC, <CAB = 45°, AC=3cm and AB =5cm  	

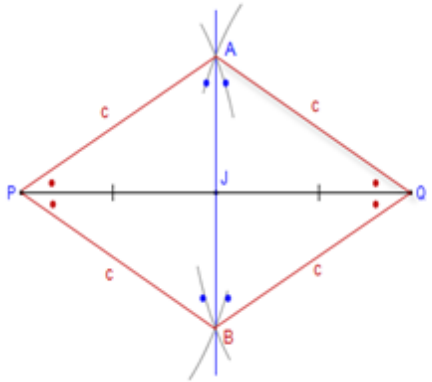
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.3.1.2.3: Construct loci under given conditions including: **(i) the locus of sets of points from a fixed point** **(ii) the locus of points equidistance equidistant from two fixed points;** **(iii) the locus of points equidistance equidistant from two intersecting straight lines, and** **(iv) the locus of points equidistance equidistant from two parallel lines**	Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used.
		E.g.1: Describe the locus of a circle by racing the path of a point P which moves in such a way that its distance from a fixed point, say O is always the same construct circles 	Reflect on work and explore thinking behind thoughts and processes.

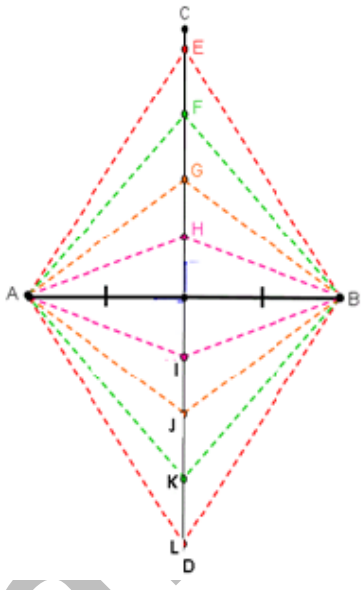
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.2: Perform geometric construction to locate the centerentre of a circle by locating the intersection of the perpendicular bisectors of any two chords on the circle Find the centre of the circle  	

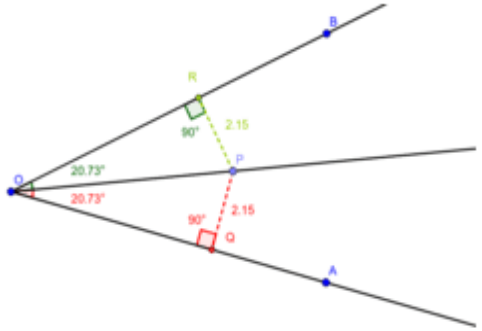
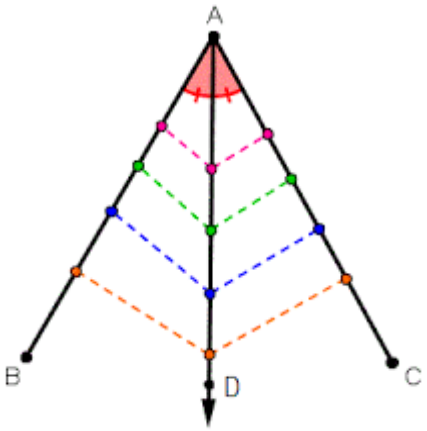
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.3: Draw circles of given radius at the points as centre and colour 	

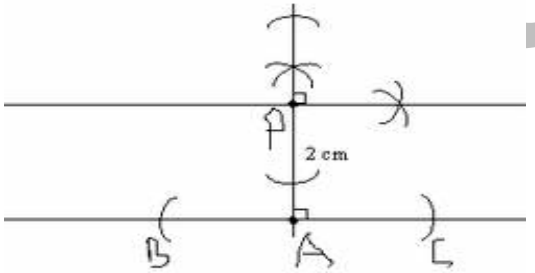
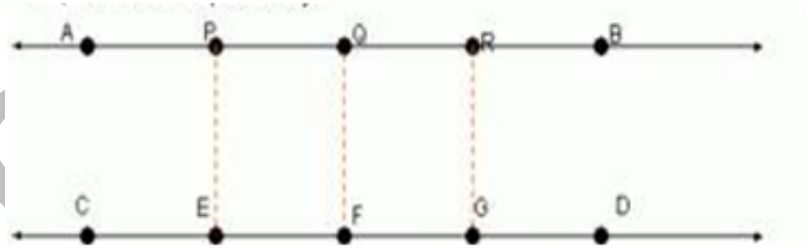
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.4: Construct a regular hexagon within a circle given the length of a side Use a pair of compasses and a ruler to construct a hexagon ABCDEF such that $\|AB\| = 6cm$. Find the measure of the angles AOB and compare to its value to <AFG, <DOE, <DOC, <EOF and <BOC. What is your observation?  	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.5 Use intersecting circles to construct a regular hexagon and measure it sides Perform geometric construction of hexagon ABCDEF using the method of intersecting circles. Take $\|OA\| = 5cm$. Measure and compare the sides of the hexagon. Find the measure of the angles AOB and compare to its value to <AFG, <DOE, <DOC, <EOF and <BOC. What is your observation?  	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.6: Construct a perpendicular bisector (mediator) as a locus and explain why the perpendicular bisector is a locus The line segment AB is a perpendicular bisector of PQ since line segments AP, AQ, PB, QB are all congruent 	

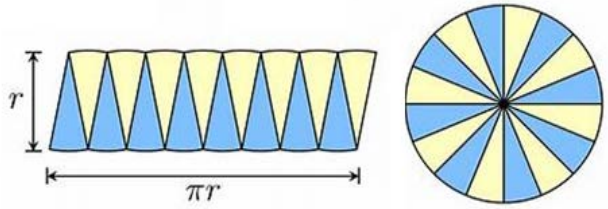
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		Any point on line CD is of equal distance from the two fixed points A ard B)  	

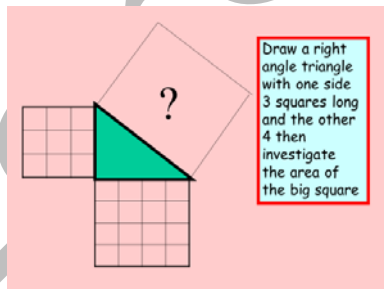
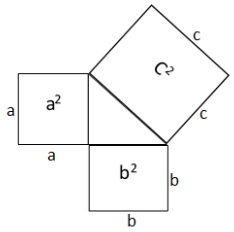
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g. 7 Construct an angle bisector as a locus of points equidistant from two lines that meet and explain why the angle bisector is a locus 	
		AD is a mediator (angle bisector) of the angle BAC 	

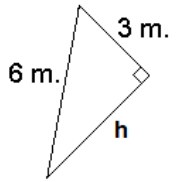
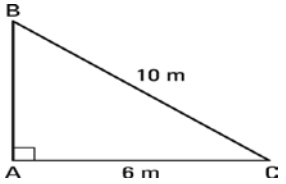
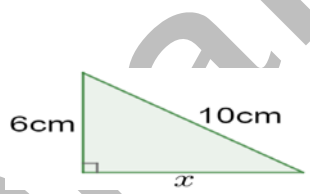
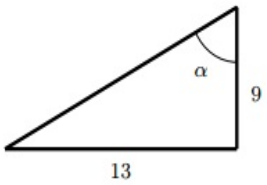
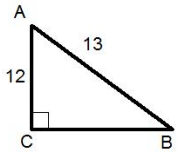
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.8: Construct parallel lines as a locus (i.e. tracing the path of a point say P which moves in such a way that its distance from line BC is always the same).  	
		E.g.9: perform Perform geometric constructions to proveof that two given lines are parallel Show that two given lines AB and CD are parallel (i.e. locate three points P, Q and R, draw perpendiculars to AB at PQ anc R to intersect CD at E, F and G respectively  Measure the lengths of PE, QF, and RG. The perpendicular distance between two parallel lines is the same everywhere	

Strand 3 Geometry and Measurement

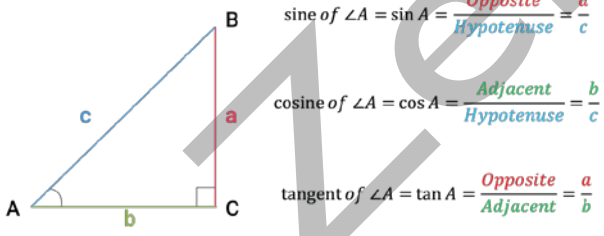
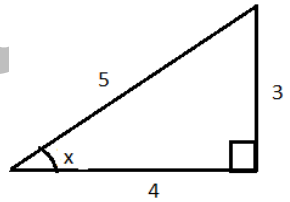
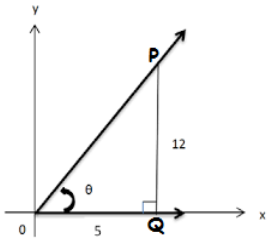
Sub-strand 2: Measurement

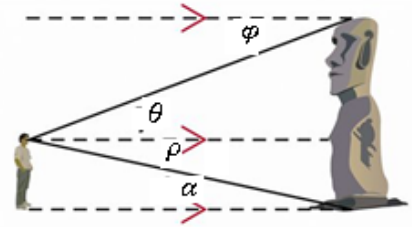
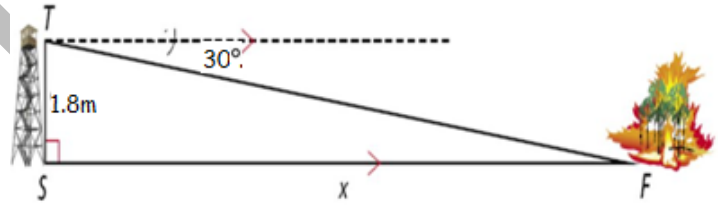
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B.8.3.2.1 **Apply the Pythagoras theorem, the primary trigonometric ratios and the formulas for determining the area of circle to solve real problemsB.8.3.2.1** **Apply the Pythagoras theorem and the formulas for determining the area of a triangle and circle to solve real problems**	**B8.3.2.1.2 1 Use the relationship between the diameter and circumference of a circle to deduce the formula finding the area and use this to solve problems**	Create simple logic trees to think through problems
		Eg 1: Divide the circle into sectors (minimum of 16) then cut the sectors and arrange to form a rectangle deduce the Area of the circle.  Thus length of rectangle = □ width = □ □ = □ × □ = □² □	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation
		E.g. 2 Solve problems on area of a circle (i) Find the area of a circle whose radius is 14cm (Take π = 22/7) (ii) Find the area of a semi-circle whose radius is 7cm (Take π = 22/7) (iii) Two circles with common centre, the small circle has radius 7cm, the big circle also has radius 14cm .with big circle shaded. .Find the shaded area. (Take π = 22/7).	Provide new insight into controversial situation or task

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.3.2.1.2 Establish the relationship between the hypotenuse '*c*' and the two other sides '*a*' and '*b*' of a right-angled triangle (i.e. $a^2 + b^2 = c^2$) and use it to solve problems	
		E.g.1 Construct squares on the three sides of a right-angled triangle in a square grid and compare the area of the square on the hypotenuse to the squares on the other two sides to state the relationship between the hypotenuse '*c*' and the two other **sides** '*a*' and '*b*' of a right-angled triangle i.e. $a^2 + b^2 = c^2$ 	Ability to combine Information and ideas from several sources to reach a conclusion
		E.g. 2 Using a pair of compasses and ruler, construct squares on the three sides of a right-angled triangle and measure the area of the square on the hypotenuse and compare to the squares on the other two sides to state the relationship between the hypotenuse '*c*' and the two other **sides** '*a*' and '*b*' of a right-angled triangle i.e. $a^2 + b^2 = c^2$. 	Analyse and make distinct judgment about viewpoints expressed in an argument

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g. 3 Solve problems involving Pythagoras theorem. i. Determine the missing side marked h in the figure. ii. Find the height AB.   iii. If the legs of a right triangle are of the same length, what is the length of the hypotenuse?	
		B8.3.2.1.3 Use the Pythagorean theorem to solve problems on right-angled triangle E.g.1 An isosceles triangle has equal sides,6cm long and a base of 4cm long. Find the altitude of the triangle.    E.g.2 Find the length of each of the diagrams indicated below, (i) the length x (ii) the length CB (iii) the longer length	Develop and defend a logical plausible resolution to a confusion, uncertainty or contradiction surrounding an event

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.3.2.1.3 5 Use Pythagoras theorem to calculate area of a triangle in real life problems E.g.1 . A boat travels 2m South and then 9m east. (i) How far is the boat from its starting point. E.g.2 Yeboah hangs a picture frame of width 15cm on the wall. The distance from the nail to the edge of the picture frame is 10cm (i) Find the length of the wire used to hang the picture frame. (ii) Find the area of the triangle. E.g.3 A ladder leans against a vertical wall of height 13m. If the foot of the ladder is 6m away from the wall, calculate the length of the ladder. E.g4 The length of a side of an equilateral triangle is 12cm .Find (1) the height of the triangle (11) the area of the triangle (111) the perimeter of the triangle	Ability to select alternative(s) that adequately meet selected criteria Ability to mentor peers

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.3.2.1.6 Establish the relationship between the basic trigonometric ratios and solve problems involving right-angled triangles E.g.1 Identify and recognize the three primary trigonometric ratios i. Establish the sine, cosine and tangent of an angle in a right-angled triangle SOH – CAH - TOA 	Preparedness to recognise and explain results after implementation of plans Implement strategies with accuracy
		ii. Find [illegible] in the diagram  iii. Write two trig ratios of the angle marked [illegible] the diagram 	Ability to keep group working on relevant activities

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g. 2 Explain the angles of elevation and depression in real life 	
		ii. Identify angles of elevation and depresion from the diagram 	
		E.g.3 Use trig ratios and the Pythagoras theorem to solve problems involving angles of elevation and depression i. A hunter sees a fire at an angle of depression 30°. The height of the hunter is 1.8m. What is the distance between the fire and the hunter? Round off your answer to 2 significant figures 	

Strand 3 Geometry and Measurement

Sub-strand 2: Measurement

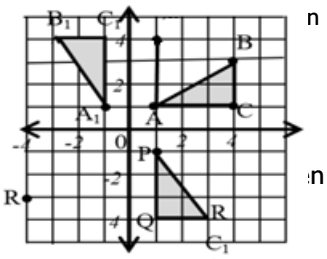
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B8.3.3.2 Demonstrate understanding of addition and subtraction of vectors and their application in solving basic problems	**B8.3.3.2. Add, subtract and find the scalar multiplication of vectors in the component form** E.g1 Add vectors using the graphical method E.g.2 Add and Ssubtracte vectors in their corresponding components. If $\overrightarrow{AB} = \begin{pmatrix} a \\ b \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} c \\ d \end{pmatrix}$ then $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$ $= \begin{pmatrix} a \\ b \end{pmatrix} + \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} a+c \\ b+d \end{pmatrix}$ If $\overrightarrow{AB} = \begin{pmatrix} a \\ b \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} c \\ d \end{pmatrix}$ then $\overrightarrow{AC} = \overrightarrow{AB} - \overrightarrow{BC}$ $= \begin{pmatrix} a \\ b \end{pmatrix} - \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} \square & \square \\ \square & \square \end{pmatrix}$ E.g3 Multiply a vector by a scalar k( )=k( ) E.g.4 If p=$\begin{pmatrix} -1 \\ 2 \end{pmatrix}$, q=$\begin{pmatrix} 4 \\ 3 \end{pmatrix}$, and r=$\begin{pmatrix} 3 \\ -2 \end{pmatrix}$, find (i) 3q-2p (ii) r-3p (ii) q-p+2r	Generate hypothesis to help answer complex problems

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B8.3.3.2.2 Demonstrate understanding of vector equality **E.g.1** Investigate the properties of equal vectors **E.g.2** If a=$\binom{3}{5}$,b=$\binom{7}{2}$ and c=$\binom{-3}{-4}$, Caculate ||p|| if p=a+ ½(b-c) **E.g.3** If M = N ,find x and y given that M=$\binom{x-2}{y+7}$ and N=$\binom{1}{2x-1}$	Generate hypothesis to help answer complex problems

Strand 3 Geometry and Measurement

Sub-strand 2: Measurement

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1. 2.	**B8.3.3.15** **Perform a single transformation (i.e. rotation) on a 2D shape using graph paper including technology and describe the properties of the image under the transformation (i.e. congruence, similarity, etc.)**	**B8.3.3.15.1 Understand rotation and can identify real-life situations involving rotation.** E.g. 1. Know Identify examples of rotation situations in everyday life and the nature of movements – clockwise and anti-clockwise. i. State the object points and its corresponding image points under a given rotation ii. Draw points of shapes under a clockwise or anti-clockwise rotation through a given angle about the origin (90°, 180°, 270°)	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation
3.		**B8.3.3.15.2 Draw rotation image in coordinate plane and determine angle of rotation.**	Identification of

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
4.		E.g. 1. Rotate a shape through a given center centre of rotation and ar n rules. iii. State the object points and its corresponding image poin iv. Draw points of shapes under a clockwise or anti-clockwi :n angle about the origin (90°, 180°, 270°)  E.g. 2. Determine the angle of rotation using the points of an object, its their images and center centre of rotation (NB: use protractor to measure).	requirements of a given situation and justification of more than one creative tool that will be suitable. Ability to visualise alternatives, seeing possibilities, problems and challenges. Ability to try alternatives and fresh approaches

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
5.		**B8.3.3.15.3 Investigate the concept of congruent and similar shapes** E.g. 1. Using multiple and varied examples of rotation on coordinate plane to verify congruent and similar shapes using their properties.	Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

Strand 4: Data

Sub-strand 1: Data Handling

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1.	**B8.4.1.1** **Select, justify, and use appropriate methods to collect data (quantitative and qualitative), use the data (grouped/ungrouped) to construct and interpret frequency tables, bar charts, pie charts, and pictograms to solve and/or pose problems.**	**B8.4.1.1.1 – Identify types of given data. including numerical, categorical, ungrouped and grouped data** E.g. 1 Learners discuss, in small groups, an information collected in the process of investigation which may be numeric. i. Numeric (and discrete): the number of Nissan cars sold by Japan Motors, Ghana in a year; the number of children in a family; the number of learners in B8 class ii. Numeric (and continuous): weight of babies in a creche (e.g. 4.5kg) which contains fractional value	Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
2.		E.g. 2 Learners, in small groups, discuss an information collected in the process of investigation which may be non-numeric i. Non-nNnumeric (cannot be quantified): sex (male or female); income group, movie type, age group, marital status, boxers' weight class, etc. ii. Lead leaners to sort out the examples of the non-numeric in (i) that have values that can be put on ordinal scale (boxers' weight class; age group) iii. Lead leaners to sort out the examples of the non-numeric in (i) that can be put into categories (Categorical data): sex (male or female); marital status; income group, etc.	
3.		E.g. 3 i. The scores for 11 learners in a class test are 25, 30, 35, 40, 45, 26, 29, 50, 45, 37 and 47. (these **individual** scores are **not grouped** in any way) ii. Learners find out those in the **group** 25 to 35 (i.e. 5) and those in the **group** 36 to 50 (i.e. 6).data now **grouped**	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem

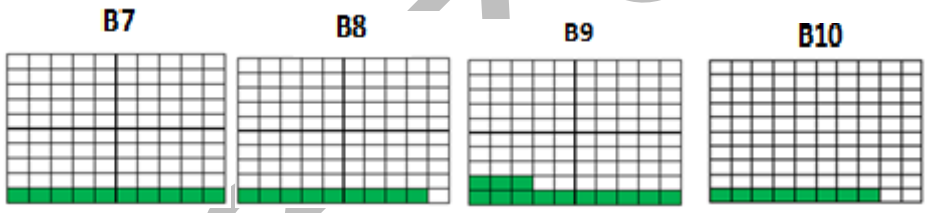
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
4.		**B8.4.1.1.2 - Select and justify a method to collect data (quantitative and qualitative) to answer a given question.**	Preparedness to recognise and explain results after implementation of plans
5.		E.g. 1- To study how eating cream crackers influence/affect one's output of work (productivity), let learners identify which method they will use to gather the facts for each of the following situations. (i.e. refer to methods stated in E.g. 2 of **B7.4.1.1.1)** i. Will eating twice a person's normal number of cream crackers increase their	Create simple logic trees to think through problems Demonstrate behaviour and skills of working towards group goals

		his/her productivity? ii. Are people who eat more cream crackers more productive? iii. Does a group of students study better when cream crackers are present or absent?	Understand and use interpersonal skills
6.		E.g. 2 -Learners should select the study they wish to undertake and design an appropriate form to be used in collecting the data.	Understand roles during group activities
7.		**B8.4.1.1.3 - Organize data (grouped/ungrouped), present it in frequency tables, line graphs, pie graphs, bar graphs and/or pictographs (representations include info graphics, waffle diagrams, box and whisker plots and stem and leaf plots) and analyse it to solve and/or pose problems.**	Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES

8.		E.g. 1 -The following set of raw data shows the lengths, in millimetres, measured to the nearest mm, of 340 leaves taken from plants of a certain species. 40 54 25 50 58 45 47 49 30 28 52 31 52 41 47 44 46 39 51 59 49 38 43 48 43 43 40 51 40 56 31 53 44 37 35 37 33 38 46 36 Make Copy and complete the table of frequency distribution, using the table distribution table below, using the data set above..	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem Preparedness to recognise and explain results after implementation of plans Create simple logic trees to think through problems Demonstrate behaviour and skills of working towards group goals Understand and use interpersonal skills

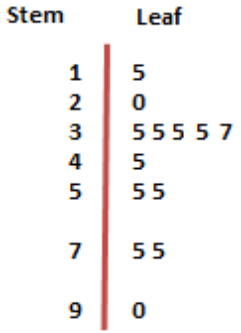
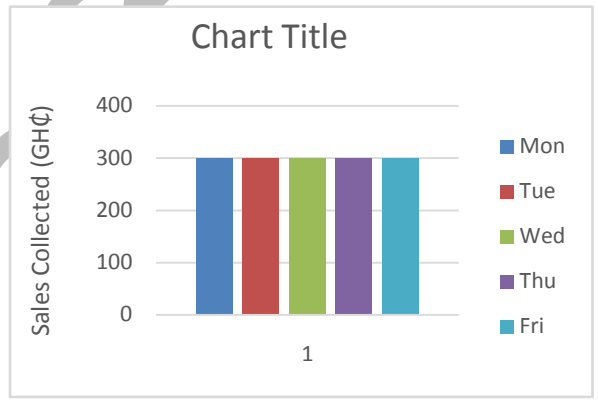
Lengths (mm)	Tally	Frequency
25 – 29		
30 – 34		
35 - 39		
40 – 44		
45 – 49		
50 – 54		
55 - 59		

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
9.		E.g. -2 A cleaner of a small office spent GH₵120 the salary on food; GH₵80 on rent; GH₵40 on clothing; GH₵110 on transport and saved GH₵50. Organize the data and draw (i) a bar chart and (b) a pie chart to represent the data.	Understand roles during group activities
10.		E.g. -3 – The waffle chart (i.e. a 10 X 10 cell grid in which each cell represents percentage point summing up to total 100%.) shows that the average score obtained by B7 learners in a mathematics test conducted, is 10%. i. Read and record the average scores obtained by B8, B9 and B10.  ii. In a mathematics quiz Cordei scored **75%**, Kofi scored **80%**, Maama scored **35%**, Kpakpo scored **70%** and Adjoa scored **50%.** Draw a waffle chart to represent the data.	

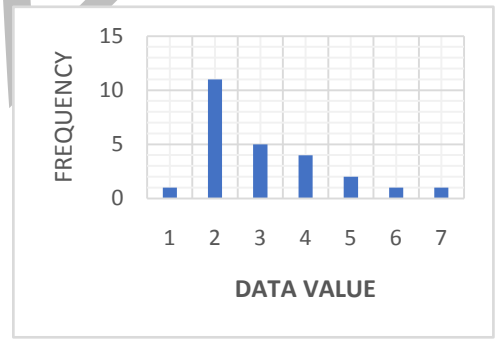
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
11.		E.g. 4 – Learners make a stem and leaf plot (a stem-and-leaf display or stem-and-leaf plot is a method for presenting quantitative data in a graphical format to assist in visualizing the shape of a distribution and giving a great idea about the distribution of the data.) i. The data below are scores for 14 B8 learners in a test marked out of a maximum of 100. Learners should make a stem and leaf plot to represent the data 23, 58, 62. 62, 63, 65, 67, 71, 71, 72, 80, 82, 82, 82 *Learners should note that though there are no scores 30s and 40s, **0**s **should not** be put against stem 3 and stem 4.those spaces must left blank. However, **0 should** be put against 8 for 80)* ii. From the plot, what can we say about the performance of the 14 B8 learners? **Where:** 2 means 23 7 means 112 means 71, 71,72	

Stem	Leaf
2	3
3	
4	
5	8
6	2 2 3 5 7
7	1 1 2
8	0 2 2 2

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES

12.		E.g. 5 – The stem and leaf plot shows the scores obtained by learners in a test. Use it to answer the following questions: i. What are the scores? Write themn in ascending order. ii. What is the mode of the scores? iii. What is the median of the scores?  	
13.	**B8.4.1.2 Demonstrate an understanding of measures of central tendency (mean, median, mode) and range for grouped data and explain when it's most appropriate to use the mean, median, or mode.**	**B8.4.1.2.1 -Calculate the mean, median and mode for a given set of ungrouped data, and explain why these values may be the same or different.** E.g. 1 The bar graph on the right shows the sales of a small business from Monday to Friday. Calculate the mean, median and mode for amounts collected during the period and explain your findings (i.e. why the values are the same)  	Interpret correctly and respond to non- verbal communication such as facial expressions, cues and gestures Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication Ability to identify important and appropriate criteria to evaluate each alternative.

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES

<table>
<tr>
<td>14.</td>
<td></td>
<td>E. g. 2 The table below shows the area of the sitting room floors of each of 7 Real Estates houses (A, B C, …) in Kwashi Kumaman
<table>
<tr><td>Houses</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td></tr>
<tr><td>Area (m^2)</td><td>22</td><td>24</td><td>26</td><td>30</td><td>48</td><td>30</td><td>30</td></tr>
</table>
i. In small groups, let learners work out the mean, median, mode.
ii. Draw a bar chart to represent the data collected, and
iii. Explain why the values are the same.</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td></td>
<td>E.g. 3. The table below shows the occurrence of the data values from 1 to 7 and represented by the corresponding bar graph.
<table>
<tr><td>Data Value</td><td>Frequency</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>2</td><td>11</td></tr>
<tr><td>3</td><td>5</td></tr>
<tr><td>4</td><td>4</td></tr>
<tr><td>5</td><td>2</td></tr>
<tr><td>6</td><td>1</td></tr>
<tr><td>7</td><td>1</td></tr>
</table>


i. Calculate the mean, median, mode
ii. Locate them on the corresponding graph, and
iii. Explain why the values are different.</td>
<td></td>
</tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES

<table>
<tr><td>16.</td><td></td><td>B8.4.1.2.2-Justify a context in which the mean, median or mode is the most appropriate measure of central tendency to use when reporting findings.</td><td rowspan="2">Interpret correctly and respond to non- verbal communication such as facial expressions, cues and gestures

Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication

Ability to identify important and appropriate criteria to evaluate each alternative.</td></tr>
<tr><td>17.</td><td></td><td>E.g. Kojo's says his taxi makes a number of journeys trips each day as shown in the table below.

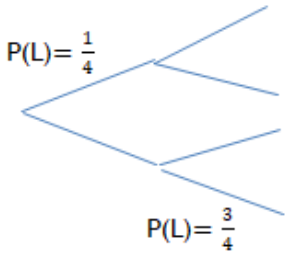
<table><tr><td>Monday</td><td>Tuesday</td><td>Wednesday</td><td>Thursday</td><td>Friday</td><td>Saturday</td><td>Sunday</td></tr><tr><td>8</td><td>6</td><td>10</td><td>10</td><td>9</td><td>10</td><td>3</td></tr></table>
i.
ii.
iii. In small groups, let learners calculate the mean, median and mode for Kojo's week

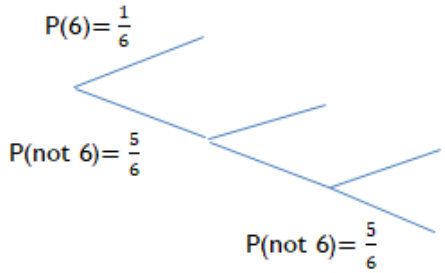
ii. Which measure of central tendency best represents or describes the number of journeys trips that Kojo makes each day

iii. Learners must justify their decisions.</td></tr>
</table>

Sub-strand 1: Probability

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
18.	**B8.4.2.1** **Identify the sample space for a probability experiment involving two independent events and express the probabilities of given events as fractions, decimals, percentages and/or ratios to solve problems.**	**B8.4.2.1.1.-Perform a probability experiment involving two independent events such as drawing coloured bottle tops from a bag with replacement and list the elements of the sample space**	Preparedness to recognise and explain results after implementation of plans. Implement strategies with accuracy. Can see the importance of including all team members in discussions and actively encourage contributions from their peers in their team.
19.		E.g. 1 -In an experiment, Emmanuel was asked to pick one bottle top from a bag, three times, which contains 3 red, 2 green and 1 pink bottle tops. i. List the elements of the sample space of the events. ii. The sample space of the event of picking a red bottle top, R, with replacement is …… iii. The probability of picking a red bottle top is …….	
20.		E.g. 2 -Consider the following two events: (a) throwing of a fair six-sided die and (b) tossing a fair coin i. What is the sample space for (a) and for (b)? ii. Does the occurrence of event (a) affect the occurrence of event (b)? iii. What is the probability of an even number showing up in (a)? What is the probability of a head showing up in (b)? iv. What is the relationship between the two events?	
21.		E.g. 3 -Ampofo and Serwa are two learners from a school. Ampofo walks to school daily and Serwa travels to school on a bus daily. i. Does the event of event involving Ampofo affect that of Serwa? ii. Can the two events occur together?	

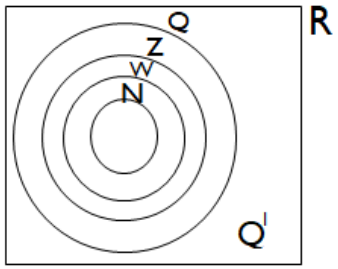
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
22.		**B8.4.2.1.2. Express the probabilities of the events as fractions, decimals, percentages and/or ratios. e.g.by using a tree diagram, table or other graphic organizer**	Develop and defend a logical plausible resolution to a confusion, uncertainty or contradiction surrounding an event Actively assist group identify changes or modifications necessary in the group activities and work towards carrying out those changes
23.		E.g. 1- The arrow on the spinner if spun twice and the number of wins recorded. i. Identify the sample space ii. Calculate the probability of a win P(W) and the probability of a lose, P(L) iii. Copy and complete the probability tree diagram that seeks to represent below of the events, i.e. the 1st and 2nd spins iv. Express the probabilities stated on the branches in decimals, percentages and ratios  	
24.		E.g. 2-A box contains 3 blue pens and 4 pink pens. A pen is taken from the box, its colour noted, and then replaced. Another pen is taken and its colour noted. i. What is the sample space of the 1st and 2nd trials? ii. Draw probability tree diagram.	

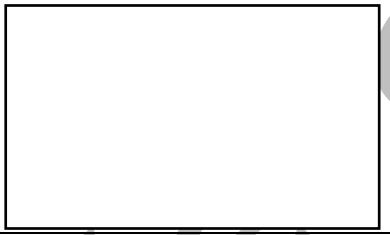
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
25.		E.g. 2 -A die is thrown at most three times. If 6 is scored the game stops.  i. Copy and complete the probability tree diagram ii. Explain why some of the branches of the tree diagram have disappeared.	Develop and exhibit a sense of cultural identity. Identify and explain a confusion, uncertainty, or a contradiction surrounding an event

BASIC 9

Strand 1: Number
Sub-strand 1: Number and Numeration System

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1.	**9.1.1.1.1 Apply the understanding of place value in solving real life problems involving integers of any size, rounding this to given decimal places and significant figures**	9.1.1.1.1 Express integers to given number of significant and decimal places E.g.1. Express integers to a number of significant figures (i) 857,386,321 -five significant figures -four significant figures -three significant figures etc E.g.2. Express decimal numbers to a given number of decimal places (i) 98745.9674 correct to -three decimal places -two decimal places -one decimal place 9.1.1.1.2. Use knowledge and understanding of place value to solve real life problems E.g.1. Create and solve a real-life problem or a story problem and write the answer in standard form (I) I am a 6-digit number. My first digit is 5 more than the last digit, but 2 less than my second digit. My second digit is the third multiple of 3, while my fourth digit is the second multiple of 3. My third digit is the quotient when the fourth digit is divided by my last digit. However, my fourth and fifth digits are consecutive numbers. What number am I?	Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication Think beyond their task and actively support other team members to complete their task. Division of task into solvable units and assign group members to task units Ability to select the most effective creative tools for working and preparedness to give explanations

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
2.		Think second digit: 3x3=9 fourth digit: 2x3=6 first digit: 9-2=7 last digit: 7-5=2 fifth digit: 6-1=5 third digit: 6 □□□□ So the number is 793652 = 7.93652×10^5	
		E.g.2 Create similar real story problems and solve	
3.	**B9.1.1.2** **Demonstrate an understanding of the relationship between members of the rational number system and solve real life problems involving union and intersection of three sets**	B9.1.1.2.1 Solve problems on relationship between members of the rational number system using knowledge and understanding of the concept of union and intersection of two sets	Knowledge and recognition of ethical use of information Recognise and generalise information and experience ; search for trends and patterns
		E.g. 1 Use sets diagrams to show the relationship among the Real numbers namely -(R) Irrational numbers	
		-Irrational numbers (Q^{I}) -Rational numbers (Q) - Integers (Z) -Whole numbers (W) -Natural or Counting numbers (N)	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
4.		E.g. 2 Write the factors of 12 and 15 and represent them on a Venn diagram. 12={1, 2, 3, 4, 6, 12} 15={1, 3, 5, 15} 	Interpret correctly and respond to non- verbal communication such as facial expressions, cues and gestures
5.		B9.1.1.2.2 Apply the concept of sets of sets to solve problems on relationship between members of rational number system and solve real life problems involving union and intersection of two sets	
6.		E.g.1 Create and solve real life problems to show union and intersection of two sets. i. There are 80 farmers in a certain village who grow either maize or beans. Fifty of them grow beans while sixty grow maize. If each farmer grows at least one of the two crops, represent the information on a Venn diagram and hence find the number of farmers who grow; a. both crops. b. only one crop.	

Strand 1: Number
Sub-strand 12: Number and Numeration System Operations

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
7.	**B.9.1.2.1 Apply mental mathematics and properties to determine answers for addition and subtraction of basic facts.**	**B9.1.2.1.1 Multiply and divide given numbers by multiples of 10 including decimals and benchmark fractions** E.g.1. Recall multiplication facts up to 144 and related division facts. E.g.2. Recall decimal names of given benchmark fractions converted to decimals or percentages (and vice versa) E.g. 3. Find the product of a given decimal number when it is multiplied by 10, 100, 1000, $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, etc.	Identify words or sentences in context or appropriately Analyse and make distinct judgment about viewpoints expressed in an argument
8.	**B9.1.1.2** **Demonstrate an understanding of the relationship between members of the rational number system and solve real life problems involving union and intersection of three sets**	**B.9.1.2.1.2 Demonstrate the ability to determine commutative properties of addition and multiplication.** E.g1. Recognize that for any two numbers **a** and **b**; i. a + b = b + a i.e. 25 + 32 = 32 + 25 = 57 ii. a × b = b × a i.e. 17 × 8 = 8 × 17 = 136 **B9.1.2.1.3 Use the associative property of addition and multiplication.**	Identify underlying themes, implications and issues when listening Identify and prove misconceptions about a generalised concept or fact specific to a task or situation
9.		E.g1. Recognize that for any three numbers **a**, **b** and **c**; i. a + (b + c) = (a + b) + c or a + (b + c) = (a + c) + b i.e. 15 + (6 + 9) = (15 + 6) + 9 = 30 ii. (a × b) × c = a × (b × c) i.e. (12 × 5) × 4 = 12 × (5 × 4) = 240	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
10.		B9.1.1.4 Use the distributive property in solving problems. E.g1. Recognize that for any three numbers **a**, **b** and **c**; i. a × (b + c) = (a × b) + (a × c) i.e. 5 × (10 + 7) = (5 × 10) + (5 × 7) = 85 ii. a × (b - c) = (a × b) - (a × c) i.e. 5 × (10 - 7) = (5 × 10) - (5 × 7) = 15	
11.	**B9.1.2.2** **Apply the understanding of the addition, subtraction, multiplication and division of decimal numbers to solve problems and round answers to given decimal places and significant figures9.1.1.1.1 Apply the understanding of place value in solving real life problems involving integers of any size, rounding this to given decimal places and significant figures**	**B9.1.2.2.1 Solve operations involving addition, subtraction, multiplication and division using word problems.9.1.1.1.1 Express integers to given number of significant and decimal places** E.g. Create and solve story problems involving a combination of two or more of the basic operations (×, ÷, —,+). i) A trader sells oranges from two baskets, A and B. Basket A contained 85 oranges and she sold 48. She sold 59 oranges from basket B and was left with the same number of oranges as in basket A. How many oranges were originally in basket B.E.g.1. Express integers to a number of significant figures (i) 857,386,321 -five significant figures -four significant figures -three significant figures etc E.g.2. Express decimal numbers to a given number of decimal places (i) 98745.9674 correct to -three decimal places -two decimal places -one decimal place	Evaluate the quality and validity of information Look and think about things differently and from different perspective Demonstrate sense of feeling or belongingness to a group

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
12.		9.1.1.1.2. Use knowledge and understanding of place value to solve real life problemE.g.1. Create and solve a real-life problem or a story problem and write the answer in standard form (I) I am a 6-digit number. My first digit is 5 more than the last digit, but 2 less than my second digit. My second digit is the third multiple of 3, while my fourth digit is the second multiple of 3. My third digit is the quotient when the fourth digit is divided by my last digit. However, my fourth and fifth digits are consecutive numbers. What number am I? Think second digit: 3x3=9 fourth digit: 2x3=6 first digit: 9-2=7 last digit: 7-5=2 fifth digit: 6-1=5 third digit: 6 □□□□ So the number is 793652 = 7.93E.g.2 Create similar real story problems and solve	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
13.	**B9.1.1.2** **Demonstrate an understanding of the relationship between members of the rational number system and solve real life problems involving union and intersection of three sets**	**B9.1.2.2.2 Solve word problems involving the four basic operations and round the answers to the nearest two decimal figures or to some significant figures.B9.1.1.2.1 Solve problems on relationship between members of the rational number system using knowledge and understanding of the concept of union and intersection of two sets** ii) The price of a jacket is three times that of a shirt. The price of a jacket is GH₵560.65. Mr Mensa bought two of the jackets and four shirts for his twin sons. Calculate the total amount Mr Mensa paid for the items, correct your answer to: α) two decimal places β) three significant figures E.g. 1 Use sets diagrams to show the relationship among the Real numbers namely -Irrational numbers -Rational numbers (Q) - Integers -Whole numbers (W) -Natural or Counting numbers (N)	Use digital tools to create novel things Identification of requirements of a given situation and justification of more than one creative tool that will be suitable
14.		B9.1.1.2.2 Apply the concept of sets to solve problems on relationship between members of rational number system and solve real life problems involving union and intersection of two sets	

Strand 1,
Sub-Strand 2: Number Operations

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th colspan="2">INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td rowspan="3">B9.1.2.3
Demonstrate understanding of surds as real numbers, the process of adding and subtracting of surds as well as determining (using a calculator) the approximate square root of a number that is not a perfect square.</td><td colspan="2">B9.1.2.3.1identify simple and compound surds</td><td rowspan="3">Recognise and generalise information and experience ; search for trends and patterns

Identification of requirements of a given situation and justification of more than one creative tool that will be suitable</td></tr>
<tr><td></td><td>E.g.1 Simple surds

$\sqrt{2}, \quad 7\sqrt{3}, \quad 2\sqrt{5}$</td><td>E.g.2 Compound surds

$(\sqrt{3}+\sqrt{7}-\sqrt{5})$</td></tr>
<tr><td></td><td colspan="2">B9.1.2.3.2 Explain the identities/rules of surds</td></tr>
<tr><td></td><td></td><td>Rule 1
$\sqrt{a \times b} = \sqrt{a} \times \sqrt{b}$

Rule 2
$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Rule 3
$\frac{b}{\sqrt{a}} = \frac{b}{\sqrt{a}} \times \frac{\sqrt{a}}{\sqrt{a}} = \frac{b\sqrt{a}}{a}$</td><td>Rule 4
$a\sqrt{c} \pm b\sqrt{c} = (a \pm b)\sqrt{c}$

Rule 5
$\frac{c}{a+b\sqrt{n}} = \frac{c}{a+b\sqrt{n}} \times \frac{a-b\sqrt{n}}{a-b\sqrt{n}}$

Rule 6
$\frac{c}{a-b\sqrt{n}} = \frac{c}{a-b\sqrt{n}} \times \frac{a+b\sqrt{n}}{a+b\sqrt{n}}$</td><td></td></tr>
<tr><td></td><td></td><td colspan="2">B9.1.2.3.3 Simplify given surds</td><td rowspan="2">Interpret correctly and respond to non-verbal communication such as facial expressions, cues and gestures

Generate hypothesis to help answer complex problems</td></tr>
<tr><td></td><td></td><td colspan="2">E.g. Simplify:
i. $\sqrt{27}$

i. $\sqrt{72}$

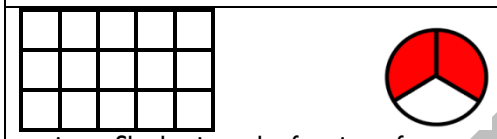
ii. $\frac{\sqrt{8}}{16}$

iii. $\frac{\sqrt{12}}{121}$

iv. $(\sqrt{2})^2$</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B9.1.2.3.4 Approximate the square roots of non-perfect squares with calculators/tables. E.g. Square roots of non-perfect squares i. $\sqrt{2}$ ii. $\sqrt{5}$ iii. $\sqrt{12}$ iv. $\sqrt{30}$	Demonstrate sense of feeling or belongingness to a group Develop and exhibit ability to defend one's cultural beliefs, practices and norms

Strand 1,
Sub-Strand 2: Number Operations

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1. 2. 3. 4. 5.	**B9.1.3.1 Apply the understanding of operations on fractions to solve problems involving fractions of given quantities and round the results to given decimal and significant places**	**B9.1.3.1.1 Review fractions and solve problems involving basic operations on fractions** E.g. 1. Review concept of fraction  i. Shade given the fraction of squares in the rectangle that is equal to the shaded portion of the circle. ii. Write down 3 fractions equivalent to $\frac{2}{5}$ iii. Cancel Express the fraction $\frac{15}{10}$down to in its simplest form: $\frac{15}{10}$ iv. Convert Express $\frac{12}{5}$to as a mixed numbers: $\frac{12}{5}$ v. Convert Express $2\frac{5}{9}$to as an improper fractions: $2\frac{5}{9}$ E.g. 2. Review the basic operations on fractions i. Adding &and Subtracting Fractions. Work out answers to the following: a) $\frac{3}{4}+\frac{7}{8}$ b) $1\frac{1}{2}+\frac{4}{5}-\frac{5}{6}$ ii. Multiplying &and Dividing Fractions. Work out answers to the following: a) $\frac{2}{3}\times\frac{3}{4}-\frac{3}{8}$ b) $\frac{5}{8}\div 2\frac{1}{2}+\frac{2}{3}$	Understand and use interpersonal skills Generate hypothesis to help answer complex problems Build a concept and understanding of one's self (strength and weaknesses, goals and aspiration, reaction and adjustment to novel situation)

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1. 2.		**B9.1.3.1.2 Add and/or subtract, multiply and/or divide given fractions, using the principle of order of operations including the use of the (through BODMAS or PEMDAS) rule, and apply the understanding of these to solve problems** E.g. 1. Use the order of operations (BODMAS or PEDMAS) to simplify whole number expressions with more than two operations. PEDMAS is Parenthesis, Exponents, Multiply/Divide (going from left to right), and Add/Subtract (going from left to right). i. $3^4 \div 3^2 + 40 - 2^3 \times 3^2 \div 9$ ii. $18 \div 6 \times (4 - 3) + 6$ iii. $18 \div 3^2 \times (4 - 3) \times 10$	Ability to set and maintain personal standards and values
3.		E.g. 2. Use the order of operations (BODMAS or PEDMAS) to simplify whole number expressions with more than two operations. a) $\frac{2}{3} \times \frac{3}{4} - \frac{5}{8} \div 2\frac{1}{2}$ b) $\frac{3}{4} \div \frac{3}{8} + (\frac{4}{5} - \frac{1}{2})$ c) $(\frac{3}{4} + \frac{5}{8}) \times \frac{4}{11} - \frac{1}{2}$	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
4. 5.		**B9.1.3.1.3. Review word problems involving basic operations on fractions** E.g. 1. Solve word problems based on fractions word problems. i. A test is made up of 20 questions, how many questions must you answer correctly to get a score of 80%? ii. What percent was a television set reduced if it was marked GH¢2250 and sold for GH¢19502,025? iii. In an election involving two contestants, one candidate claimed 52% of the votes, while the other candidate claimed 2681 votes. If 5000 people voted, how do you know the election results are invalid? iv. A rectangle is $2\frac{1}{3}$ cm by $3\frac{3}{4}$cm. Calculate its (i) perimeter and (ii) area. **v.** YaaEsi and Alamisi Fusena made orange drink by mixing orange squash and water. Esi drink was made of $\frac{23}{78}$ orange squash and Fusena's was made up of $\frac{12}{45}$ orange squash. Whose drink tastes stronger of orange?	Adjustment to the demands of customs, traditions, values and attitudes of society Identification of requirements of a given situation and justification of more than one creative tool that will be suitable

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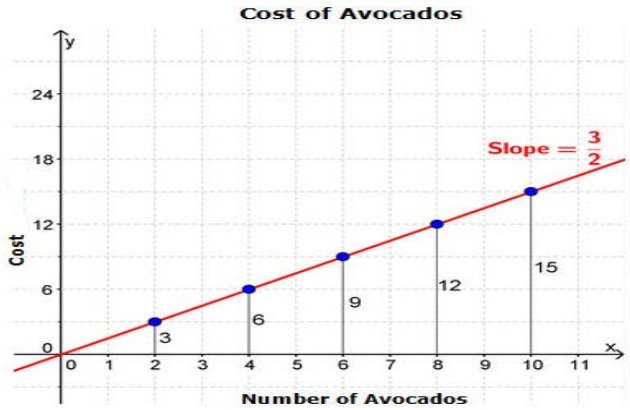
B9 Strand 1,
Sub-Strand 4: Number: Ratios and Proportion

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B9.1.4.1 **Apply the understanding of ratio, rate and proportions to solve problems that involve rates, ratios, and proportional reasoning and use it to solve real-world mathematical problems**	**B9.1.4.1.1 Represent proportional relationships by equations.**	Anticipate and overcome difficulties relating initiatives
		E.g.1 If total cost **(t)** is proportional to the number of items **(n)** purchased at a constant price **(p),** the relationship between the total cost and the number of items can be expressed as **t = pn**.	
		B9.1.4.1.2 Use proportional relationships to solve multistep ratio and percent problems, examples: simple interest, tax, discount and commissions, NHIL, depreciation, insurance, etc.	Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation
		E.g.1 solve problems on simple interest • A girl deposited Gh¢ 4500 at the bank at a rate of 3% per annum for three years. Find the simple interest. What is the amount at the end of the fifth year?	
		E.g.2 solve problems on tax (VAT) • The rate of VAT rate of a country Ghana is 1512.5%. A man bought an item at Gh¢ 4500.00, VAT inclusive. Calculate: a) The basic cost of the item. b) The VAT paid by the man.	
		E.g.3 solve problems on discount • If a car cost Gh¢ 80,500.00. What is its new value if there is a discount of 10%? **E.g.4 solve problems on commission** • A car agent's commission on the sale of a car is $3\frac{1}{2}$%. Calculate her commission on a house car sold for Gh¢68,000.00.	

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td></td><td>E.g.5 solve problems on depreciation
The value of a mobile phone depreciates according to the following:

<table><tr><th>Year of manufacture</th><th>Depreciation on the original value</th></tr><tr><td>In the first year</td><td>5%Nil</td></tr><tr><td>In the second year</td><td>10%</td></tr><tr><td>In the third year</td><td>15%</td></tr><tr><td>In the fourth year</td><td>22%</td></tr></table>
The original value of the mobile phone is Gh¢ 1800.00. Find the value of the mobile phone at the end of each of the first four years.</td><td></td></tr>
<tr><td></td><td></td><td>E.g.6 Solve problems involving NHIL
• The NHIL inclusive price of a television set is Gh¢ 1200.00. if the NHIL is charged at a rate of 2.5%, find
a) The cost of the television set (NHIL exclusive)
b) The NHIL charged.</td><td></td></tr>
<tr><td></td><td></td><td>E.g.7 Solve problems based on insurance
• Kofi Mereku insured his house and paid a premium of Gh¢ 30,000.00. If the insurance company fixed the rate at 5% of the value of the house computer, calculate the insured value of the house.</td><td></td></tr>
</table>

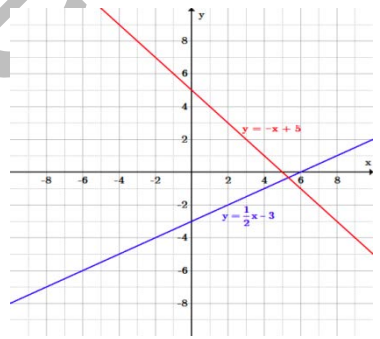
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B9.1.4.1.3 Recognize and Graph proportional relationships, interpreting the unit rate as the slope of the graph and use these to solve problems.	Ability to find and consume digital content Putting forward constructive comments, ideas, explanations and new ways of doing things
		E.g.1 In the figure above, the graph shows the cost of avocados.  The unit rate from the data is ¢1.50 per avocado, which is the same as the slope of the line connecting the data points is $\frac{3}{2}$. From the graph, how much does eight avocados cost? Also, using the graph how much does 15 avocados cost?	

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td rowspan="3">B9.2.1.1 Demonstrate the ability to draw construct tables of values for pairs of linear relations, graph the relations in a number plane and determine the intersection of the lines to solve simultaneous linear equation.</td><td colspan="2">B9.2.1.1.1 Draw Construct a table of values for two linear relations and graph the relation</td><td rowspan="3">Understanding of influences of globalisation on traditions, languages and cultures

Implement strategies with accuracy</td></tr>
<tr><td>E.g.1Draw Construct a table of values for two linear relations and to draw the graphs of the relations

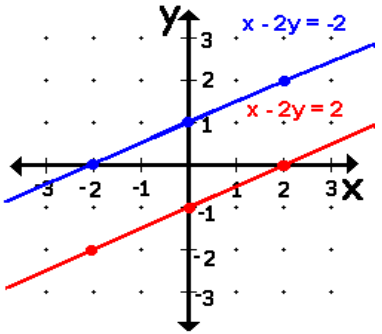
Copy and complete the table of values for the relations $y_1 = -x + 5$ and $y_2 = \frac{1}{2}x - 3$ for x from -4 to 3.

<table>
<tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>$y_1 = -x + 5$</td><td>8</td><td></td><td></td><td></td><td>4</td><td></td><td></td></tr>
<tr><td>$y_2 = \frac{1}{2}x - 3$</td><td></td><td>-4</td><td></td><td></td><td></td><td></td><td>-1.5</td></tr>
</table></td><td>E.g.2 Draw graph for two linear relations

 
</td></tr>
<tr><td></td><td>E.g.3Draw Construct a table of values for two linear relations

Copy and complete the table of values for the relations $x - 2y = -2$ and $x - 2y = 2$ for x from -4 2 to 32.

<table>
<tr><td>x</td><td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td>$x - 2y = -2$</td><td>y= $(x + 2)/2$</td><td>0</td><td></td><td></td><td></td><td>2</td></tr>
<tr><td>$x - 2y = 2$</td><td>$= (x - 2)/2$</td><td></td><td>-$1\frac{1}{2}$</td><td></td><td></td><td>0</td></tr>
</table></td><td>E.g.4 Draw graph for two linear relations

 
</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B9.2.1.1.3 Use graphs of two linear relations to determine subsequent missing elements in ordered pairs of the relation.	

E.g.1 Find the missing elements of ordered pairs on graphs of two linear relations.

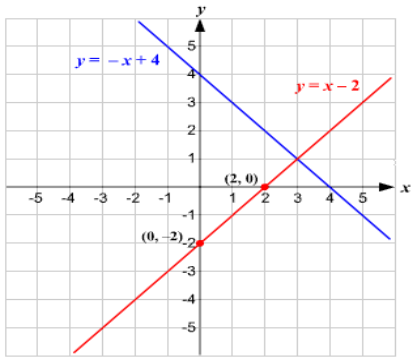
The graph is drawn from a two linear relations;

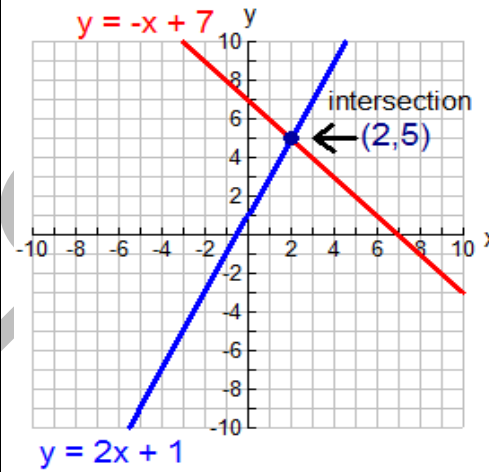
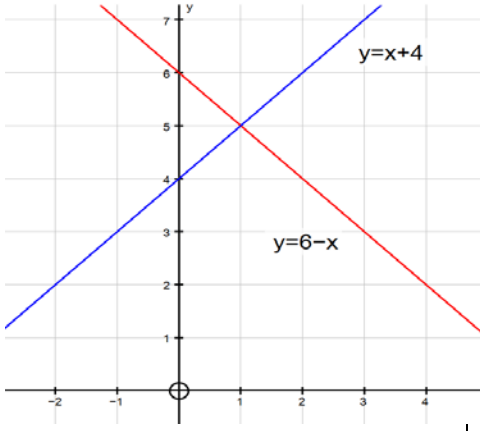
$y = -x + 4$

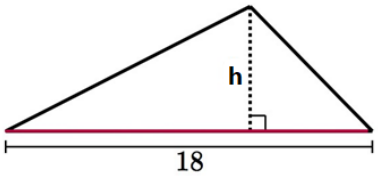
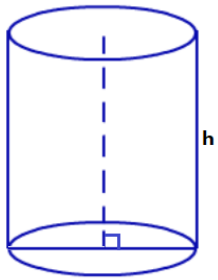
$y = x - 2$

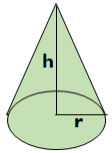
i. Determine the coordinates for the intersection of the two lines.
ii. Determine the corresponding values for y for both straight lines if x = -1.
iii. Use the graph to find the values for y for the two relations.

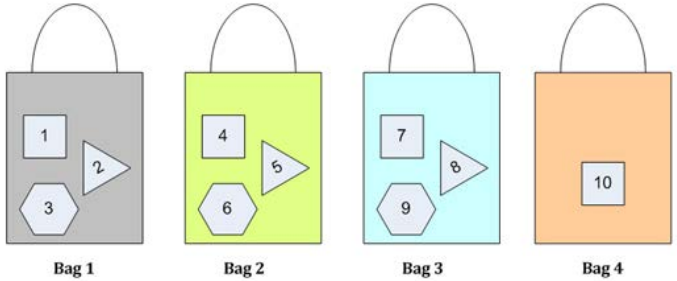
x	6-3	7-2	8-1	90	1	2
$y = -x + 4$						
$y = x - 2$						

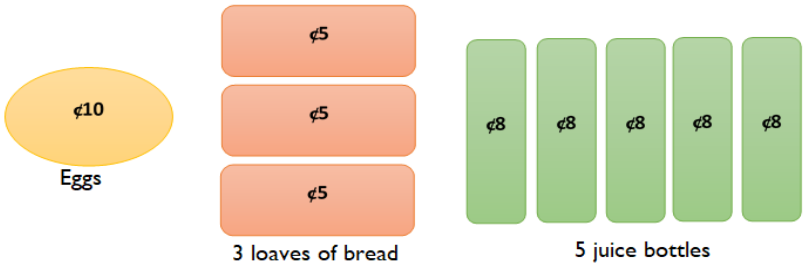


S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B9.2.1.1.3 Use graphs to solve equations involving two linear relations.	
		E.g.1 Solve two linear equations simultaneous using the graph. i. Solve the following equations simultaneously using a graph. $y = -x + 7$ $y = 2x + 1$ **Hint.** Draw the graphand find the coordinates for the intersection of the two lines. In the graph shown the values of (x, y) = (2, 5) 	
		E.g.2 Solve two linear equations simultaneous using the graph. From the graph, determine the values of x and y that makes the linear equations true. $y = x + 4$ $y = 6 - x$ 	

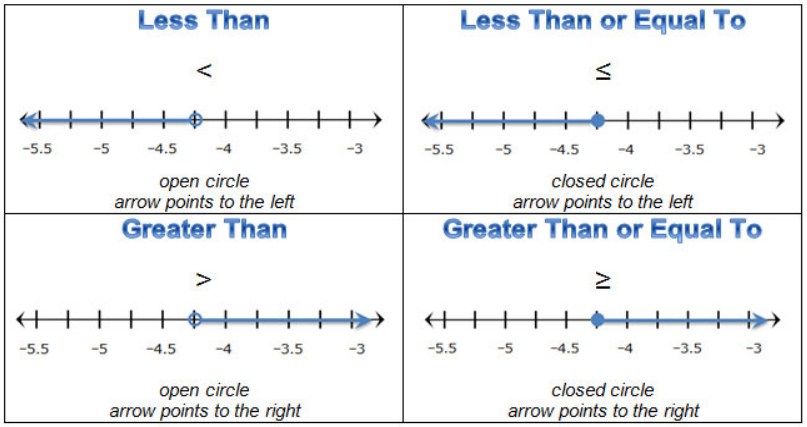
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B9.2.2.1 **Demonstrate an understanding of (i) change of subject (ii) substituting values to evaluate expressions, and (iii) factorize expressions that have simple binomial as a factor.**	**B9.2.1.1.1 Perform change of subject of a given formula and use it to solve problems.**	Identify and explain a confusion, uncertainty, or a contradiction surrounding an event
		E.g.1 Perform change of subject for given formulae Make x the subject of the following formulae 1) $q = x+7$ 4) $\frac{3x+1}{2} = h$ 2) $r = x-3$ 5) $3z = \frac{x}{4}+1$ 3) $5x = s$ $a = x+6$ $l = 0.7x$ $36m = x^2$ $v = -2x+8$ $b = x-2$ $hx = 5m$ $2x^2 = 40r$ $w = -8x+9$ $7x = c$ $2x = 7.2n$ $x^3 = 4s$ $y = \frac{5x-7}{3}$ $d = \frac{x}{3}$ $\frac{3p}{q} = \frac{x}{8}$ $\frac{5(t+4)}{2} = ux^5$ $z = 4x^3+8$	
		E.g.2 Use the concept of change of subject to solve problems involving formulae i. The area of a rectangle is $24cm^2$. If the length is 8cm, find the value of the width. ii. The formula for calculating the area of a circle is given as πr^2. If a circle has an area of $154cm^2$, what is its radius $[take\ \pi = \frac{22}{7}]$ iii. The triangle below has an area of $54cm^2$. Find the value of the height of the triangle. iv. The cylinder below has an area volume of $330cm^3$. Find the value of the height of the cylinder. $[take\ \pi = \frac{22}{7}]$  	Ability to visualise alternatives, seeing possibilities, problems and challenges

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B9.2.1.1.2 Substitute values into given formulae to evaluate it and use it to solve problems.	
		E.g. i. Find the value of $(\boldsymbol{x-b})^2 - \boldsymbol{3(x-b)}$ $\boldsymbol{if\ x=2\ and\ b=-5}$ ii. Make $\boldsymbol{k}$ the subject of the formula: $\boldsymbol{\frac{1}{n}=\sqrt{(\frac{k^2+a^2}{hg})}}$ If $\boldsymbol{n}=\frac{8}{5}, a=3, h=2, g=32, findthevalueofk.$ iii. $if\ a=\frac{3b-2}{2b+3}$ and $b=\frac{2d-1}{d-2}$; express d in terms of a. hence find the value of a, if $d=3\ and\ b=2$ iv. The formula for finding the volume of the shape below is given as $\frac{1}{3}\pi r^2 h$. Find the volume $if\ r=7, h=21, and \pi=\frac{22}{7}$ 	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B9.2.1.1.3 Factorize expressions that have simple binomial. **E.g.** i. 3x + 4xy = x (3 +4y) ii. 12ab ± 16b = 4b (3a ± 4) iii. -13xy + 39x= -13x(y-3) iv. 5y-2y2+3y=-3y+3y v. $8y-2y^2= 2y(4-y)$ vi. -6x+12=-3(2x-4)	
		B9.2.1.1.4 Use the knowledge of simplifying and factorizing expressions to solve real world problems.	
		E.g.1 You purchased 10 items from a shopping plaza, and now you need plastic bags to carry them home. If each bag can hold only 3 items, how many plastic bags you will need to accommodate 10 items? **Solution**: We use simple algebraic formula $\frac{x}{y}$ to calculate the number of bags. x = Number of items purchased = 10 y = Capacity of 1 bag = 3 Hence, $\frac{10}{3}$ = 3.333 bags = 4 bags So, we need 4 shopping bags to put 10 items.  	Ability to look at alternatives in creating new things Preparedness to make better decision with information at hand

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.2 You have to buy two dozen eggs priced at GH¢10, three breads (each bread is GH¢5), and five bottles of juice (each bottle is GH¢8). How much money you will need to take to the grocery store? The prices are a = Price of two dozen eggs = GH¢10 b = Price of one bread = GH¢5 c = Price of one bottle of juice = GH¢8 => Money needed = a + 3b + 5c => Money needed = GH¢10 + 3(GH¢5) + 5(GH¢8) = GH¢10 + GH¢15 + GH¢40 = GH¢65	Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication Identify and analyse different points of views of speaker
		E.g.3 The area of a rectangle is 72 cm^2. The width is twice its length. What is the length and width of the rectangle? Let "x" be the length and "2x" be the width. Length × Width = Area $x \times (2x) = 2x^2$ = Area $2x^2$ = Area $2x^2$ = 72 $\frac{2x^2}{2} = \frac{72}{2}$ $x^2 = 36$ x = 6 Length = 6cm 2x = 2 x 6 = 12 So, the width is 12 cm 	Generate hypothesis to help answer complex problems

B9 Strand 3
Sub-strand 2 Equations and Inequalities

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B9.2.3.2 **Demonstrate understanding of single variable linear inequalities with rational coefficients including:** • **solving inequalities** • **verifying** • **comparing** • **graphing**	**B9.2.3.2.1 Solve single variable linear inequalities with rational coefficients**	Build a concept and understanding of one's self (strength and weaknesses, goals and aspiration, reaction and adjustment to novel situation)
		i. $2x + 7 > \frac{5}{2}$ ii. $\frac{4}{5} - \frac{1}{5}x > \frac{2}{7}$ iii. $\frac{3}{2}y - \frac{2}{5} < \frac{4}{5}$ iv. $\frac{1}{2}(5x - 4) < x + \frac{11}{24}$ v. $\frac{1}{3} > x - \frac{4}{5}$ vi. $\frac{1}{2}(2x + 3) \leq x + 1$ vii. $x + \frac{1}{2} \geq -\frac{3}{2}$ viii. $-\frac{2}{3}x + 3 \geq 0$	
		B9.2.3.2.2 Illustrate solution sets of linear inequalities on the number line	
		E.g.1 Illustrate and explain the inequality signs  	Imagining and seeing things in a different way

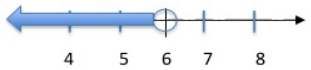
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.2 Graph linear inequalities in one variable on a number line	Evaluate the quality and validity of information

Word Phrase	Inequality	Solution Set
x is less than 5	$x < 5$	
a is greater than 0 a is more than 0	$a > 0$	
y is less than or equal to 2 y is at most 2	$y \leq 2$	
m is greater than or equal to 3 m is at least 3	$m \geq 3$	

E.g.3 Solve and graph linear inequalities on a number line

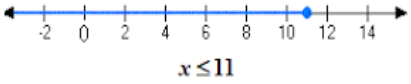
i. $-3x - 8 > -26$

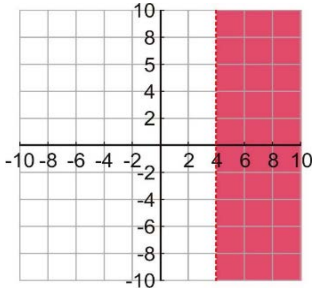
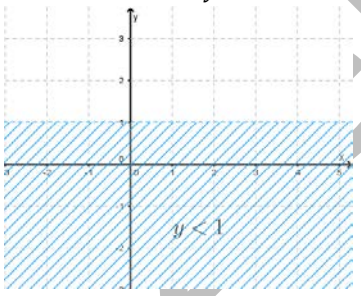
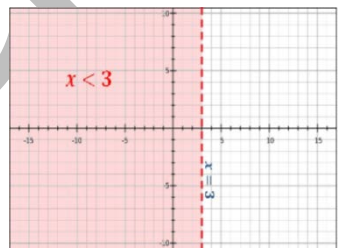
$$-3x - 8 > -26$$
$$+8 \quad +8$$
$$-3x > -18$$
$$\frac{-3x}{-3} > \frac{-18}{-3}$$
$$x < 6$$

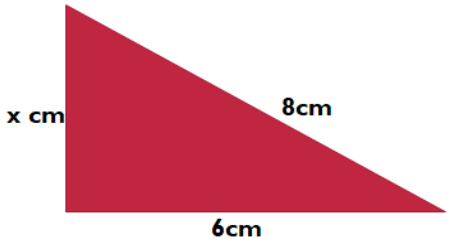


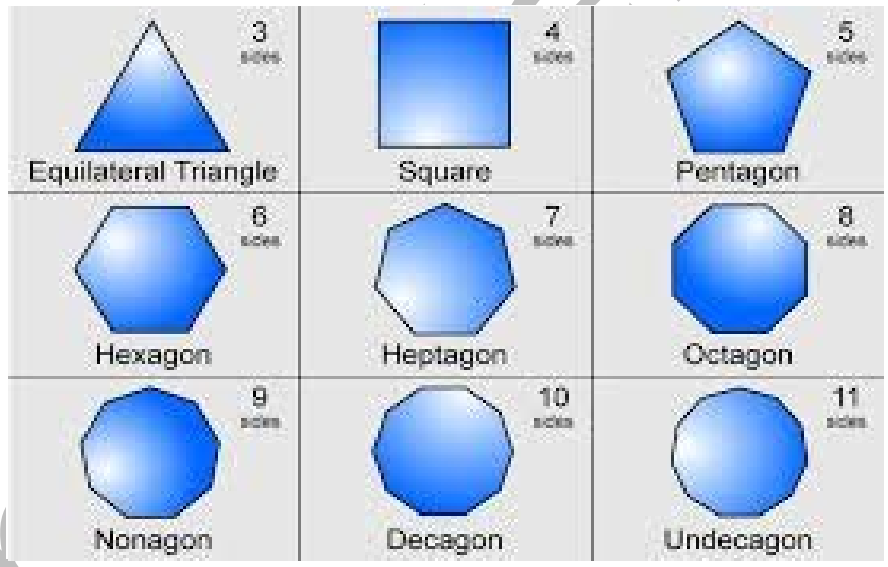
ii. $2x - 3 \leq 19$

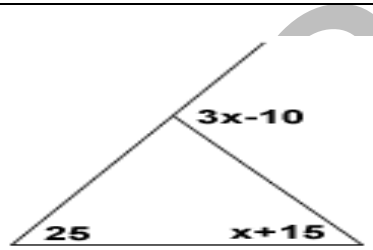
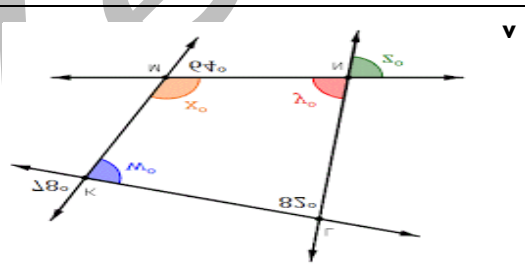
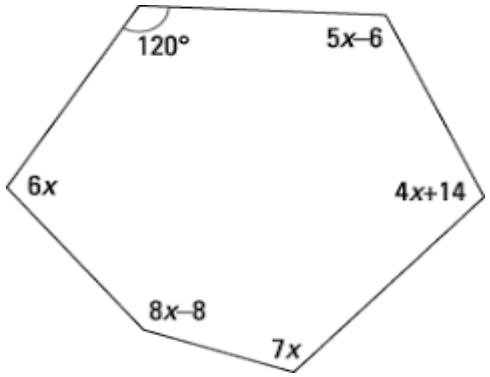
$$2x \leq 22$$
$$\frac{2x}{2} \leq \frac{22}{2}$$
$$x \leq 11$$

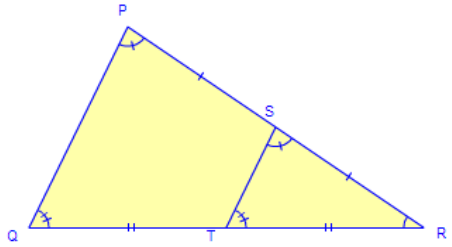
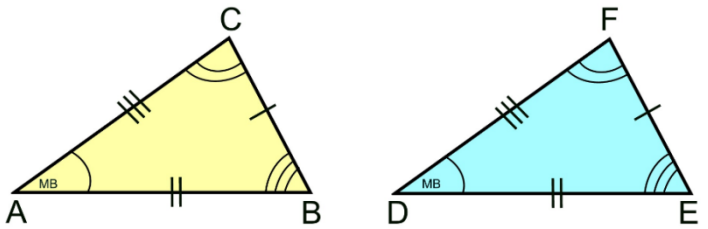
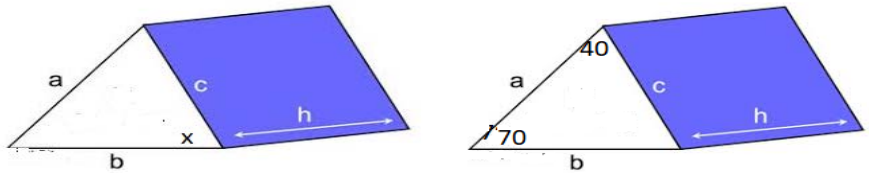


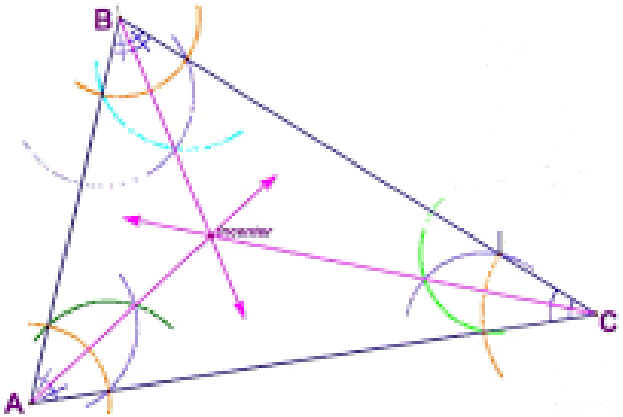
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.4 Solve and graph linear inequalities on a cartesian plane	
		i. $2x \geq 8$ $\frac{2x}{2} \geq \frac{8}{2}$ $x \geq 4$  	ii. $5y + 3 < 6 + 2y$ $5y - 2y < 6 - 3$ $3y < 3$ $\therefore y < 1$  	iii. $\frac{7x}{3} < 7 \quad \rightarrow 3 \times \frac{7x}{3} < 7 \times 3$ $\frac{7x}{7} < \frac{21}{7}$ $x < 3$ 
		B9.2.3.2.3 Solve real-life problems involving linear equations and inequalities	
		E.g.1 Solve real-life problems involving linear equations. i. A man has 260metres of fencing which he is going to put around a rectangular field which is 50metres wide. How long is the field? **Solution**: Since we need to find the length of the field, let $x\ metres$ be the length.  But this expression is given as 260m $\therefore 2(x + 50) = 260$ $x + 50 = 130$ $x = 80$	Identify and prove misconceptions about a generalised concept or fact specific to a task or situation

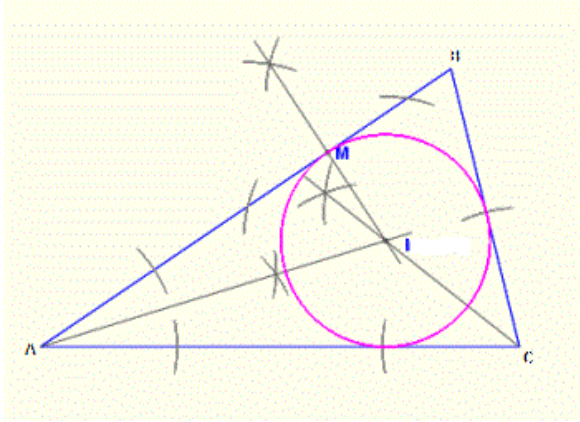
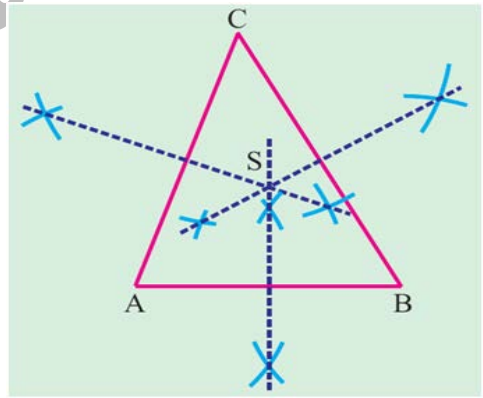
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		ii. A man paid GH¢ 29 for 11 books. Some of the books were geography books, and the rest were history books. If each geography book cost GH¢ 3 and each history book cost GH¢2, how many geography books did he buy? Solution: i. Total cost of the books is GH¢29; total number of books is 11. ii. 1 geography book costs GH¢3; 1 history book costs GH¢2, Total cost of all the books is $3x + 2(11 - x) = 29$ $\therefore \mathbf{3x + 2(11 - x) = 29}$ $\mathbf{3x + 22 - 2x = 29}$ $\mathbf{x + 22 = 29}$ $\mathbf{x = 7}$ Hence the number of geography books bought is 7.	
		E.g.2 Solve real-life problems involving linear inequalities. i. Two sides of a triangle have lengths 6 cm and 8 cm. what is the length of the third side? **Note**: the sum of the lengths of the two sides of a triangle is greater than the length of the third side. If the third side is $x$cm long then $6 + 8 > x$ giving $x < 14$. Also, $6 + x < 8\ givingx >$ 2. Also, $8 + x > 6\ whichgivesx >$ -2. Hence, $2 < x < 14$. that is, the third side has length between 2cm and 14cm. **ii.** A student scores 70 and 76 marks in two tests. How many marks must she score in the third test to be put in Grade A if all students scoring an average of 80 or higher in three tests are put in grade A?  	

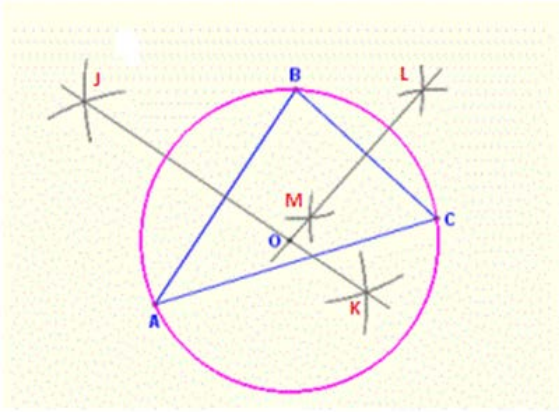
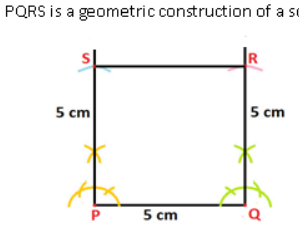
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B9.3.1.1 **Apply the properties of angles at a point, angles on a straight line, vertically opposite angles, corresponding, angles to` solve problems**	**B9.3.1.1.1** Derive the formula for calculating the sum of angles in any polygon and use this to calculate the value of missing angles in polygons **E.g.1.** E.g.1. identify and name the various polygons such as a triangle, quadrilaterals, pentagons, and hexagons, etc  	Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication

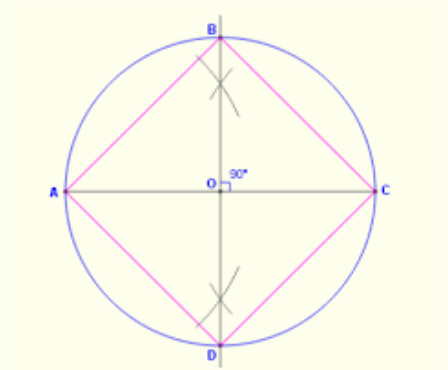
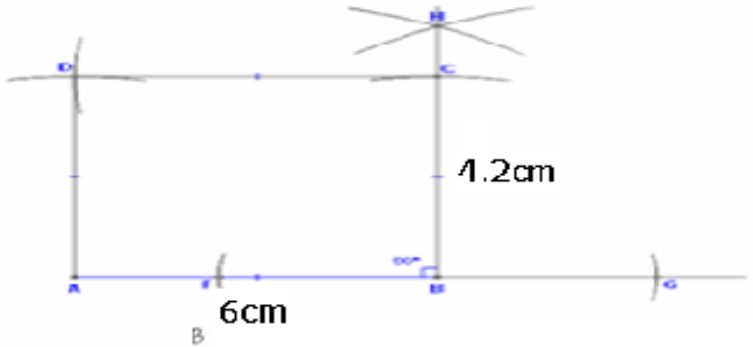
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS		COMPETENCIES
		E.g.2. Derive Use the formula (n - 2) × 180 ° and calculate the value of x (interior and angles of a triangle)		
		E.g.3. Derive Use the formula (n - 2) × 180 ° and calculate the interior angles of a quadrilateral		
		E.g.4. Derive Use the formula (n - 2) × 180 ° and calculate the interior angles of polygons.a pentagons, hexagons, etc. (i) Example find the value of x and the various angles in the hexagon		

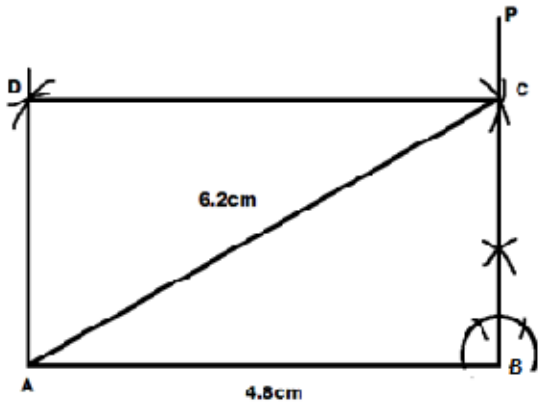
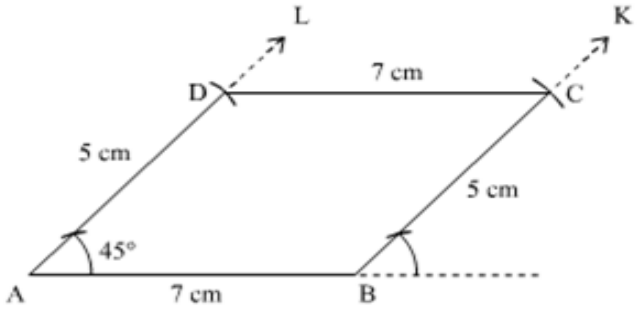
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B9.3.1.1.2 Identify similar and congruent triangles and use the knowledge to solve related problems E.g.1. Recognise similar triangles and solve for the values of the indicated angles in the diagram below 	
		E.g.2. Recognise congruent triangles and solve for the values of the indicated angles in the diagram below  $\Delta ABC \cong \Delta DEF$	
		E.g. 3. Determine the value of x (using knowledge in similarity and congruency) 	

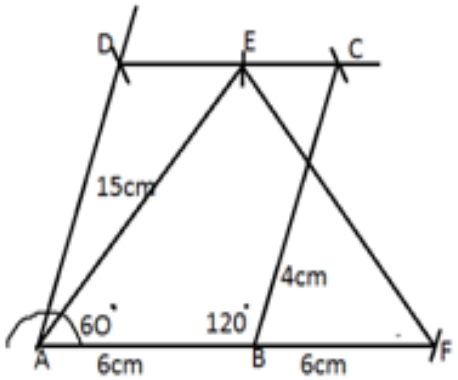
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B9.3.1.2	**B9.3.1.2.1 Draw inscribed and circumscribed circles for triangles under given conditions**	
	Construct inscribed and circumscribed triangles and parallelograms with given dimensions	E.g.1: Use a pair of compasses and a ruler to construct a triangle (Say ΔABC) under a given conditions and locate the incentre of the triangle (the incentre is the point of concurrency of the three angle bisectors of a triangle); measure the shortest distance from the incentre to the line segments AB, AC and BC. What do you observe about the lengths? 	Actively promote effective group interaction and the expression of ideas and opinions in a way that is sensitive to the feelings and background of others

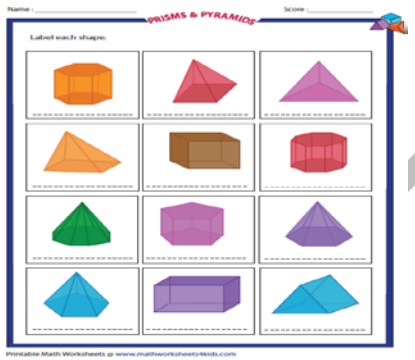
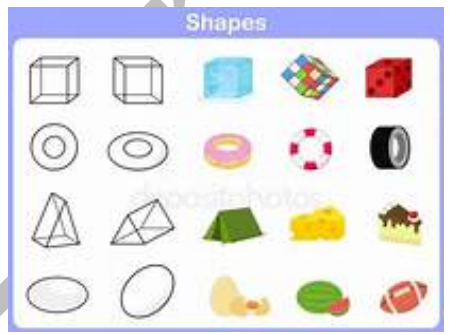
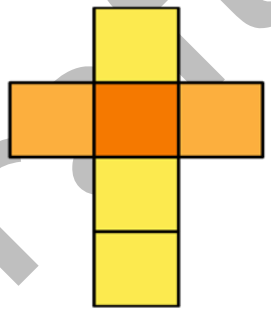
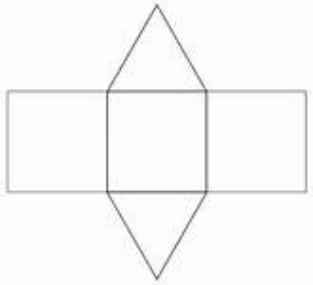
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g..2: Use a pair of compasses and a ruler to construct a triangle (Say ABC) under a given conditions, bisect at least any two angles (BAC and BCA); locate the intersection of the two angle bisectors (L) and draw a locus of points equidistant from the fixed point (L) to touch the edges of the triangle 	Ability to look at alternatives in creating new things Evaluate the quality and validity of information
		E.g.3: Construct of a triangle (Say ABC); bisect all three sides (i.e. line segments $AB, AC\ and\ BC$); locate the intersection (circumcentre) of the three perpendicular bisectors (S); Measure the distance from the intersecting centre (S) to points A B and C, What do you observe about the lengths 	Desire to accept one's true self and overcome weakness

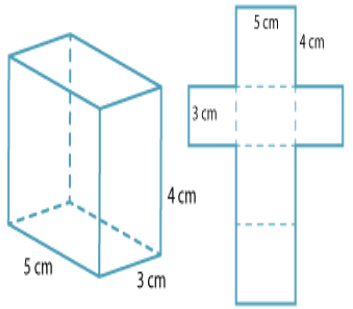
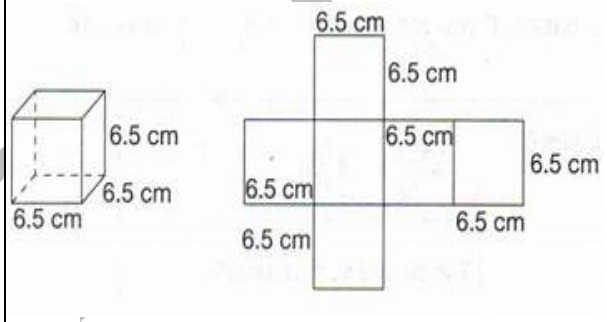
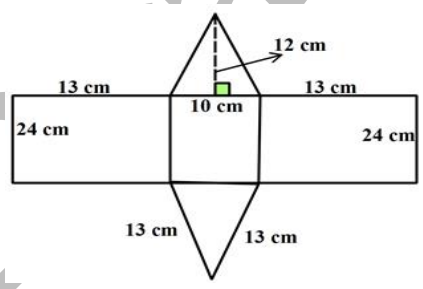
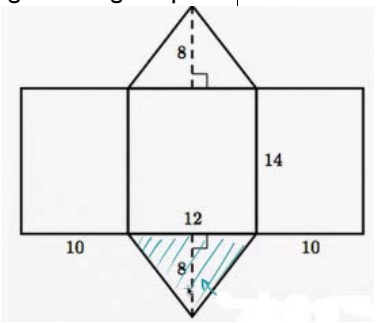
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.4: Perform geometric construction of a triangle (Say ABC) under a given conditions, bisect at least any two sides (AB and BC); locate the intersection of the two perpendicular bisectors (O) and draw a locus of points equidistant from the fixed point (O) to circumscribe the triangle 	Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used
		B9.3.1.2.2 Construct parallelograms (i.e. square, rectangle, rhombus) under given conditions E.g.1: Perform geometric construction of a square with a given side 	Can vary the level of detail and the language use when presenting to make it appropriate to the audience.

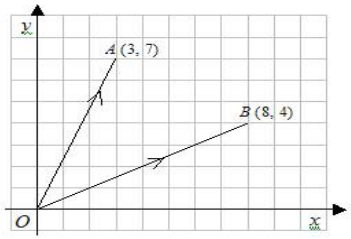
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.2: Construct a square ABCD with $\overrightarrow{AB}$=6.5cm; Measure and record the diagonal meter of the square E.g.3: Perform geometric construction of a square with a given diagonal Construct the square ABCD with AC = 10cm. What is the length of the sides?  	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem
		E.g.4: Perform geometric construction of a rectangle with given side Construct rectangle ABCD such that AB=6cm and BC=4.2cm  	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.5: Perform geometric construction of a rectangle with given side and diagonal Construct a rectangle ABCD with length AB = 4.8cm and diagonal AC= 6.2cm  	Preparedness to recognise and explain results after implementation of plans
		E.g.6: Perform geometric construction of a parallelogram rhombus with given sides and given angle(s) angle Construct the parallelogram ABCD such that the line segments AB=7cm and AD=5cm, and < DAB=45°  	Being open-minded, adapting and modifying ideas to achieve creative results

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.7: Perform geometric construction of regular compound plane shapes with given sides and angle ABCD is a parallelogram such that <DÂB=60°, <CBA = 120°, AB=6cm. AEF is an isosceles triangle, such that AE=FE= 15cm, B is the midpoint of AF=12cm.  	Preparedness to make better decision with information at hand

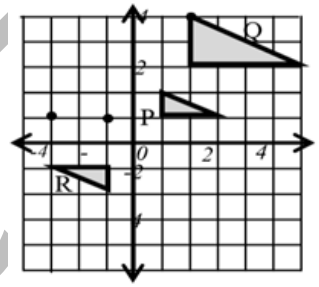
<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th colspan="2">INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td>1.</td><td rowspan="5">B.9.3.2.1
Derive the formulas for determining the surface area of prisms (i.e. cuboid and triangular prism) and use to solve problems</td><td colspan="2">B9.3.2.1.1 Identify cuboids and triangular prisms, draw their nets to construct the 3-D shapes and use it to determine the surface area
E.g.1 Sort out shapes that are triangular prisms and cuboids.</td><td rowspan="5"></td></tr>
<tr><td>2.</td><td>  </td><td>  </td></tr>
<tr><td>E.g.2 Identify each of the nets below</td><td></td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>A net of……..</td><td>A net of……..</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
3.		E.g.3 Measure and find the area of each of the boxes sections in the net and adding all together to give the surface area.	
		B9.3.2.1.2 Use the net of a cuboid to determine the its surface area E.g.1 Find the surface area of each of the cuboids	
		 	
4.		B9.3.2.1.3 Use the net of a triangular prism to determine the its surface area E.g.1 Find the surface area of each of the triagulartriangular prims.  	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B9.3.3.2.3 Express points in the Cartesian plane as position vectors	Ability to merge simple/ complex ideas to create novel situation or thing
	s	E.g.1 Identity the following using the diagram below (i) the origin (ii) the position vector If $a = \begin{pmatrix} 3 \\ 7 \end{pmatrix}$, then the coordinates of A will be (3, 7). Similarly, if $b = \begin{pmatrix} 8 \\ 4 \end{pmatrix}$, then coordinates of B will be (8, 4)  E.g.2 Draw and write the position vectors of the following with 0 as the origin (i) M(2,3) (ii) N(-1,2)	

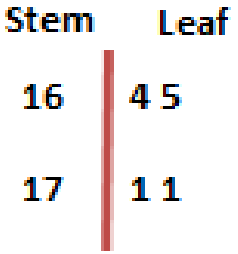
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B9.3.3.2 **Solve more problems involving bearings and addition/subtraction of vectors**	**B9.3.3.2.1 Show an understanding of parallel vectors and perpendicular vectors** E.g.1 Investigate conditions for parallel vectors and perpendicular vectors E.g.2 Use the result from the investigation to solve the following questions (i) Find the value (s) of x, if the vectors $\begin{pmatrix}3x\\2\end{pmatrix}$ and $\begin{pmatrix}6\\x\end{pmatrix}$ are parallel. (ii) Which of the vectors is perpendicular to $\begin{pmatrix}3\\4\end{pmatrix}$ **(a)** $\begin{pmatrix}-3\\4\end{pmatrix}$ (b) $\begin{pmatrix}-3\\-4\end{pmatrix}$ (c) $\begin{pmatrix}-4\\3\end{pmatrix}$ (d) $\begin{pmatrix}-4\\-3\end{pmatrix}$	Preparedness to make better decision with information at hand
		B9.3.3.2.2 Apply the triangular and parallelogram laws of addition to resolve vectors E.g.1 Deduce the triangle law of vector addition, $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}$ Where ABC are point in the 0xy plane E.g.2 The vertices of a triangle are P(1,-3) Q(7,5) and R(-3,5) (i) Express $\overrightarrow{PQ}, \overrightarrow{QR}$, and $\overrightarrow{PR}$ as column vectors. (ii) Show that triangle PQR is an isosceles. (iii) Find the equation of the line $\overrightarrow{PR}$. Eg3 Investigate the parallelogram law of vector addition. Eg.4 P,Q,R,S is a parallelogram whose vertices are P (x ,y), Q (5,7), R(2,4) and S(1,3) (i) Find $\overrightarrow{PQ}$, and $\overrightarrow{SR}$ hence find the values of x and y.	Recognise and generalise information and experience ; search for trends and patterns

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B9.3.3.5 **Demonstrate understanding of how to perform an enlargement on a geometrical shape given a scale factor and describe the properties of the image under the transformation (i.e. congruence, similarity, etc.)**	**B9.3.3.5.1 Know examples of situations in everyday life that depict enlargement situations in everyday life** E.g. 1. Know examples of situations that relate to enlargement situations in everyday life and the nature of movements – vertical and horizontal.  	Recognition of societal issues raised by digital technologies
		 	

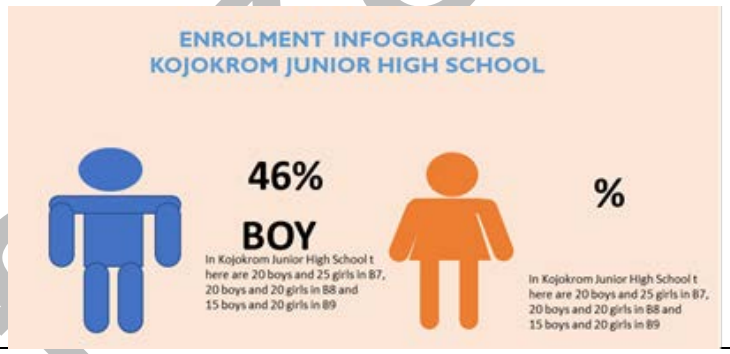
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1. 2.		**B9.3.3.5.1 Understand enlargement and can identify real-life situations involving enlargement** E.g. 1. Draw an enlargement of shapes using a given scale factor. i. State the single transformation that maps triangle P onto Q ii. State the single transformation that maps triangle P onto R  iii. Investigate the characteristics of enlargements under the following conditions of scale factor: • if the scale factor (K) is negative • if the scale factor (K) is greater than 1 or less than –1 • if the scale factor (K) is between –1 and 1 (i.e., fraction) E.g. 2. Using an object, and its image, can learners determine the scale factor?	

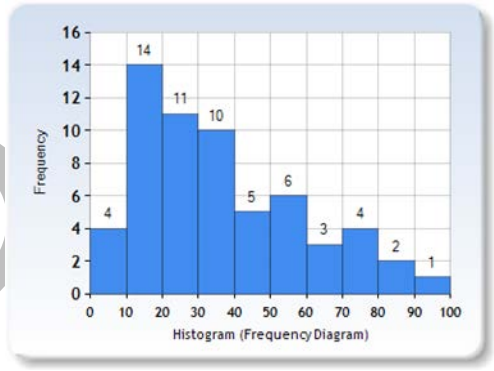
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
3. 4.		**B9.3.3.5.3 Investigate the concept of congruent and similar shapes** E.g. 1. Using multiple and varied examples of enlargement on coordinate plane verify congruent and similar shapes using their properties.	Putting forward constructive comments, ideas, explanations and new ways of doing things
 5. 6. 7.	**B9.4.1.1Select, justify, and use appropriate methods of collecting data (grouped/ungrouped), use the data to construct and interpret frequency tables and histogram and use it to determine the mode and to solve and/or pose problems.**	**B9.4.1.1.1 - Select and justify a method to collect data (quantitative and qualitative) to answer a given question.** E. g. 1 -In small groups, learners discuss and decide (i) from where/ whom they will collect the data for the studies presented below, (ii) on which data collection methods they will use and (iii) justify their decisions. Areas of study are described as follows: a. Musa has started a book club for Ayisha and her friends. He wants Ayisha to find out books that are most popular among her friends **b.** Find the most common mode of travel by learners in Oyoko Junior and Senior High Schools	Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech.
8.		**B9.4.1.1.2. - Organize data (grouped/ungrouped) present it in frequency tables, line graphs, pie graphs, bar graphs and/or pictographs (representations include infographics, waffle diagrams, box and whisker plots and stem and leaf plots) and analyze it to solve and/or pose problems.** E.g. 1 -Thirty bulbs were life-tested and their lifespan to the nearest hour are as follows 167 171 179 167 171 165 175 179 169 171 177 169 171 177 173 165 175 167 174 177 172 164 175 179 179 174 174 168 171 168	

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td>9.</td><td></td><td rowspan="2">i. Present the raw data in a frequency table by completing the table below.
<table><tr><th>Lifespan of Bulbs (hours)</th><th>Tally</th><th>Frequency</th></tr><tr><td>164 - 167</td><td></td><td></td></tr><tr><td>168 – 171</td><td></td><td></td></tr><tr><td>172 - 175</td><td></td><td></td></tr><tr><td>176 – 179</td><td></td><td></td></tr></table>ii. What is the modal group? Justify your decision for that choice.</td><td rowspan="2">Provide new insight into controversial situation or task

Ability to try alternatives and fresh approaches</td></tr>
<tr><td>10.</td><td></td></tr>
<tr><td colspan="3">i. Complete the stem and leaf plots below to display the raw data.
 

Use the plot to solve the following problems.
a. Find the range of the lifespan of bulbs
b. What is the mode lifespan?
c. What is the median lifespan?
d. What other problems can you pose?
e.</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g. 2 The pictograph below describes the number boys and girls in each class in Kojokrom Junior High  School	
		 	
		i. What is the percentage of boys and of girls in the school? ii. Use your answers in (i) to represent the data by copying completing the following infographic	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
11.		**B9.4.1.1.3 Use histogram to determine the mode of the data to solve and/or pose real life cases**	
12.		25 12 53 8 26 5 19 73 67 18 87 42 6 21 14 19 12 15 13 36 36 16 72 36 13 37 11 51 39 32 30 47 6 22 68 25 98 23 45 22 7 9 26 35 27 48 58 56 29 20 32 62 80 41 58 17 54 15 14 74 E.g. 1- The waiting times, x minutes, for 60 patients at a certain clinic are as follows	
		i. Construct a frequency table using class intervals 0 – 10.5; 10.5 – 20.5; 20.5 – 20.5 – 30.5, and so on ii. Construct a frequency table using class intervals $0 < x \leq 10; 10 < x \leq 20;$ $20 < x \leq 30$, and so on. ii. Draw a histogram and find the modal class. 	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
13. 14.	**B9.4.1.2** **Select, justify, and use appropriate methods of collecting data (quantitative and qualitative), organize and analyzeanalyse the data (grouped/ungrouped) to interpret the results using the descriptive statistics (measures of central tendency and range).**	B9.4.1.2.1 - Select a method for collecting data (quantitative and qualitative), taking into consideration how bias - use of language, ethics, cost, time and timing, privacy or cultural sensitivity may influence the data – and collect data E. g. 1 Suppose in a school survey form the following question was asked: **Overall, don't you think the teaching of mathematics is very good?** The designer of the survey form has a **bias** for the methodology used in math lessons and the bias influences how the question was written. The **language** used in writing the question may lead people to just answer yes or no. A better question would be: Overall, how will you rate the teaching of mathematics? ◯ **Very poor** ◯ **Poor** ◯ **Fair** ◯ **Good** ◯ **Very Good**	Preparedness to make better decision with information at hand Look and think about things differently and from different perspective
15.		E.g. 2 -Ama Mereku in B9 wants to write an article for their school magazine on **sport-related injuries** The responses for the survey question stated below was **collected** from **only the schools' football team**. *How many sport-related injuries have you had during your years of **playing football**?* The influencing factors in this survey question are: **time.** and **bias**. Football is a contact sport. The chances are that the answers from her targeted respondents will be high in favour injuries and negatively affect the conclusion/report. In order to report **accurately** on sport-related injuries Ama needs to ask **more** people (**time needed)** who participate in **variety of sports,** including **contact and non-contact** sports **(e.g. athletics tennis, volley ball,** and so on).	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
16.		E.g. 3 -Learners in B9 are asked by their physical education teacher to complete a survey related to "**Overall Physical Health**". One question on the survey form is; ***What is your current body weight?*** Identify the influencing factor in the survey and provide a solution.	
17.		E.g. 4 - Suppose you tell your classmates that the response to the question: ***What is your worst subject?*** in the Class Survey Question Form is to help you plan remedial classes. If you then use the information collected **to write an article for the school magazine** how would your actions be described and how would that influence future surveys you conduct.	
18.		E.g. 5 -Suppose in a survey questionnaire you wanted to know the favourite method of cooking pork meat and you asked: Please tick the box against your favourite method of cooking meat ☐ Boiling ☐ Grilling ☐ Frying This question does not apply to everyone because some people do not eat pork (i.e. the question is not culturally sensitive.) A better question would be: Please tick the box against your favourite method of cooking meat**(Optional)** ☐ Boiling ☐ Grilling ☐ Frying	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
19.		ORS **If** you eat meat please name the favourite method you cook it. ☐ Boiling ☐ Grilling ☐ Frying	
20.		**B9.4.1.2.2 -- Organize and analyze analyse data and interpret the results using the descriptive statistics (i.e. minimum, maximum, measures of central tendency and range) to answer a given question.** Refer to E.g. 1 of **B9.4.1.1.2** and find (minimum, maximum, measures of central tendency and range) i. The minimum lifespan, to the nearest hour, of the bulbs tested. ii. The maximum lifespan, to the nearest hour, of the bulbs tested. iii. The range of the data collected from the life-testing. iv. What is the mean lifespan of the bulbs? v. What is the median of the lifespan of the bulbs? vi. What is the mode of the lifespan of the bulbs? **vii.** When placing an order for the bulbs tested to sell in your shop, which of them will you consider buying?	Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem. Look and think about things differently and from different perspective
21.			

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
22.		**B9.4.1.2.3- Demonstrate the effect on the mean, median, and mode when extreme data is included in a data set** E.g. –Refer to E.g. 1 of B9.4.1.1.2. i. In small groups, find the mean of the data, if one of the bulbs is replaced with a new bulb with lifespan of 300 hours, find the new mean of the bulbs and compare it to the original mean ii. In small groups, find the mean of the data, if the lifespan of one of the bulbs tested was 70 hours, and compare it to the original mean **iii.** Continue to replace the values of the lifespan in the data *with extreme values* (small and large), calculate the mean, median, and mode and discuss the findings.	Develop and defend a logical plausible resolution to a confusion, uncertainty or contradiction surrounding an event Interpret correctly and respond to non- verbal communication such as facial expressions, cues and gestures
23.			
24.	**B9.4.2.1Identify the sample space for a probability experiment involving two dependent events and express the probabilities of given events as fractions, decimals, percentages and/or ratios to solve problems.**	**B9.4.2.1.1.- Perform a probability experiment involving two dependent events e.g. drawing coloured bottle tops from a bag without replacement** E.g. 1 - In an experiment, Anita was asked to pick one bottle top, in three trials, from a bag which contains 3 red, 2 green and 1 pink bottle tops **without replacement**. i. List the elements of the sample space of the events. **ii.** Does the occurrence of the one trial affect the occurrence of the other trials?	Demonstrate behaviour and skills of working towards group goals
25.			

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
26.		**B9.4.2.1.2. Express the probabilities of the events as fractions, decimals, percentages and/or ratios; e.g. using a tree diagram, table or another graphic organizer**	Ability to combine Information and ideas from several sources to reach a conclusion
27.		E.g. 1 Draw a probability tree diagram for the experiment in B9.4.2.1.1, E.g. 1. Express the probabilities of the events (on their respective branches) as decimals, percentages and ratios.	
28.		E.g. 2 – i. Consider the experiment of drawing two Aces (in two trials) in a standard deck of cards without replacement ii. Calculate the probability of **each** trial and express the probabilities of the events as decimals, percentages and ratios.	Division of task into solvable units and assign group members to task units
29.		E.g. 3 i. Consider the experiment of drawing an Ace and a Jack (in two trials) in a standard deck of cards without replacement ii. Calculate the probability of **each** trial and express the probabilities of the events as decimals, percentages and ratios	

BASIC 10

Strand 1: Number
Sub-strand 1: Number and Numeration System

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td>.</td><td>10.1.1.1.
Apply the understanding of place value and standard form in solving real life problems involving integers of any size, rounding this to decimal places and significant figures</td><td>
10.1.1.1.1Solve problems involving integers of any size and write answers in standard form and rounding off in given number of decimal places and significant figures

E.g.1. Apply the understanding of place value to other sets of integers
(i) order these numbers in ascending and descending order:
804,356, 1478,942, 769,256, 306,984,721, 133,567,451, etc.

E.g. 2. Round numbers to given significant figures

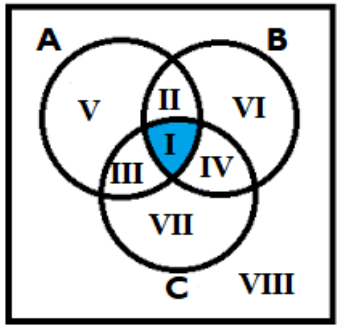
(i) Express these numbers, correct to four, three, two significant figures.
<table>
<tr><td>number</td><td>4-sig. figures</td><td>3-sig. figures</td><td>2-sig. figures</td></tr>
<tr><td>187594</td><td>187600</td><td>188000</td><td>190000</td></tr>
</table>
E.g.3 Approximate a decimal number to a given number of significant figures

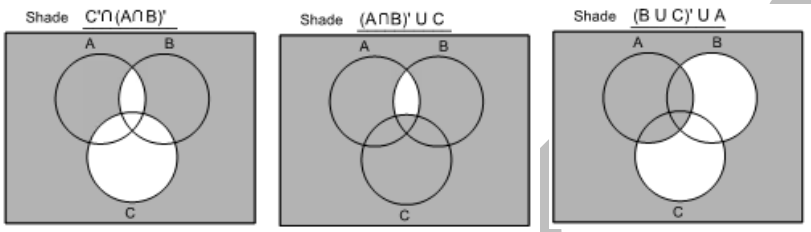
E.g.34. Round decimal numbers to given of decimal places
<table>
<tr><td>Number</td><td>Three decimal. places</td><td>Two decimal. places</td><td>One decimal. place</td></tr>
<tr><td>436.8437
98.9654</td><td>436.844
98.965</td><td>436.84
98.97</td><td>436.8
99.0</td></tr>
</table>
</td><td>Ability to keep group working on relevant a

Identify words or sentences in context or appropriately

Explain ideas in a clear order with relevant detail, using conjunctions to structure and speechactivities.

Ability to keep group working on relevant</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
..		**10.1.1.1.2. Solve story or real-life problems and express answers in standard form**	Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem
.		E.g.1. Create and solve real-life or story problems (i) The length of a square field is 426m. Oko runs 8 times around the field. What is the total distance covered by Oko? Express the answer in standard form. (ii) A bus was hired from Monday to Wednesday. It traveled 1760.94kg on Monday and traveled 204.2kg more on Tuesday than on Monday. It traveled 96.32kgs less on Wednesday than on Tuesday. What was the total distance traveled by the bus on Wednesday? Write the answer in standard form.	
.	**B10.1.1.2** **Apply the understanding of the concepts and vocabulary of sets and the relationship between members of the real number system to solve real life problems involving union and intersection three sets.**	B10.1.1.2.1Use Venn Diagrams to solve problems on relationship between sets of real number systems solve real life problems on relationship between sets of real number system. E.g.1: Identify the various sets or regions of the three intersecting sets i. Draw three intersecting sets and identify the various regions or sets as-: • All three sets • Exactly two sets • Two sets • Only one set, etc. • 	Ability to keep group working on relevant Ability to combine Information and ideas from several sources to reach a conclusion Ability to identify important and appropriate criteria to evaluate each alternatives

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
.		ii. Shade the regions labelled I, II, III, IV, V, VI and VII in terms of sets A, B and C. For example,  	
		E.g. 2. Create three-set real life or story problems on real number systems and solve. Think: A group of 22 travellers were each asked to acquire a passport, health certificate and foreign currency equivalent to $800. Only 7 of them obtained both health certificate and currency. 6 had both the passport and health certificate and 6 had both the passport and currency. Each of the travellers had at least one of the three requirements. a. Represent this data on a Venn diagram if x of them had all the three requirements. b. Write an equation in x and solve. c. How many travellers obtained: i. Exactly 2 of the requirements At most 2 of the requirements. etc.	

Strand 1: Number
Sub-strand 12: Number and Numeration System Operations

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
15.	B10.1.2.1 Demonstrate an understanding of the number properties to determine answers for addition, subtraction, multiplication, and division basic facts**B.9.1.2.1 Apply mental mathematics and properties to determine answers for addition and subtraction of basic facts.**	**B10.1.2.1.1Demonstrate the ability to determine commutative properties of addition and multiplication.B9.1.2.1.1 Multiply and divide given numbers by multiples of 10 including decimals and benchmark fractions** E.g1. Recognize that for any two numbers **a** and **b**; i. a + b = b + a i.e. 56 + 45 = 45 + 56 = 101 ii. a × b = b × a i.e. 11 × 13 = 13 × 11 = 143E.g.1. Recall multiplication facts up to 144 and related division facts.E.g.2. Recall decimal names of given benchmark fractions converted to decimals or percentages (and vice versa E.g. 3. Find the product of a given decimal number when it is multiplied by 10, 100, 1000, $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, etc.	Ability to keep group working on relevant activities Ability to combine Information and ideas from several sources to reach a conclusion
16.		**B.9.1.2.1.2 Demonstrate the ability to determine commutative properties of addition and multiplication.** E.g1. Recognize that for any two numbers **a** and **b**; i. a + b = b + a i.e. 25 + 32 = 32 + 25 = 57 ii. a × b = b × a i.e. 17 × 8 = 8 × 17 = 136	Ability to serve group members effectively Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation

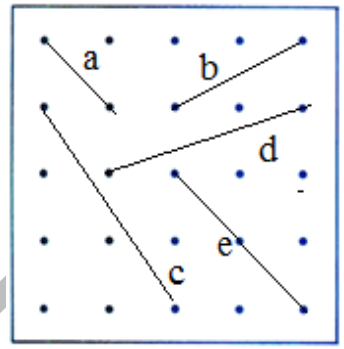
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
17.		**B9B10.1.2.1.3 2 Use the associative property of addition and multiplication.**	Ability to combine Information and ideas from several sources to reach a conclusion
18.		E.g1. Recognize Recognise that for any three numbers **a**, **b** and **c**; i. a + (b + c) = (a + b) + c or a + (b + c) = (a + c) + b i.e. 20 + (15 + 35) = (20 + 15) + 35 = 70 ii. (a × b) × c = a × (b × c) i.e. (20 × 4) × 5 = 20 × (4 × 5) = 200	
19.		B9B10.1.1.4 3 Use the distributive property in solving problems.	
20.		E.g1. Recognize Recognise that for any three numbers **a**, **b** and **c**; i. a × (b + c) = (a × b) + (a × c) i.e. 20 × (8 + 12) = (20 × 8) + (20 × 12) = 400 ii. a × (b - c) = (a × b) - (a × c) i.e. 2 × (35 - 11) = (2 × 35) - (2 × 11) = 48	
21.		B10.1.1.4 4Use the closure property in solving problems.	
22.		E.g.1 Recognise that a set is **closed** with respect to that operation if the operation can always be completed with elements in the set.	
23.		B10.1.1.4 4Use the identity property in solving problems.	
24.		E.g.1 Recognize Recognise that for any given set of numbers 1 is the multiplicative identity and 0 is the additive identity. i.e. 1 × b = b × 1 = b and 0 + a = a + 0 = a, are the multiplicative and additive identities respectively.	
25.		B10.1.1.4 5Use the inverse property in solving problems. E.g.1 Recognize Recognise that the additive inverse of $p\ is = -pi.e.additive\ inverse\ of\ 3\ is = -3$ E.g. 2 Recognize Recognise that the multiplicative inverse of $p\ is = \frac{1}{p}\ i.e\ multiplicativeinverse\ of\ = 3\ is = \frac{1}{3}$	

Strand 1: Number
Sub-strand 2: Number Operations

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
26.	**B10.1.2.2 Apply the understanding of the addition, subtraction, multiplication and division of decimal numbers to solve word problems and round answers to given decimal places or significant figures**	**B10.1.2.2.2 Solve word problems involving the four basic operations and including problems that require rounding the answers to a given decimal or significant figures.** **E.g.1 Word problems involving the four basic operations** ii. There were 42 mangoes in each crate. 12 such crates of mangoes were delivered to a factory. 4 mangoes were rotten and had to be thrown away. The remaining mangoes were packed into boxes of 10 mangoes each. How many boxes of mangoes were there? iii. There were 9500 spectators at a football match. 6375 of them were men. Of the remaining spectators, there were 4 times as many children as women. How many children were there? iv. Mikiru loves animals. She has three times as many goats as she has chickens. She has four more ducks than chickens. Altogether, she has 49 animals (just goats, ducks and chickens). How many more goats does she have than ducks? v. At the school talent show, 1/3 of the students were boys, 3/6 were girls, and the rest were adults. If there were 50 more girls than adults, how many people were there in total?	Ability to combine Information and ideas from several sources to reach a conclusion Identification of requirements of a given situation and justification of more than one creative tool that will be suitable
27.			

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
28.		**E.g.2 Word problems involving rounding the answers to a given decimal or significant figures.**	Ability to combine Information and ideas from several sources to reach a conclusion
29.		i. At a musical show in Salaga Adaku and Aliu bought 3 times more popcorn than they usually buy. A box of popcorn is GH₵2.65. If in their previous show they bought 3 boxes of popcorns, how much did they for their popcorn at the Salaga show? Leave your answer to the nearest whole number. iii. At a senior high school in the Bono Region, a teacher assigned a task to her students to calculate the density of some given items. Kwaakye had 12.134kg/m^3, Abebrese had 0.05632kg/m^3 and Rakia had 1,132.125kg/m^3. Correct each of their results to: b. 2dp c. 1dp d. 3sf e. 4sf	

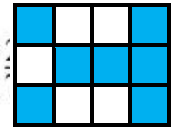
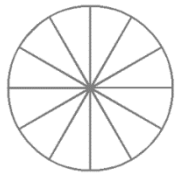
B10 Strand 1,
Sub-Strand 2: Number Operations

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS		COMPETENCIES
	B10.1.2.3 Demonstrate understanding of the process of multiplying and rationalizing surds as well as determining (using a calculator) the approximate square root of a non-perfect square and use these in solving real life problems.	**B10.1.2.3.1 Perform addition, subtraction and multiplication of surds** E.g. 1 Use geo.dot activities on perimeter of shapes to develop the generate numbers in the form of surds		Ability to combine Information and ideas from several sources to reach a conclusion
		The lengths of the line segments in the diagram above are $\sqrt{2}$, $\sqrt{5}$,, $\sqrt{13}$, $\sqrt{10}$and $2\sqrt{2}$ for a, b, c, d, and e, respectively		
		The perimeter of the shape is $2\sqrt{2} + \sqrt{2} + 1 + \sqrt{2} + 1 + 4 = 6 + 4\sqrt{2}$		

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td></td><td>E.g.1 Perform addition of and subtraction of surds.
i. $5\sqrt{6}+4\sqrt{6}$
ii. $9\sqrt{3}-4\sqrt{3}$
iii. $\sqrt{12}+7\sqrt{3}$
iv. $\sqrt{7}-7-2\sqrt{7}$
v. $\sqrt{45}+\sqrt{125}-\sqrt{45}$</td><td></td></tr>
<tr><td></td><td></td><td>E.g.2 Perform multiplication of surds.
i. $\sqrt{3}\times\sqrt{5}$
ii. $(\sqrt{3})^3$
iii. $(\sqrt{3})^2\times(\sqrt{5})^3$
iv. $(\sqrt{2})^6$</td><td></td></tr>
<tr><td></td><td></td><td>B10.1.2.3.2 Conjugate a given surd
E.g.<table><tr><th>Surd</th><th>Conjugate</th></tr><tr><td>$\sqrt{a}+\sqrt{b}$</td><td>$\sqrt{a}-\sqrt{b}$</td></tr><tr><td>$xy\sqrt{z}-yz\sqrt{x}$</td><td>$xy\sqrt{z}+yz\sqrt{x}$</td></tr><tr><td>$\frac{1}{2}x+\frac{1}{2}\sqrt{y}$</td><td>$\frac{1}{2}x-\frac{1}{2}\sqrt{y}$</td></tr></table></td><td rowspan="2">Ability to combine Information and ideas from several sources to reach a conclusion</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B10.1.2.3.3 Rationalize a monomial denominator of a given surd **E.g.** Rationalize a surd with a monomial denominator i. $\frac{1}{\sqrt{5}}$ i. $\frac{5}{\sqrt{7}}$ **ii.** $\frac{7\sqrt{3}}{2\sqrt{11}}$	
		B10.1.2.3.4 Rationalize a binomial denominator of a given surd **E.g.** Rationalize a surd with a binomial denominator ii. $\frac{5}{2-\sqrt{3}}$ iii. $\frac{1}{\sqrt{7+\sqrt{5}}}$ iv. $-\frac{2}{3\sqrt{5+4}}$	Ability to combine Information and ideas from several sources to reach a conclusion
		B10.1.2.3.5 Use the knowledge of surds to solve problems. **E.g.2**	Ability to combine Information and ideas from several sources to reach a conclusion
		The trapezium below has an area of $(9 + 6\sqrt{3})\text{cm}^2$. What is the perpendicular height of the trapezium? $(\sqrt{2} + \sqrt{5})cm$  $(\sqrt{18} - \sqrt{5})cm$	

B10 Strand 1,
Sub-Strand 3: Fractions, decimals and percentages

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1. 2. 3.	**B10.1.3.1 Apply the understanding of operations on fractions to solve problems involving fractions of given quantities and round the results to given decimal and significant places**	**B10.1.3.1.1 Add and/or subtract, multiply and/or divide given fractions, including the use of the BODMAS/PEDMAS rule, and apply the understanding to solve problemsB10.1.3.1.1 Review fractions and solve problems involving basic operations on fractions** E.g.1 Solve the following addition and subtraction of fractions E.g. 1. Review concept of fraction 1. $3\frac{1}{3}+1\frac{3}{4}-1\frac{2}{3}$ 2. $\frac{17}{6}+\frac{5}{3}-3\frac{1}{2}$ 3. $\frac{1}{2}+\frac{13}{8}-\frac{11}{12}$ 4. $\frac{11}{2}-($  5. $1\frac{1}{5}+\frac{17}{2}-\frac{3}{2}$ 6. $2\frac{5}{6}-(4\frac{1}{3}-\frac{3}{2})$  Shade given sectors in a circle that is equal to the shaded portion of the rectangle. Write down 3 fractions equivalent to $\frac{2}{5}$ Cancel the fraction down to its simplest form: $\frac{12}{30}$ Convert to mixed numbers: $\frac{17}{6}$ Convert to improper fractions: $5\frac{5}{9}$	Ability to combine Information and ideas from several sources to reach a conclusion Show a strong sense of belongingness to one's culture

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
4. 5. 1.		E.g. 2. Review the basic operations on fractionsE.g.2 Solve the following multiplication and division of fractions I. $\frac{12}{17} \times \frac{34}{120} \div \frac{5}{6}$ iii. $(15\frac{1}{2} \times \frac{20}{62}) \div (3\frac{1}{5} \times 3\frac{3}{4})$ ii. $(\frac{7}{9} \div \frac{14}{21}) \times (\frac{3}{5} \div \frac{1}{4})$ iv. $\frac{\frac{1}{3} \times \frac{1}{5} \div \frac{2}{3} \times \frac{1}{4}}{\frac{1}{4} \div \frac{1}{2}}$ **B10.1.3.1.2 Add and/or subtract, multiply and/or divide given fractions, including the use of the BODMAS rule, and apply the understanding to solve problems**	
2.		E.g.3 Find the value of each expression (involving the four operations) in the lowest term. i. $\frac{2}{3} + \frac{1}{5} - \frac{5}{8} \div \frac{1}{4}$ iii. $\frac{5\frac{2}{7} + \frac{1}{14} \times \frac{2}{3} - 1\frac{1}{4}}{\frac{3}{8} \div \frac{1}{16}}$ ii. $7\frac{1}{9} \div \frac{8}{9} + \frac{3}{5} \times \frac{1}{4}$ iv. $3\frac{2}{5} \times 1\frac{1}{2} \div \frac{20}{15}$	
3.		**B10.1.2.2.2 Express recurring decimals as common fractions.** E.g. 1. Use the order of operations (BODMAS or PEDMAS) to simplify whole number expressions with more than two operations. PEDMAS is Parenthesis, Exponents, Multiply/Divide (going from left to right), and Add/Subtract (going from left to right). $2^4 \div 2^2 + 30 - 3^2 \times 2^2 \div 7$ $28 \div 4 \times (5 - 2) + 5$ $250 \div 5^3 \times (7 - 2) \times 20$	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
4.		E.g.1 Recognize that a recurring decimal has a digit or a block of digits which keep repeating. i. $2.555\ldots$ or $2.\dot{5}$ ii. $0.323232\ldots$ or $0.\dot{3}\dot{2}$	
		E.g.2 Guide students to express recurring decimals as fractions of the form $\frac{a}{b}$ where b≠ 0 iii. $0.\dot{7} = 0.7777777\ldots = \frac{7}{9}$ iv. $0.\dot{3} = 0.3333333\ldots = \frac{3}{9}$ ii. $0.\dot{6}\dot{3} = 0.63636363\ldots \frac{63}{99} = \frac{21}{33} = \frac{7}{11}$ iii. $0.\dot{2}\,0\,\dot{1} = 0.201201201\ldots = \frac{201}{999} = \frac{67}{333}$	
5.		**B10.1.2.2.3Apply knowledge of fractions and proportional relationships to solve multistep percent problems, examples: simple interest, tax, discount and commissions, NHIL, depreciation, insurance, etc.** **B10.1.3.1.3. Review word problems involving basic operations on fractions**	Ability to combine Information and ideas from several sources to reach a conclusion
6.		E.g. 1. Solve fraction word problems. A box contains 20 bottles of water, how many bottles must you drink to get 80%? What percent was a television set reduced if it was marked ¢2250 and sold for ¢1950?An item which costs GH¢220 was sold for GH¢180 after a discount was allowed. Calculate the discount.	

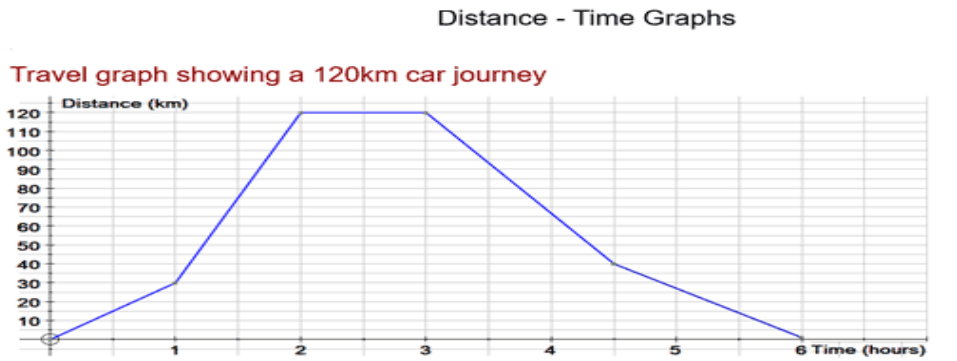
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
7.		In an election involving two contestants, one candidate claimed 852% of the votes, while the other candidate claimed 2681 votes. If 12,5000 people voted, how do you know the election results are invalid? A rectangle is $23\frac{1}{32}$ cm by $32\frac{31}{4}$cm. Calculate its (i) perimeter and (ii) area. Esi and Fusena made orange drink by mixing orange squash and water. Esi drink was made of $\frac{2}{7}$ orange squash and Fusena's was made up of $\frac{1}{4}$ orange squash. Whose drink tastes stronger of orange?	

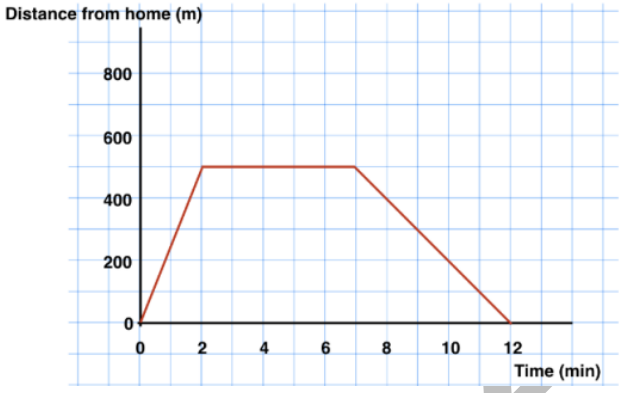
B10 Strand 1
Sub-Strand 4: Number: Ratios and Proportion

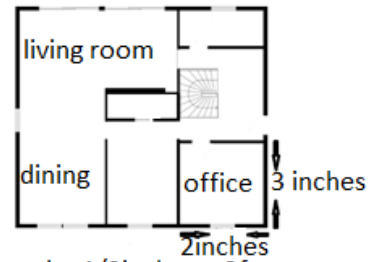
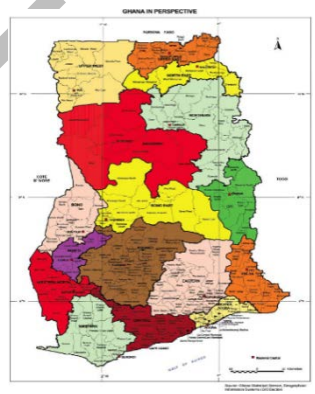
<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td rowspan="3">B10.1.4.1
Apply the understanding of ratio, rate and proportions solve problems that involve rates, ratios, and proportional reasoning and use it to solve real-world mathematical problems</td><td>B10.1.4.1.1 Use ratio reasoning to convert foreign currencies into Ghana cedis and vice versa to solve problems.</td><td rowspan="3">Ability to combine Information and ideas from several sources to reach a conclusion

Ability to keep group working on relevant activities</td></tr>
<tr><td>E.g.1 At a forex bureau, the rate of cedi to dollar is GH¢ 5.60: $1. How much cedis will Keku receive for $55?</td></tr>
<tr><td>E.g.2 A Daily Interbank Forex Rates in Ghana
<table>
<tr><th>Currency</th><th>Rate</th><th>Cedi (GH¢)</th></tr>
<tr><td>US Dollar</td><td>1</td><td>5.70</td></tr>
<tr><td>Pound Sterling</td><td>1</td><td>7.62</td></tr>
<tr><td>Swiss Franc</td><td>1</td><td>5.80</td></tr>
<tr><td>Euro</td><td>1</td><td>6.37</td></tr>
<tr><td>Naira</td><td>1</td><td>0.016</td></tr>
<tr><td>CFA franc</td><td>1</td><td>0.0097</td></tr>
</table>
Juhanah is travelling to Lagos. How much cedis does he need to buy a plane ticket costing ₦50,800?</td></tr>
<tr><td></td><td></td><td>B10.1.4.1.2 Explain and use rates such as kmh^{-1}, ms^{-1} and those used in utility bills to solve problems.</td><td></td></tr>
<tr><td></td><td></td><td>E.g.1 Calculate average speed
i. A boy cycles 6.5 kilometres to school in 30minutes. Find the average speed in metres per second.
ii. A woman covered a distance of 3kilometers in 20minutes 5minutes on her motorbike. Find her average speed in kilometres per hour.
iii. An airplane leaves Accra at 12:10 pm and reaches Lagos 464.22 km away at 1:25pm. Calculate, correct to the nearest whole number, the average speed of the air plane in km/h.</td><td>Ability to combine Information and ideas from several sources to reach a conclusion

Ability to keep group working on relevant activities</td></tr>
</table>

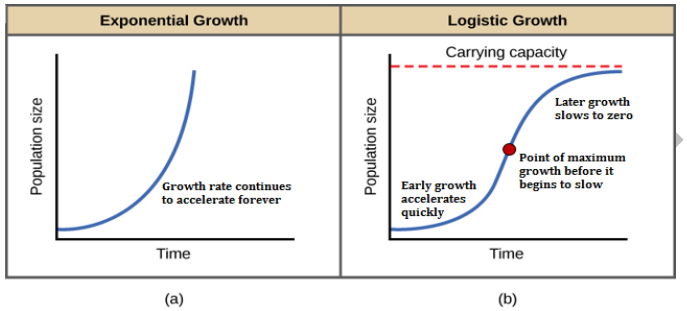
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g. 2 Calculate utility bills (water and light bills) i. The monthly electricity charges in Ghana for a certain year were calculated as follows: First 100 units GH¢35.00 Remaining units 40p per unit How much did Mrs Anku pay for using 600 units in a month? ii. In a company, the metre reading for water at the end of February 2020, was 8,786,000 litres. The metre reading at the end of March 2020 was 9,101,000 litres. The company was charged for the consumption at the following rates: a) The first 10,000 litres at 10p per litre b) The remaining litres at 15p per litre. Calculate 1) consumption at the end of much 2) the total charge of the consumption	
		B10.1.4.1.3 Draw and interpret travel graphs or distance-time graphs. **E.g.1** Use the line graph to answer the following questions	Ability to combine Information and ideas from several sources to reach a conclusion Ability to keep group working on relevant activities
		 1. How much time did it take to reach the destination? 2. How long was spent at the destination? 3. At which point in the journey was the car travelling it's fastest? 4. Suggest an explanation for the change in speed on the return journey.	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		The graph shows Karim running to a shop, spending some time in the store, and then walking home.  a) How long does karim spend in the shop? b) How far away from his house is the shop? c) At what speed does Karim run to the shop? d) At what speed does he walk home? e) What is the total distance covered by Karim?	
		B10.1.4.1.4 Interpret scales used in drawing plans and maps, use them to calculate distances between two points and to solve problems.	Ability to keep group working on relevant activities Anticipate different responses from the audience and plan for them. Ability to combine Information and ideas from several sources to reach a conclusion Show a strong sense of belongingness to one's culture
		E.g.1interpret scales The Ghana map show is drawn to scale of 1cm representing 80km. **Hint:** 80km = 8, 000, 000cm. We therefore express the scale of this map as 1:8,000,000. 	
		E.g. 2 Use proportions to find measurements on scale drawings The scale drawing of the tree is 1:500. If the height of the tree on paper is 20inches, what is the height of the tree in real life? 	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS		COMPETENCIES
		E.g.3 Set out a proportion to find actual measurement (actual length) The plan of the floor shows several rooms. The length of the office space in the plan is 3inches. What is the actual length in feet of the office space?	 scale: 1/2inches = 3ft	
		E.g.4 Calculate actual distances between two places. The Ghana map shown is drawn to scale of 1cm representing 40km. **Hint:** 40km = 4, 000, 000cm. We therefore express the scale of this map as 1:4,000,000. What is the actual distance (km) from Kumasi to TameleTamale if the distance on the map is 8.2cm?		

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td></td><td>B10.1.4.1.5 Calculate and compare population growth rates and population densities.
E.g.1 Explain, with illustration, exponential and logistic population growth</td><td rowspan="3">Analyse and make distinct judgment about viewpoints expressed in an argument

Implement strategies with accuracy

Ability to combine Information and ideas from several sources to reach a conclusion</td></tr>
<tr><td></td><td></td><td> 
</td></tr>
<tr><td></td><td></td><td>E.g.2 calculate Calculate population growth rate.
The table shows the annual population growth rate for countries A, B and C.

Population increase in a year ÷ Population at the start of the year ×100 = Annual Population growth rate (%)

<table>
<tr><th>Country</th><th>Population at the start of the year</th><th>Population at the end of the year</th><th>Population increase during the year</th><th>Annual Population growth rate (%)</th></tr>
<tr><td>A</td><td>28,000,000</td><td>28,530,000</td><td>530,000</td><td>1.9%</td></tr>
<tr><td>B</td><td>450,000,000</td><td>470,000,000</td><td>20,000,000</td><td>4.4</td></tr>
<tr><td>C</td><td>7,900,000</td><td>8,100,000</td><td>200,000</td><td>2.5</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td></td><td>
E.g. 3 calculate Calculate birth rates and death rates to find population growth rates

Birth rates (%) = $\frac{number\ of\ births}{population} \times 100$Population growth rate (%) = birth rates – death rates

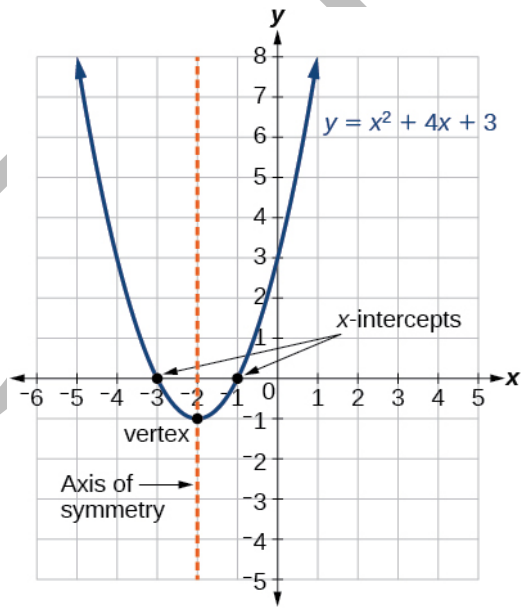
Death rates (%) = $\frac{number\ of\ deaths}{population} \times 100$

<table>
<tr><td>Country</td><td>Births</td><td>Deaths</td><td>Population</td><td>Birth rates (%)</td><td>Death rates (%)</td><td>Annual Population growth rate (%)</td></tr>
<tr><td>A</td><td>862,000</td><td>325,000</td><td>68,200,000</td><td>1.2%</td><td>0.5%</td><td>0.7%</td></tr>
<tr><td>B</td><td>490,000</td><td>185,000</td><td>32,000,000</td><td></td><td></td><td></td></tr>
<tr><td>C</td><td>315,300</td><td>199,000</td><td>8,150,000</td><td></td><td></td><td></td></tr>
</table>
</td><td></td></tr>
<tr><td></td><td></td><td>
E.g.4 Calculate population densities

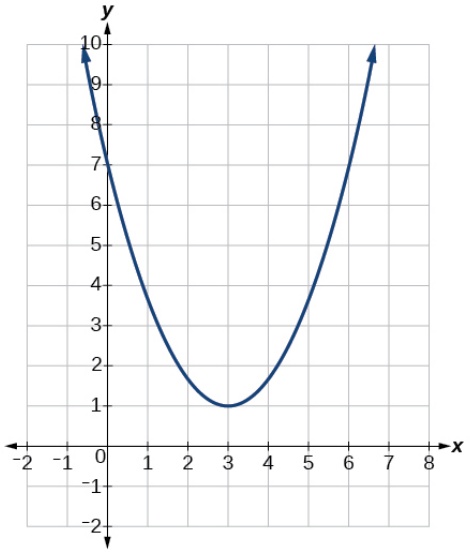
Population density = $\frac{number\ of\ people}{land\ area - (km^2)}$

Ghana has a land area of 238,535 km² and a population of 30,420,000. Calculate the population density.
</td><td></td></tr>
</table>

B10 Strand 2
Sub-strand 1 Patterns and Relations

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th colspan="2">INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td rowspan="2">B10.2.1.1 Demonstrate the ability to draw construct a table of values for a linear relation and a quadratic relation, graph the relations in a number plane and determine the intersections to solve simultaneous equation involving one linear, and a quadratic, equation.</td><td colspan="2">B10.2.1.1.1 Draw Construct a table of values of a given quadratic relation and graph the relation
E.g.1 Identify the properties of quadratic graphs (Parabolas)</td><td rowspan="2">Ability to combine Information and ideas from several sources to reach a conclusion</td></tr>
<tr><td></td><td>i. The graph of a quadratic function is a U-shaped curve called a parabola.
ii. It has an extreme point, called the vertex.
iii. If the parabola opens up, the vertex represents the lowest point on the graph, or the minimum value of the quadratic function.
iv. If the parabola opens down, the vertex represents the highest point on the graph, or the maximum value. (In either case, the vertex is a turning point on the graph)
v. The graph is also symmetric with a vertical line drawn through the vertex, called the axis of symmetry.</td><td>Graph of a parabola showing where the x and y intercepts, vertex, and axis of symmetry are.
 

The y-intercept is the point at which the parabola crosses the y-axis. The x-intercepts are the points at which the parabola crosses the x-axis. If they exist, the x-intercepts represent the zeros, or roots, of the quadratic function, the values of x at which y=0.</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS		COMPETENCIES
		E.g.2 Determine the vertex, axis of symmetry, zeros, and y-intercept of the parabola shown in figure.		Anticipate different responses from the audience and plan for them.
			• Vertex is at (3,1) • The axis of symmetry is x=3x=3. • It has no zeros. • The y-intercept. (0,7)(0,7) so this	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.2 Make tables for given quadratic relations i. Make a table of values for the equation $y = 2x^2 - 3x + 1$ $y = 2x^2 - 3x + 1$	

x	$y = 2x^2 - 3x + 1$
0	1
1	0
2	3
3	10
4	21
5	36
6	55

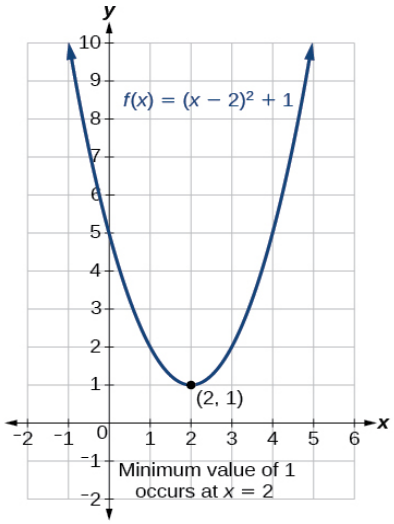
i. Make a table of values for the equation

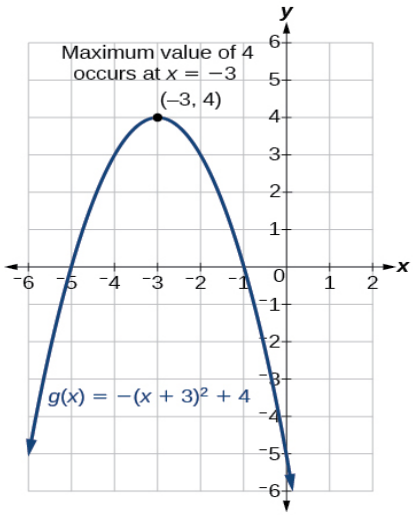
$y = x^2 + 3x - 1$

x	$y = x^2 + 3x - 1$
-3	-1
-2	-3
-1	
0	
1	
2	

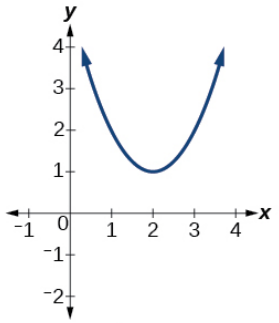
x	$y = x^2 + 3x - 1$
-3	-1
-2	-3
-1	
0	
1	
2	

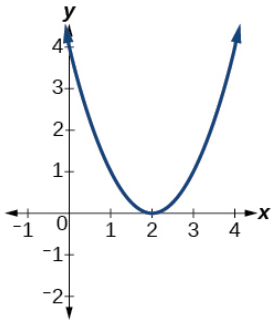
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.3 Determine the minimum and maximum values of a quadratic graph	

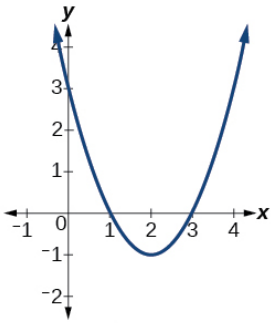




E.g.4 Determine the intercept of a quadratic function

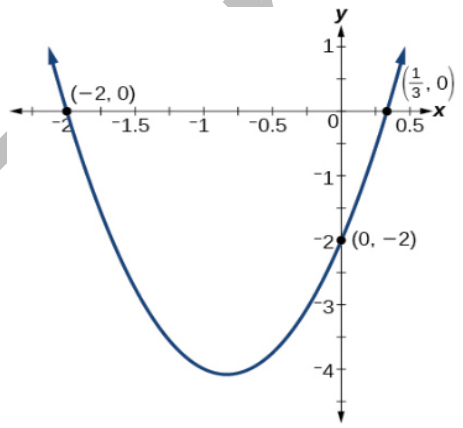
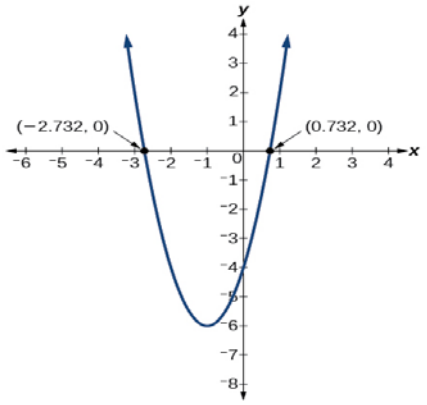


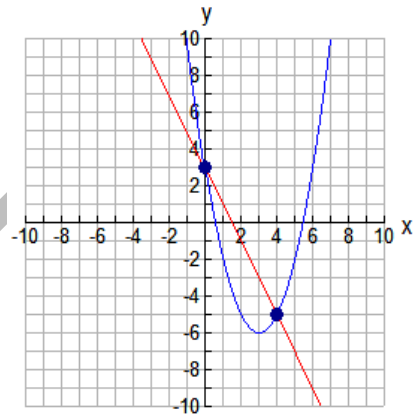
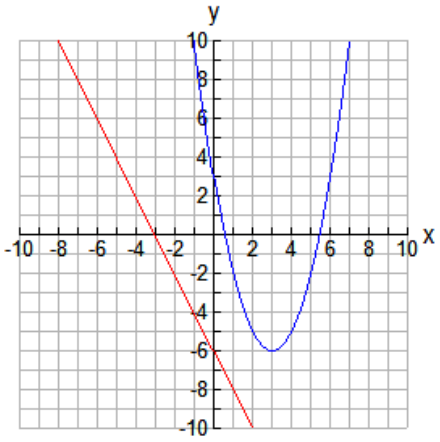




i. Find the intercept of the quadratic function $f(x) = x^2 - 2x - 8$.

ii. Find the intercept of the quadratic function $f(x) = x^2 + 3x + 4$.

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS		COMPETENCIES
		E.g.5 Determine the domain and range of a quadratic function i. Find the domain and range of the function and determine the interval on which the function is increasing and decreasing. $f(x) = x^2 - 3x - 4$. ii. Find the domain and range of $f(x) = -5x^2 + 9x - 1$.		
		E.g.6 Sketch/graph a quadratic function i. Sketch the quadratic function $f(x) = 3x^2 + 5x - 2$		
		ii. Sketch the quadratic function $f(x) = 2x^2 + 4x - 4$		

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS		COMPETENCIES
		B10.2.1.1.3 Use graphs to solve equations involving one linear and one quadratic relation. **E.g.1** Sketch the graph and determine the solution for a straight line and a quadratic graph i. Graph the solution for the straight line and the parabola intercept and state whether it has one or two solution(s).		Ability to combine Information and ideas from several sources to reach a conclusion
		• $y = -2x + 3$ • $y = x^2 - 6x + 3$ There are two solutions because the linear and the quadratic graph intercepts at two points.		
		ii. Graph the solution for the straight line and the parabola intercept and state whether it has one, two or no solution(s). • $y = -2x - 6$ • $y = x^2 - 6x + 3$ There is no solution since the linear and the quadratic graphs does not intercept intersect.		

B10 Strand 2

Sub-strand 2 Algebraic Expressions

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B10.2.2.1 **Solve problems involving algebraic expressions or formulas (including difference of two squares) and substitute values to evaluate expressions**	**B10.2.1.1.1 Express simple statements involving algebraic expressions in mathematical symbols and use it to solve problems involving the four operations.**	Ability to combine Information and ideas from several sources to reach a conclusion Implement strategies with accuracy
		E.g.1 Translate statements involving algebraic expressions in mathematical symbols. **i.** Write an expression for "the sum of 6 and the product of 3 and d". **ii.** Daniel makes 100 cedis each week. He worked for x weeks this summer. **iii.** Sebastian has 12 more trophies than Megan. Megan has t trophies. **iv.** Write an expression for "8 less than the product of 7 and x". **v.** The sum of -7 and the quantity of 8 times x	
		E.g.2 Add and subtract algebraic expressions. Simplify the following expressions i. $4x + 2y + 3x + 5y$ ii. 4a + 5b - 3c iii. 7x3 – 3x2y + xy2 + x2y – y3 iv. Subtract 3x + y – 3z from 9x – 5y + z. v. Add: $5x^2 + 7y - 8$, $4y + 7 - 2x^2$ and $6 – 5y + 4x^2$.	
		E.g.3 Multiply and divide algebraic expressions. Simplify the following expressions i. X3 (x 4 + 5a) ii. $\mathbf{5z \times 8z^2}$ iii. $\mathbf{4xy^3 \times 4x^4y}$ iv. $\mathbf{32a^3 \div 4a^2}$ v. $\frac{\mathbf{3ab(4a^2b^5)}}{\mathbf{8a^2b^3}}$ vi. $2a[(a + 3b) + 4(2a - b)$	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B10.2.1.1.2 Multiply two binomial expressions and simplify	
		E.g.1 Expand and simplify product of two binomial expressions. i. $(a+2)(a+3)$ ii. $(2x+3)^2$ iii. $(x-3)(x+2)$ iv. $(a-b)^2$	
		B10.2.1.1.3 Factorize algebraic expressions (including quadratic trinomials)	
		E.g.1 Factorize given algebraic expressions with variable index not exceeding 2. Factorize completely i. $x^2-ax+bx-ab$ ii. $3a^2+2ab-12ac-8bc$ iii. $y(5x-2)-n(3x-1)$ iv. $ab-by-ay-y^2$ Factorize completely i. x^2+5x+6 ii. x^2+x-6 iii. $2x^2-3x+1$ iv. $3q^2-2x-5$	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B10.2.1.1.4 Apply difference of two squares to solve problems **E.g.1** Develop the rule of difference of two squares i.e. $a^2 - b^2 = (a + b)(a - b)$	
		E.g.2 Apply the idea of difference of two squares to evaluate algebraic expressions i. $4x^2 - y^2$ ii. $36k^2 - 49t^2$ iii. $27x^2 - 12y^2$ iv. $x^2 - y^2 = (x + y)(x - y)$, i.e. $6.42 - 3.62 = (6.4 + 3.6)(6.4 - 3.6)$ $= 10 \times 2.8 = 28.$ v. $(4\frac{5}{8})^2 - (3\frac{3}{8})^2$	
		B10.2.1.1.5 Perform operations on simple algebraic fractions including monomial and binomial denominators	
		E.g.1 Multiply and divide algebraic fractions **Simplify the following** i. $(\frac{16xy}{3} \times \frac{12x}{8})$ ii. $\frac{\mathbf{4a^2+8ab}}{\mathbf{3}} \div \frac{\mathbf{15ab+10b^2}}{\mathbf{9}}$ iii. $\frac{\mathbf{6x^2+2xy}}{\mathbf{5z}} \times \frac{\mathbf{15z^2}}{\mathbf{3x+y}}$	
		E.g.2 Add and subtract algebraic fractions with monomial denominators. Simplify the following i. $\frac{2}{5x^2} + \frac{1}{2x}$ ii. $\frac{\mathbf{1}}{\mathbf{a^2}} + \frac{\mathbf{3}}{\mathbf{a}} - \frac{\mathbf{1}}{\mathbf{3a}}$ iii. $\frac{2}{3b^2} - \frac{5}{3b^2} + \frac{3}{4b}$ iv. $\frac{3}{4t^2} - \frac{5}{6t^2} + \frac{2}{3t}$	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.3 Add and subtract algebraic fractions with binomial denominators. Simplify the following i. $\frac{2}{x+3}+\frac{3}{x-3}$ ii. $\frac{5}{2x+1}-\frac{6}{3x-1}$ iii. $\frac{2x}{x+4}+\frac{8x-32}{x^2-16}$ iv. $\frac{10x^2+xy-24y^2}{4x^2-9y^2}-\frac{x+2y}{2x+3y}$	
		B10.2.1.1.6 Determine the conditions under which algebraic fraction is zero or undefined.	
		E.g.1 Identify the condition under which an algebraic expression is zero. i. $\frac{4y}{7d}$ is zero when $4y$ = 0 i.e. when $y = 0$	
		E.g.2 Determine the condition under which an algebraic expression is undefined Find the value(s) of x which make the fractions undefined i. $\frac{1}{x+3}$ ii. $\frac{x+2}{(x-2)(x+1)}$ iii. $\frac{1}{x^2+3x+2}$	

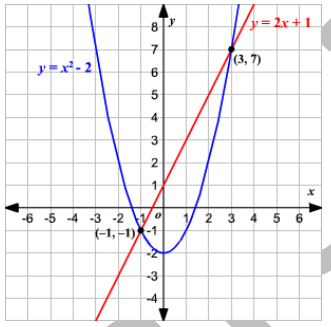
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B10.2.1.1.6 Perform change of subjects and substitute values into formulae and use it to solve problems	
		E.g.1 Change subjects in given formulae i. make m the subject of the relation $mt + n = mp + q$ ii. $make \pi the subject of the relation$ $l = 2r + \frac{1}{2}\pi r$ iii. $make g the subject of the relation T = 2\pi\sqrt{l/g}$ iv. $make\ x\ the\ subject\ of\ the\ relation$ $y = \frac{ax^3 - b}{3c}$ v. $y = a(c + \frac{1}{x})^3$	
		E.g.2 Substitute values into formulae and evaluate i. Given that R = 3, d = 2, and L =12, find the value of K, if $K = \frac{Rd^2}{L}$	

Strand 2: Algebra
Sub-strand 3: Equations and Inequalities

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
30.	**B10.2.3.2** **Demonstrate understanding of the multiplication and factoring of polynomial expressions (concretely, pictorially, and symbolically) including:** • **multiplying of monomials, binomials, and trinomials** • **common factors** • **trinomial factoring** **relating multiplication and factoring of polynomials.**	**B10.2.3.2.1 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters** i. Linear equation of the form $ax + b = c$, where a, b and c real numbers, and $a \neq 0$. Eg1. Solve for the variable indicated (a). $2x + 3 = 17$ (b). $3(2k - 4) = 9 - 3(k + 1)$ Eg. 2 $\frac{a(b-2)}{c-3} = x$, solve for b ii. Linear Inequality of the forms $ax + b < c$, $ax + b \leq c$, $ax + b > c$, $ax + b \geq c$ Eg.1) Find the solution set: (a) $5x + 3 < 17$ (b) $3(2 - x) \leq 5x - 2$ (c) $\frac{x+1}{3} - \frac{x-3}{2} < \frac{1}{6}$ Eg2. Solve $7x - 5 > 6x + 4$ Graph the solution set on a number line Eg3. Mumuni is delivering boxes of paper to each floor of Cedi House. Each box weighs 34 kilograms and Mumuni weigh 80kg. If the maximum capacity of the elevator is 1000kilograms, how many boxes can Mumuni safely take on each elevator trip? Let x be the number of boxes Mumuni can carry on each trip.	Ability to combine Information and ideas from several sources to reach a conclusion

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
31.		Total weight of boxes plus Mumuni's weight must be equal to or less than 1000 $80 + 32x \leq 1000$ $32x \leq 920$ $x \leq 28.75$ Since there cannot be fractional boxes, Mumuni cannot take more than 28 boxes	
32.		**B10.2.3.2.2 Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.** i. If $x^2 + bx$ is a binomial, then $x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$ Eg. Solve $x^2 - 6x + 2 = 0$ by completing the square $(x - 3)^2 = 7$ $x = 3 - \sqrt{7}; x = 3 + \sqrt{7}$ i. Given $ax^2 + bx + c = 0$, where $a > 0$ $ax^2 + bx + c = 0$ $x^2 + \frac{b}{a}x + \frac{c}{a} = 0$ $x^2 + \frac{b}{a}x = -\frac{c}{a}$ $x^2 + \frac{b}{a}x + \frac{b^2}{4a^2} = -\frac{c}{a} + \frac{b^2}{4a^2}$ $\left(x + \frac{b}{2a}\right)^2 = -\frac{c}{a}\left(\frac{4a}{4a}\right) + \frac{b^2}{4a^2}$ $\left(x + \frac{b}{2a}\right)^2 = \frac{-4ac + b^2}{4a^2}$	Ability to combine Information and ideas from several sources to reach a conclusion Implement strategies with accuracy Demonstrate behaviour and skills of working towards group goals

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
33.		$\left(x+\frac{b}{2a}\right)^2=\frac{b^2-4ac}{4a^2}$ $\left(x+\frac{b}{2a}\right)=\pm\sqrt{\frac{b^2-4ac}{4a^2}}$ $x+\frac{b}{2a}=\pm\frac{\sqrt{b^2-4ac}}{2a}$ $x=\frac{-b}{2a}\pm\frac{\sqrt{b^2-4ac}}{2a}$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-b+\sqrt{b^2-4ac}}{2a}$ $x=\frac{-b-\sqrt{b^2-4ac}}{2a}$	
		B10.2.3.2.3 Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.	
		The discriminant and the nature of a quadratic equation's solution. The solution of a quadratic equation of the form $ax^2+bx+c=0$, where $a>0$ is given by $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ b^2-4ac determines the nature of the solutions to the quadratic equations. 1. If b^2-4ac is negative, the solutions are not real numbers. 2. If b^2-4ac is positive perfect square, the solutions are rational numbers. 3. If b^2-4ac is a positive number that is not a perfect square, the solutions are irrational numbers	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
2.		**B10.2.3.2.4 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = mx + c$ and the curve** $y = ax^2 + bx + c$ **Eg. 1. Find the solution of the line $y = 2x + 1$ and the curve $y = x^2 - 2$ on the interval $-4 < x < 4$**  $2x + 1 = x^2 - 2$ $x^2 - 2x - 3 = 0$ $(x^2 - 3x) + (x - 3) = 0$ $(x - 3)(x + 1) = 0$ $x = 3, -1$ The line meets the curve at $x = 3, -1$	Ability to combine Information and ideas from several sources to reach a conclusion Implement strategies with accuracy Demonstrate behaviour and skills of working towards group goals

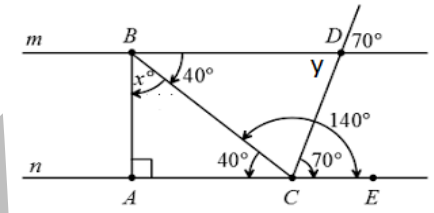
Strand 3: Geometry and Measurement

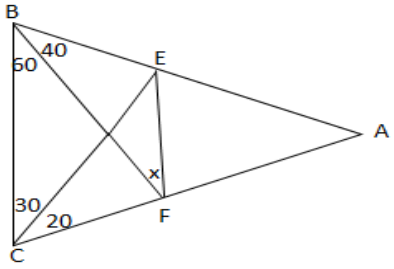
Sub-strand 1: Lines and Shapes

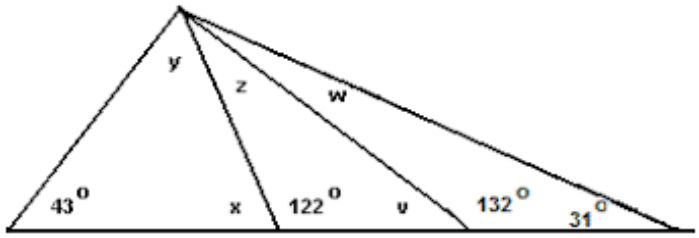
<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td rowspan="4">B10.3.1.1 Apply the properties of angles and triangles to solve problems on the similar and special triangles</td><td>B10.3.1.1.1 Use the knowledge and understanding of properties of angles to solve problems on similar angles</td><td rowspan="4">Demonstrate behaviour and skills of working towards group goals

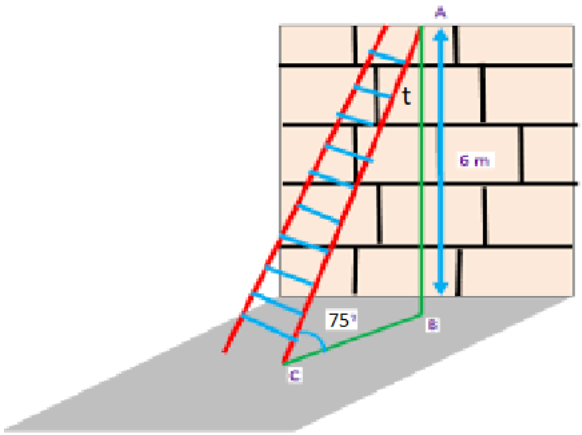
Ability to combine Information and ideas from several sources to reach a conclusion

Implement strategies with accuracy</td></tr>
<tr><td>E.g.1. Calculate the value of x and y

 
</td></tr>
<tr><td>E.g.2. Determine the value of x
Note. |BC| and |EF| are parallel.

 
</td></tr>
<tr><td>B10.3.1.1.2 Solve more problems on similar and special angles using the knowledge and understanding of properties of angles
E.g. 1. Determine the values of angles v, w, x, y and z.

 
</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g. 2 Calculate the value of t (angle between ladder and the wall) 	

<table>
<tr><th></th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td></td><td rowspan="3">B10.3.1.2
Construct inscribed and circumscribed triangles and quadrilaterals with given dimensions</td><td rowspan="3">B10.3.1.2.1 Draw Construct inscribed and circumscribed circles for triangles under given conditions

E.g.1: Construct and inscribe ΔXYZ, such that $|XY| = 6cm\ |ZY| = 10cm\ |XZ| = 8cm$

E.g.2: Construct and circumscribe ΔXYZ, such that $|XY| = 6cm\ |ZY| = 10cm\ |XZ| = 8cm$

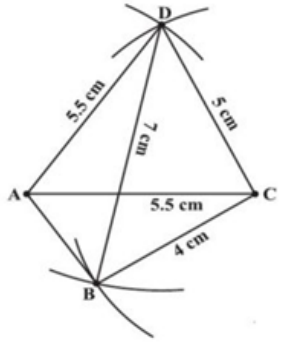
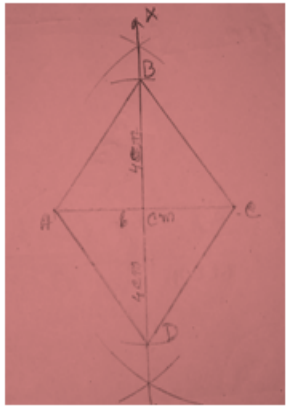
E.g.3: Group - Project work

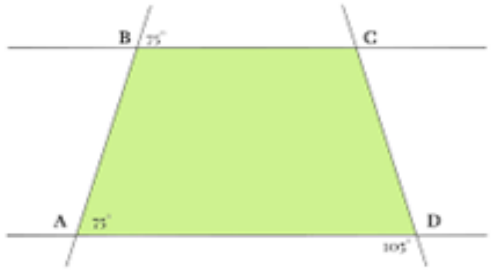
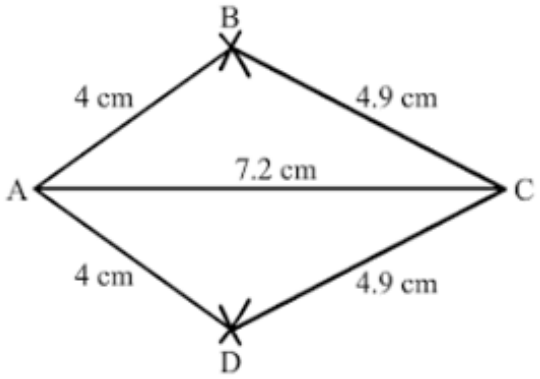
Use a pair of compasses and ruler to construct and circumscribe ΔABC with line segments $AB = 5cm BC = 6.5cm$ and $AC = 6cm$.

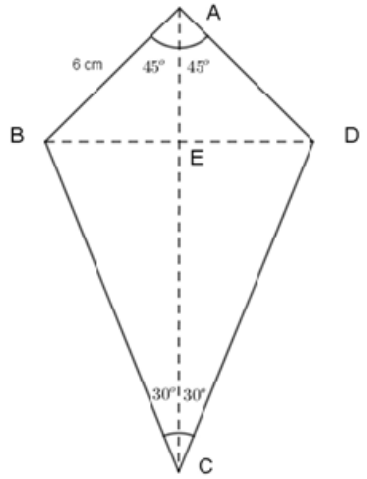
(i) Measure $< ACB$ on the arc
(ii) Construct a perpendicular bisectors of the base $< CAB$ and $< CBA$ to intersect at P.
(iii) How is the inscribed angle at P related to its intercepted arc?
(iv) Repeat parts (i), (ii) and (iii) several times for different triangles of different sides. Record your results in the following table. Write a conjecture about how an inscribed angle is related to its intercepted arc.

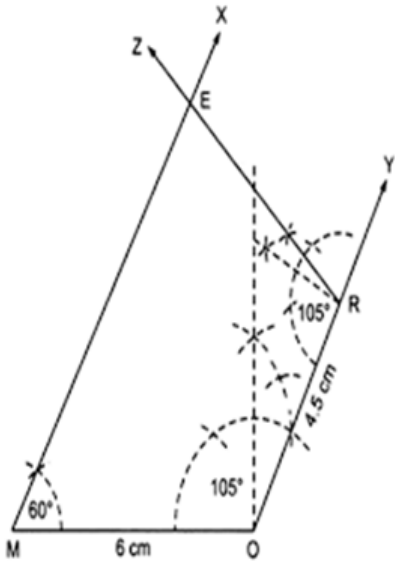
<table><tr><th>Measure of Inscribed Angle</th><th>Measure of Central Angle</th><th>Relationship</th></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table></td><td>Ability to combine Information and ideas from several sources to reach a conclusion

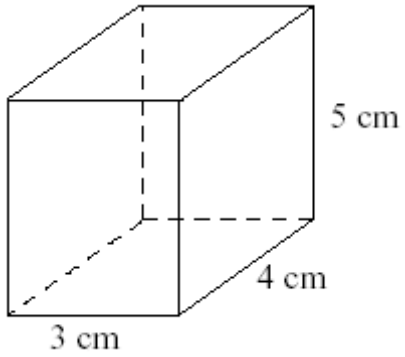
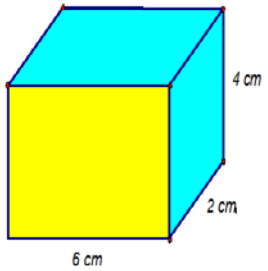
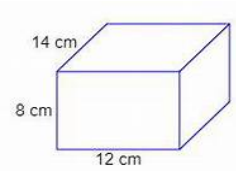
Implement strategies with accuracy</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td><td>Understand and use interpersonal skills</td></tr>
</table>

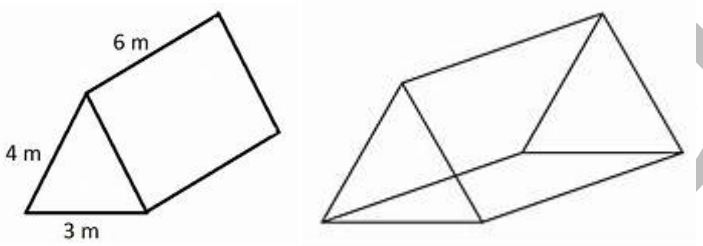
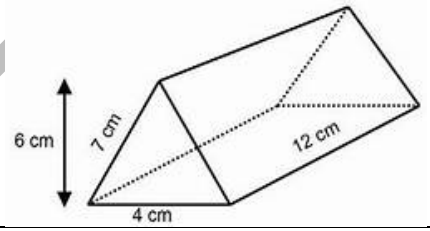
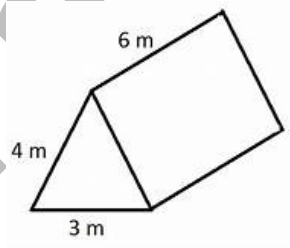
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		B10.3.1.2.2 Draw kites, isosceles quadrilaterals, scalene trapezoids and right-trapezoids under given conditions **E.g.1:** Perform geometric construction of a quadrilateral with given sides and diagonal(s) Construct the quadrilateral ABCD such that AC=AD=5.5cm, CB=4cm CD=5cm and DB=7cm. Complete the shape by joining BD. Measure the line segment AB  Construct the rhombus ABCD whose diagonals are 8cm and 6cm respectively. Measure the length of the side and the angle at the vertices  	Ability to combine Information and ideas from several sources to reach a conclusion Implement strategies with accuracy

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.2: Perform geometric construction of a an isosceles quadrilateral Draw the isosceles quadrilateral ABCD such that AD= 9cm, AB= CD = 4cm and <BAD =<CDA =75°  	
		E.g.3 Use a pair of compasses and a ruler to construct a kite to with given sides Construct a kite ABCD with sides AB = 4cm and BC = 4.9cm. Measure the diagonals of the kite.  	

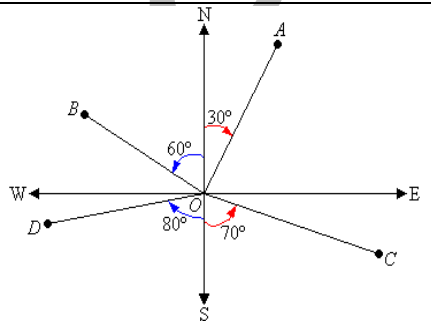
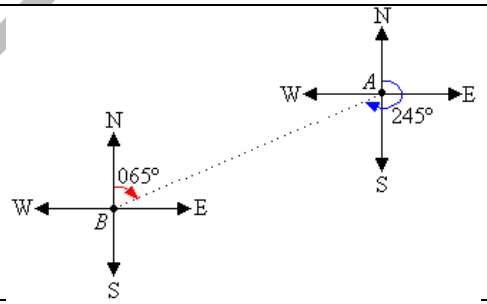
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.4 Perform geometric construction of a kite with given opposite angles Use a pair of compasses and ruler to construct the quadrilateral $ABCD$ such that the line segment $AB = 6cm$; $BC = 9cm$;, $< BAD = 90^{\circ}$ and $< BCD = 60^{\circ}$  	

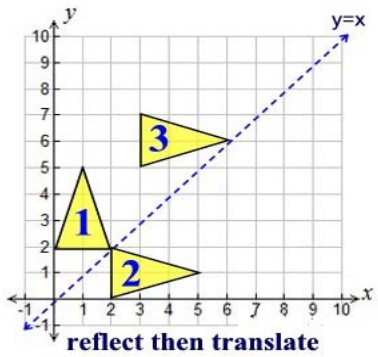
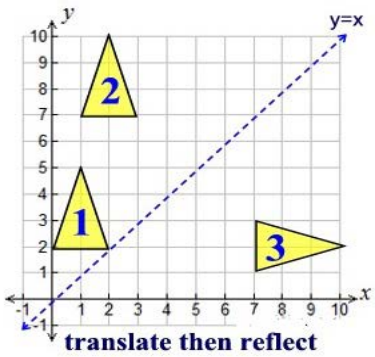
S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
		E.g.35: Perform geometric construction of quadrilaterals under given conditions Construct quadrilateral MORE such that the line segments MO=6cm, and OR=4.5cm. <EMO=60°, <MOR= <ORE=105°. Measure the line segments RE and ME.  	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1.	**B10.3.2.1** **Derive the formulas for determining the volumes of cuboid and triangular prisms and use these to solve problems**	B10.3.2.1.1Identify (length ,width ,height) of cuboids and triangular prims and use it to determine the volume    E.g.1 Identify the length, the width and the height of the cuboids above.	Implement strategies with accuracy Ability to combine Information and ideas from several sources to reach a conclusion
2.			
3.		E.g.2 Multiply the length, the width and the height for each of the volumes of the cuboids above.	
4.		E.g.3 Calculate the volume of a cuboid whose length is 3cm ,width is 4cm and height is 5cm	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
5.		B10..3.2.1.2 Identify triangles and, rectangles in the triangular prisms E.g.1 How many triangles and rectangles is / are in the triangular prisms 	
6.			
7.		E.g.2 Find the cross sectional area of one of the triangular bases and multiply it by the prism length to obtain length of the prism ,and that is the volume (V=Area of base times heightcross sectional area × prism length) 	
		E.g.3 Find the volume of the triangular prisms. 	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
8.		**B10.3.2.1.3** **Solve real life problems on cuboids and triangular prisms** E.g.1 The volume of water in a rectangular thank is $30cm^3$. The length of the tank is 5cm and its breadth is 2cm. Calculate the depth of water in the tank. E.g.2 A rectangular box has length 20cm width 6cm and height 4cm .Find how many cubes of size 2cm that will fit into the box. Eg.3E.g.3 Find the volume of the diagram	Ability to combine Information and ideas from several sources to reach a conclusion Implement strategies with accuracy
9.			

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
	B10.3.3.2 Solve distance and bearing problems and problems involving application of vectors	**B10.3.3.2.1 Determine the bearing of objects in the various quadrants**	Implement strategies with accuracy Ability to combine Information and ideas from several sources to reach a conclusion
		E.g.1 Investigate and identify Bearings and the two kinds. E.g.2 Describe each of the following bearings as directions (i) 065° (ii) 080° (iii) 135° Eg.3 Describe the position of A, C, and E as bearing from 0 in the figure above. 	
		E.g.4 Write the distance and the bearing of A from B from the diagram 	
		B10.3.3.2.2 Solve distance and bearing problems involving application of vectors	Ability to combine Information and ideas from several sources to reach a conclusion Implement strategies with accuracy
		E.g.1 The point B is 4km due east of the point C. If A is 3km due south of C, find; (i) The bearing of B from A (ii) The distance of B from A. E.g.2 A cyclist travels 5km south, then12 km east. Find the cyclist's bearing from her starting point to the nearest degree. E.g.3The bearing of B from A is 035° and the bearing of C from B is 125°. If $\lfloor AB \rfloor$ = 50km and $\lfloor BC \rfloor$=40km. Find the bearing and distance between A and C.position of the A from C.	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
1.	**B10.3.3.5** **Describe changes and invariance achieved by performing a combination of successive transformations (reflection, translation, rotation) in 2D shape**	**B10.3.3.5.1 Perform a combination of successive transformations and examine their properties (angles, lengths, shapes etc.) to determine congruent transformations and similar transformation** E.g. 1. Draw sequence of transformation and examine relationships, changes and invariance  reflect then translate  translate then reflect	Implement strategies with accuracy Ability to combine Information and ideas from several sources to reach a conclusion
2.		**B10.3.3.5.2 Understand and describe transformation in real-life including transformation used to create designs and patterns.** E.g. 1. Describe the world around us with transformation language Describe the movement of the monkey using appropriate language for transformation such as below: The monkey started at the bottom of the tree, on the left, and then slid up the tree. The monkey flipped from the left-side to the right-side of the tree. The monkey then turned up and out onto the branch by rotating 90° clockwise.	

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr>
<td>10.</td>
<td>B10.4.1.1

Demonstrate an understanding of simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts, illustrate using scatter graphs and use them to solve and/or pose problems.</td>
<td>
B10.4.1.1.1– Collect data from an observational study in which, for example, the interest is the relationship between weight and height of learners. Illustrate the data using scatter graphs and find the relationship between the weight and height if any

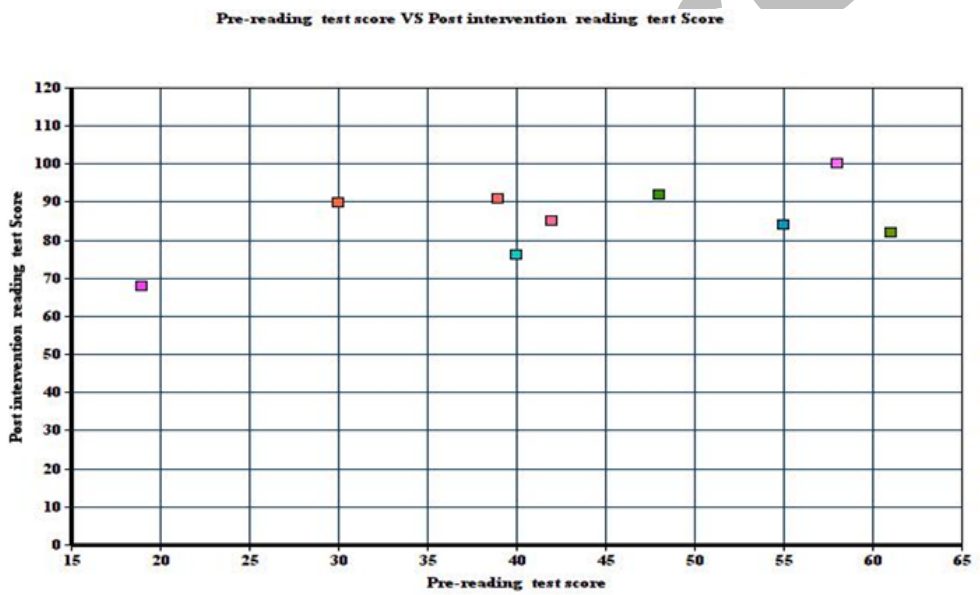
E.g. 1- An observational study data (i.e. data collected are not due to manipulation or interference) is presented in the tables below.
i. Let learners identify which table does not show bivariate data?

A
<table>
<tr><th>Litreers</th><th>Kilometreers Driven</th></tr>
<tr><td>68.2</td><td>482.8</td></tr>
<tr><td>90.9</td><td>643.7</td></tr>
<tr><td>113.7</td><td>804.7</td></tr>
</table>
B
<table>
<tr><th>Height (m)</th><th>Weight (kg)</th></tr>
<tr><td>0.96</td><td>22.67</td></tr>
<tr><td>1.22</td><td>31.75</td></tr>
<tr><td>1.52</td><td>40.82</td></tr>
</table>
C
<table>
<tr><th>Score</th><th>Frequency</th></tr>
<tr><td>10</td><td>2</td></tr>
<tr><td>20</td><td>6</td></tr>
<tr><td>35</td><td>4</td></tr>
<tr><td>50</td><td>3</td></tr>
</table>
ii. Identify the independent and dependent variables in the tables that show bivariate data
iii. What effect has the number of liters of fuel used on number of kilometers driven? (learners should note the relationship between the two variables)
iv. Can any comparison be made between Score and Frequency in Table B? [note: in this case though the frequencies are not the same, there is (i) one variable – univariate and (ii)no relationship between Score and Frequency]
</td>
<td>Ability to combine Information and ideas from several sources to reach a conclusion

Understand and use interpersonal skills</td>
</tr>
</table>

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td>11.</td><td></td><td>E.g. 2 -The bivariate data presented in the table below shows the hours studied and the percentage score(two variables -independent and dependent respectively) obtained in a statistics course by 9 learners.

<table>
<tr><th>Learner</th><th>Hours Studied (h)</th><th>Test Score (s)</th></tr>
<tr><td>Ama</td><td>3</td><td>90</td></tr>
<tr><td>Koblah</td><td>1</td><td>86</td></tr>
<tr><td>Akua</td><td>5</td><td>84</td></tr>
<tr><td>Yaw</td><td>4</td><td>92</td></tr>
<tr><td>Efua</td><td>3</td><td>91</td></tr>
<tr><td>Kwami</td><td>5</td><td>100</td></tr>
<tr><td>Akosoa</td><td>0</td><td>76</td></tr>
<tr><td>Fiifi</td><td>1</td><td>82</td></tr>
<tr><td>Adioa</td><td>2</td><td>85</td></tr>
</table>
i. In small groups, learners should place the information on a graph sheet (scatter plot) by plotting each learner as an ordered pair with Hours Studied on the x-axis and Test Score on the y-axis.
ii. Lead a discussion on the scatter plot to enable group find the relationship between Hours Studied and Test Score, draw their conclusion and justify it
iii. Pose questions based on the analyses.</td><td></td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
12.		**B10.4.1.1.2 - Collect data from an *experimental study* in which the interest is based on a treatment and non-treatment (control) groups. Illustrate the data using scatter graphs and find the relationship between the variables, if any**	Understand and use interpersonal skills Ability to combine Information and ideas from several sources to reach a conclusion
13.		 E.g. 1-A reading test is given to 9 learners in B3. They then participated in an extensive reading program. After participating in the program *(group manipulated)*, they were retested. The data collected was organized and plotted as a scatterplot (*the ordered pair of scores for each learner)* as follows: In small groups, study the **scatterplot**, (using the skills for plotting and interpreting points on a graph sheet), find the relationship between **Pre-reading test scores** and **Post -intervention Reading Test Scores**, do a **comparison**, **draw a conclusion and justify the conclusion.**	

<table>
<tr><th>S/N</th><th>CONTENT STANDARDS</th><th>INDICATORS AND EXEMPLARS</th><th>COMPETENCIES</th></tr>
<tr><td>14.</td><td></td><td>E.g. 2 -The blood sugar level of 10 learners is tested before and after an exercise session. The bivariate <u>(two variables – independent and dependent) data</u> collected are organized and presented in the table below:
<table>
<tr><th>Age</th><th>Sex</th><th>Blood Sugar Level before the Exercise (mmol/L)</th><th>Blood Sugar Level after the Exercise (mmol/L)</th></tr>
<tr><td>12</td><td>F</td><td>9.0</td><td>8.1</td></tr>
<tr><td>11</td><td>M</td><td>8.5</td><td>7.5</td></tr>
<tr><td>13</td><td>M</td><td>10</td><td>8.7</td></tr>
<tr><td>12</td><td>F</td><td>7.2</td><td>6.6</td></tr>
<tr><td>12</td><td>F</td><td>9.5</td><td>8.1</td></tr>
<tr><td>11</td><td>M</td><td>12.0</td><td>10.8</td></tr>
<tr><td>13</td><td>F</td><td>8.0</td><td>6.9</td></tr>
<tr><td>12</td><td>M</td><td>16.0</td><td>14.3</td></tr>
<tr><td>14</td><td>F</td><td>7.5</td><td>6.7</td></tr>
<tr><td>11</td><td>M</td><td>9.0</td><td>7.5</td></tr>
</table>
i. In small groups, do a scatterplot of the bivariate data (you may round off the Blood Sugar Levels to the nearest whole numbers)
ii. What is the relationship between the Blood Sugar Level before and after the Exercise sessions?</td><td></td></tr>
<tr><td>15.</td><td>B10.4.1.2
Demonstrate an understanding of the effect of contextual issues on the collection of data as well as develop and implement a survey/research to draw conclusions on issues/problems of interest.</td><td>B10.4.1.2.1 Design a questionnaire for the collection of data for a survey taking into consideration contextual issues such as bias, use of language, ethics, cost, time and timing, privacy and cultural sensitivity
E.g. –
i. In small groups, learners discuss and decide on a survey each group wants to undertake, what facts/contextual issues to take into consideration in designing the survey questionnaire, choose a suitable data collection method that includes the social considerations and how they would collect the data.</td><td>Ability to combine Information and ideas from several sources to reach a conclusion
Understand and use interpersonal skills</td></tr>
</table>

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
16.		ii. The introduction of the survey questionnaire should make clear the ***purpose*** of the survey, approximate ***time*** for completion of the questionnaire, ***assurance statement*** on how data collected would be handled *(e.g. … your answers will remain confidential and they will be only used in finding …),* and avoid all factors that would ***negatively influence responses***, and so on. (reference: **B9.4.1.2.1)** **iii.** Develop the survey questionnaire	
17.		**B10.4.1.2.2** -Conduct the survey and draw conclusions	Ability to combine Information and ideas from several sources to reach a conclusion
18.		E.g. - Complete the survey according to the design/plan, analyse the data, draw conclusions and communicate findings to the class.	
19.	**B10.4.2.1** **Demonstrate an understanding of the role of probability in society and solve/pose problems involving single, two-independent and two-dependent events.**	**B10.4.2.1.1.-** Provide an example from print and electronic media, *e.g., newspapers, television, the Internet,* where probability is used and explain how the given probability influences individual decision *(e.g. how we often cope with the uncertainties of life)* E.g. 1 -In small groups, learners should list and present with explanation at plenary some decisions that point to uncertainties/certainties of everyday life *(for example, going out with or without an umbrella, the safety of crossing a road, getting married, the quantity of bread, koliko, akara a roadside seller prepares for sale for the day, chance of dying in an accident on a particular stretch of a road/highway, and so on)*	Ability to combine Information and ideas from several sources to reach a conclusion Understand and use interpersonal skills

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
20.		E.g. 2 -Before planning for picnic, you check the weather forecast. And it says there is a 60% chance (probability) that rain may occur. In groups, lead learners in discussion to provide answers to the following questions: i. What does this probability mean? ii. How was the 60% determined? iii. What are the things taken for granted in determining the probability *(assumptions)* and/or anything that could change the forecast *(limitations)* if any? iv. How will it influence your decision on the planned picnic?	
21.		E.g. 3- In groups, lead learners in discussion to provide answers to the following questions Interpret and explain their answers, indicating the assumptions and limitations involved, if any? *(refer to E.g. 2)* a. How may politics analysts predict a certain political party to come into power? b. Flipping a coin is one of the most important events before the start of a footballtfootball match. What is the chance or the probability of your team getting the desired outcome? c. As an active smoker, the chances (probability) of getting lungs disease are higher in you. Aware of this fact, which insurance scheme will you go for: health, vehicle or house insurance?	
22.		E.g. 1 - There is a probability of getting a desired card when we randomly pick one out of 52 deck of cards. i. What is the probability of picking up an ace in a 52 deck of cards? ii. What will be the odds of picking up any other card? Explain your answer. iii. How will the probabilities in (i) and (ii) influence the picking of cards at the start of the game.	

S/N	CONTENT STANDARDS	INDICATORS AND EXEMPLARS	COMPETENCIES
23.		B10.4.2.1.3.-Solve real life cases involving the probability of two-independent events *(Refer to the examples in **B8.4.2.1.1 to set the processes of solving the following problems)*** 1. A dresser drawer contains pairs of socks with the following colours: blue, brown, red, white and black. Each pair is folded together in a matching set. You reach into the drawer and choose a pair of socks without looking. You replace this pair and then choose another pair of socks. What is the probability that you will choose the red pair of socks both times? 2. A coin is tossed and a single 6-sided die is rolled. Find the probability of landing on the head side of the coin and rolling a 3 on the die 3. A card is chosen at random from a deck of 52 cards. It is then replaced and a second card is chosen. What is the probability of choosing a jack and then an eight? 4. A nationwide survey showed that 65% of all children dislike eating vegetables. If 4 children are chosen at random, what is the probability that all 4 dislike eating vegetables? (Round your answer to the nearest percent) *(note that the choice of any child does not affect the other three children)*	
5.		B10.4.2.1.4.-Solve real life cases involving the probability of two – events (independent and dependent combined) 1. A card is chosen at random from a standard deck of 52 playing cards. Without replacing it, a second card is chosen. What is the probability that the first card chosen is a queen and the second card chosen is a jack? 2. Mr. Mills needs two students to help him with a science demonstration for his class of 15 girls and 13 boys. He randomly chooses one student who comes to the front of the room. He then chooses a second student from those still seated. *(learner should note that the sample space of the dependent event will change)* What is the probability that both students chosen are girls? 3. In a shipment of 20 computers, 3 are defective. Three computers are randomly selected and tested. What is the probability that all three are defective if the first and second ones are not replaced after being tested?	

Appendix A

UNPACKING THE CORE COMPETENCES OF THE STANDARDS-BASE CURRICULUM

COMMUNICATION AND COLLABORATION

SUBSKILLS (B7- 10)		
Listening	**Presenting**	**Team Work**
Identify words or sentences in context or appropriately	Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group	Demonstrate behaviour and skills of working towards group goals
Interpret correctly and respond to non-verbal communication such as facial expressions, cues and gestures	Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech.	Understand and use interpersonal skills
Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication	Apply appropriate diction and structure sentences correctly for narrative, persuasive, imaginative and expository purposes	Understand roles during group activities
Identify underlying themes, implications and issues when listening	Anticipate different responses from the audience and plan for them.	Ability to keep group working on relevant activities
Identify and analyse different points of views of speaker	Can vary the level of detail and the language use when presenting to make it appropriate to the audience.	Can see the importance of including all team members in discussions and actively encourage contributions from their peers in their team
		Ability to work with all group members to complete a task successfully
		Effectively perform multiple roles within the group
		Demonstrate an awareness of the wider team dynamics and work against negative conflict in the team

CRITICAL THINKING AND PROBLEM SOLVING

SUBSKILLS (B7- 10)	
Critical Thinking	**Problem Solving**
Ability to combine Information and ideas from several sources to reach a conclusion	Ability to effectively define goals towards solving a problem
Analyse and make distinct judgment about viewpoints expressed in an argument	Ability to explain plans for attaining goals
Create simple logic trees to think through problems	Identify important and appropriate alternatives
Generate hypothesis to help answer complex problems	Ability to identify important and appropriate criteria to evaluate each alternatives
Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem	Ability to select alternative(s) that adequately meet selected criteria
Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation	Preparedness to recognise and explain results after implementation of plans
Provide new insight into controversial situation or task	Implement strategies with accuracy
Identify and prove misconceptions about a generalised concept or fact specific to a task or situation	
Identify and explain a confusion, uncertainty, or a contradiction surrounding an event	
Develop and defend a logical plausible resolution to a confusion, uncertainty or contradiction surrounding an event	

PERSONAL DEVELOMENT AND LEADERSHIP

SUBSKILLS (B7- 10)	
Personal Development	**Leadership**
Build a concept and understanding of one's self (strength and weaknesses, goals and aspiration, reaction and adjustment to novel situation)	Ability to serve group members effectively
Demonstrate sense of feeling or belongingness to a group	Division of task into solvable units and assign group members to task units
Recognise one's emotional state and preparedness to apply emotional intelligence	Ability to manage time effectively
Ability to understand one's personality trait	Ability to manage and resolve conflict
Desire to accept one's true self and overcome weakness	Ability to monitor team members to ascertain progress
Ability to set and maintain personal standards and values	Ability to mentor peers
	Actively promote effective group interaction and the expression of ideas and opinions in a way that is sensitive to the feelings and background of others
	Actively assist group identify changes or modifications necessary in the group activities and work towards carrying out those changes

CULTURAL IDENTITY AND GLOBAL CITIZENSHIP

SUBSKILLS (B7- 10)	
Cultural Identity	**Global Citizenship**
Show a strong sense of belongingness to one's culture	Understanding of influences of globalisation on traditions, languages and cultures
Develop and exhibit ability to defend one's cultural beliefs, practices and norms	Recognise resistance to global practices that are inimical to our culture
Develop and express respect, recognition and appreciation of others' culture	Know the global discourse about the roles of males and females
Develop and exhibit a sense of cultural identity	Exhibit a sense of nationality and global identity
Adjustment to the demands of customs, traditions, values and attitudes of society	

CREATIVTY AND INNOVATION

SUBSKILLS (B7- 10)	
Knowledge, Understanding, Skills and Strategies	**Reflection and Evaluation**
Ability to look at alternatives in creating new things	Exhibit strong memory, intuitive thinking; and respond appropriately
Ability to merge simple/ complex ideas to create novel situation or thing	Ability to reflect on approaches to creative task and evaluate the effectiveness of tools used
Identification of requirements of a given situation and justification of more than one creative tool that will be suitable	Ability to select the most effective creative tools for working and preparedness to give explanations
Ability to visualise alternatives, seeing possibilities, problems and challenges	Imagining and seeing things in a different way
Ability to try alternatives and fresh approaches	Anticipate and overcome difficulties relating initiatives
Understand and use analogies and metaphor	Being open-minded, adapting and modifying ideas to achieve creative results
Putting forward constructive comments, ideas, explanations and new ways of doing things	Look and think about things differently and from different perspective
	Recognise and generalise information and experience ; search for trends and patterns
	Interpret and apply learning in new context
	Reflect on work and explore thinking behind thoughts and processes

DIGITAL LITERACY

SUBSKILLS (B7- 10)	
Photo-Visual and Information Literacy	**Socio-Emotional and Reproduction**
Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem	Understand sociological and emotional aspects of work in cyberspace
Ability to recognise and avoid traps in cyberspace	Use digital tools to create novel things
Ability to find and consume digital content	Adhere to behavioural protocols that prevail in cyberspace
Ability to construct knowledge from a non-linear hyper textual navigation	Recognition of societal issues raised by digital technologies
Evaluate the quality and validity of information	Knowledge and recognition of ethical use of information
Preparedness to make better decision with information at hand	

Please note these inclusivity issues:

The core competencies outlined in this document must be assessed with consideration of people with special needs (physical disabilities, learning disabilities etc.).

Consider the use of realia for those with visual disabilities and visual learners.

A system of creating alternatives for task must also be adopted.