SC4021
WASSCE 2020
MATHEMATICS (CORE) 1
Objective Test
1½ hours

1

THE WEST AFRICAN EXAMINATIONS COUNCIL

West African Senior School Certificate Examination for School Candidates

SC 2020 — MATHEMATICS (CORE) 1 — 1½ hours

OBJECTIVE TEST

[50 marks]

Do **not** *open this booklet until you are told to do so. While you are waiting, read and observe the following instructions carefully. Write your* **name** *and* **index number** *in the spaces provided above. Answer* **all** *the questions on your Objective Test answer sheet.*

1. Use 2B pencil throughout.
2. On the pre-printed answer sheet, check that the following details are **correctly** printed:
   (*a*) In the space marked *Name*, check your **surname** followed by your **other names**.
   (*b*) In the spaces marked *Examination, Year, Subject* and *Paper*, check 'WASSCE', 'SC 2020', 'MATHEMATICS (CORE)', and '1' in that order.
   (*c*) In the box marked *Index Number,* your **index number** has been printed vertically in the spaces on the left-hand side, and each numbered space has been shaded in line with each digit. **Reshade** each of the shaded spaces.
   (*d*) In the box marked *Subject Code*, the digits 402112 are printed vertically in the spaces on the left-hand side. **Reshade** the corresponding numbered spaces as you did for your index number.
3. An example is given below. This is for a male candidate whose *name* is Elliot Kofi AGBANA.

THE WEST AFRICAN EXAMINATIONS COUNCIL

ANSWER SHEET

PRINTED IN BLOCK LETTERS.
Name: AGBANA ELLIOT KOFI — GHA
Examination: WASSCE — Year: SC 2020
Subject: MATHEMATICS (CORE) — Paper: 1

INSTRUCTIONS TO CANDIDATES
1. Use grade 2B pencil throughout.
2. Answer each question by choosing one letter and shading it like this: ⊏A⊐ ⊏B⊐ ⊏C⊐ ⊏D⊐ ⊏E⊐
3. Erase completely any answer you wish to change.
4. Leave extra spaces blank if the answer spaces provided are more than you need.
5. Do not make any markings across the heavy black marks at the right hand edge of your answer sheet.

INDEX NUMBER

	0	1	2	3	4	5	6	7	8	9
7								■		
1		■								
0	■									
2			■							
1		■								
4				■						
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SUBJECT CODE

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For Supervisors only
If candidate is absent shade this space. ☐

Answer **all** *the questions.*

Mathematical tables may be used in any question. The use of non-programmable, silent and cordless calculator is allowed.

Each question is followed by four options lettered A *to* D. *Find the* **correct** *option for* **each** *question and shade in* **pencil**, *on your answer sheet, the answer space which bears the same letter as the option you have chosen.*

Give only **one** *answer to* **each** *question. An example is given below.*

The ages, in years, of four boys are 10, 12, 14 and 18. What is the average age of the boys?

A. 12 years
B. 12½ years
C. 13 years
D. 13½ years

The correct answer is 13½ years, *which is lettered* D, *and therefore answer space* D *would be shaded.* ⊂A⊃ ⊂B⊃ ⊂C⊃ ⊂D⊃

Think carefully before you shade the answer spaces; erase completely any answers you wish to change.

Do all rough work on this question paper.

Now answer the following questions.

1. Evaluate, correct to **two** decimal places, 75.0785 – 34.624 + 9.83.

A. 30.62
B. 50.28
C. 50.29
D. 30.60

2. If $X = \{x: x < 7\}$ and $Y = \{y: y \text{ is a factor of } 24\}$ are subsets of $\mu = \{1, 2, 3, ..., 10\}$, find $X \cap Y$.

A. {1, 2, 3, 4 ,6, 8}
B. {2, 3, 4, 6, 8}
C. {1, 2, 3, 4, 6}
D. {2, 3, 4, 6}

3. Simplify: $\left[\left(\frac{16}{9}\right)^{\frac{-3}{2}} \times 16^{\frac{-3}{4}}\right]^{\frac{1}{3}}$.

A. $\frac{1}{4}$
B. $\frac{3}{8}$
C. $\frac{9}{16}$
D. $\frac{3}{4}$

4. Find the **least** value of x which satisfies the equation $4x = 7 \pmod 9$.
   A. 4
   B. 5
   C. 6
   D. 7

5. Express $1 + 2\log_{10}3$ in the form $\log_{10}q$.
   A. $\log_{10}6$
   B. $\log_{10}9$
   C. $\log_{10}19$
   D. $\log_{10}90$

6. If $101_{two} + 12_{y} = 23_{five}$, find the value of y.
   A. 5
   B. 6
   C. 7
   D. 8

7. An amount of ₦550,000.00 was realized when a principal, x was saved at 2 % simple interest for 5 years. Find the value of x.
   A. ₦500,000.00
   B. ₦490,000.00
   C. ₦480,000.00
   D. ₦470,000.00

8. Given that $\frac{\sqrt{3} + \sqrt{5}}{\sqrt{5}} = x + y\sqrt{15}$, find the value of $(x + y)$.
   A. $\frac{1}{5}$
   B. $1\frac{1}{5}$
   C. $1\frac{2}{5}$
   D. $1\frac{3}{5}$

9. If $x = 3$ and $y = -1$, evaluate $2(x^2 - y^3)$.
   A. 16
   B. 20
   C. 22
   D. 24

10. Solve $3x - 2y = 10$ and $x + 3y = -7$.
   A. $x = 4, y = 1$
   B. $x = 1, y = 4$
   C. $x = -1, y = -4$
   D. $x = -4, y = 1$

11. The implication $x \Rightarrow y$ is equivalent to
    A. $\sim y \Rightarrow \sim x$.
    B. $y \Rightarrow \sim x$.
    C. $\sim x \Rightarrow \sim y$.
    D. $y \Rightarrow x$.

12. The first term of a Geometric Progression (G.P) is 3 and the 5th term is 48. Find the common ratio.
    A. 16
    B. 8
    C. 4
    D. 2

13. Solve: $\frac{1}{3}(5 - 3x) < \frac{2}{5}(3 - 7x)$.
    A. $x < \frac{-7}{27}$
    B. $x > \frac{-7}{27}$
    C. $x < \frac{7}{22}$
    D. $x > \frac{7}{22}$

14. Make m the subject of the relation $k = \sqrt{\frac{m-y}{m+1}}$.
    A. $m = \frac{y - k^2}{1 - k^2}$
    B. $m = \frac{y - k^2}{k^2 + 1}$
    C. $m = \frac{y + k^2}{1 - k^2}$
    D. $m = \frac{y + k^2}{k^2 + 1}$

15. Find the quadratic equation whose roots are $\frac{1}{2}$ and $-\frac{1}{3}$.

A. $6x^2 - x - 1 = 0$

B. $3x^2 + x - 1 = 0$

C. $6x^2 + x - 1 = 0$

D. $3x^2 + x + 1 = 0$

16. Given that x is directly proportional to y and inversely proportional to z, $x = 15$ when $y = 10$ and $z = 4$, find the equation connecting x, y and z.

A. $x = \frac{3y}{2z}$

B. $x = \frac{3y}{z}$

C. $x = \frac{12y}{z}$

D. $x = \frac{6y}{z}$

17. Two buses start from the same station at 9.00 am and travel in opposite directions along the same straight road. The first bus travels at a speed of 72 km/h and the second at 48 km/h. At what time will they be 240 km apart?

A. 10.00 a.m.

B. 11.00 a.m.

C. 12.00 noon

D. 1.00 p.m.

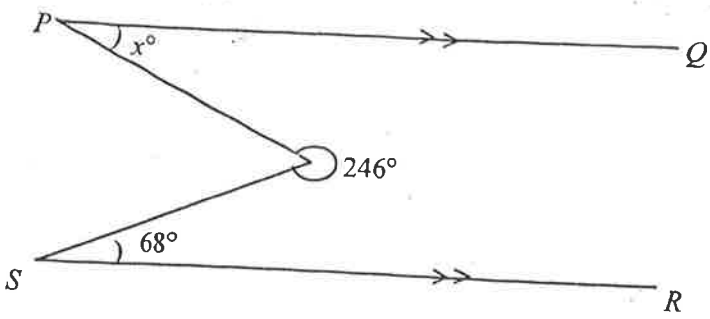
18. A solid cuboid has length 7 cm, width 5 cm and height 4 cm. Calculate its total surface area.

A. 83 cm^2

B. 140 cm^2

C. 166 cm^2

D. 280 cm^2



NOT DRAWN TO SCALE

19. In the diagram, $\overrightarrow{PQ} // \overrightarrow{SR}$. Find the value of x.

A. 68
B. 57
C. 46
D. 34

20. Find the equation of the line parallel to $2y = 3(x-2)$ and passes through the point (2, 3).

A. $y = \frac{-2}{3}x$

B. $y = \frac{3}{2}x$

C. $y = \frac{2}{3}x - 2$

D. $y = \frac{3}{2}x - 3$

21. The expression $\frac{5x+3}{6x(x+1)}$ will be undefined when x equals

A. $\{-3, 0\}$.

B. $\{-3, -1\}$.

C. $\{0, -1\}$.

D. $\{0, 1\}$.

22. A man is five times as old as his son. In four years time, the product of their ages would be 340. If the son's age is y, express the product of their ages in terms of y.

A. $5y^2 + 24y - 324 = 0$

B. $5y^2 - 16y - 330 = 0$

C. $5y^2 + 24y - 308 = 0$

D. $5y^2 - 16y - 380 = 0$

23. Simplify: $\frac{a}{b} - \frac{b}{a} - \frac{c}{b}$.

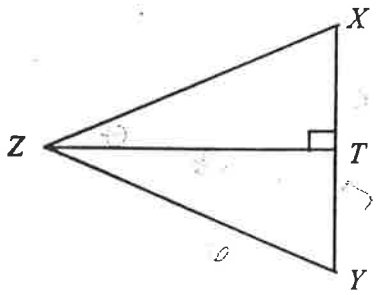
A. $\frac{a^2 - b^2 - ac}{ab}$

B. $\frac{a^2 - b^2 + ac}{ab}$

C. $\frac{ab - bc - ac}{ab}$

D. $\frac{a - b + c}{ab}$

24.



NOT DRAWN TO SCALE

In the diagram, XYZ is an equilateral triangle of side 6 cm and T is the midpoint of $\overline{XY}$. Find $\tan(\angle XZT)$.

A. $\frac{1}{2}$

B. $\sqrt{3}$

C. $\frac{\sqrt{3}}{2}$

D. $\frac{1}{\sqrt{3}}$

25. A fence 2.4 m tall, is 10 m away from a tree of height 16 m. Calculate the angle of elevation of the top of the tree from the top of the fence.

A. 51.32°

B. 52.40°

C. 53.67°

D. 76.11°

26. Fati buys milk at ₦ x per tin and sells each at a profit of ₦y. If she sells 10 tins of milk, how much does she receive from the sales?

A. ₦10 $(x + y)$

B. ₦$(10x + y)$

C. ₦$(x + 10y)$

D. ₦$(xy + 10)$

27. If tan y is positive and sin y is negative, in which quadrant would y lie?

A. Second only

B. Third only

C. First and second only

D. First and third only

28. The dimensions of a rectangular base of a right pyramid are 9 cm by 5 cm. If the volume of the pyramid is 105 cm^3, how high is the pyramid?

A. 7 cm

B. 8 cm

C. 6 cm

D. 10 cm

29. Each interior angle of a regular polygon is 168°. Find the number of sides of the polygon.

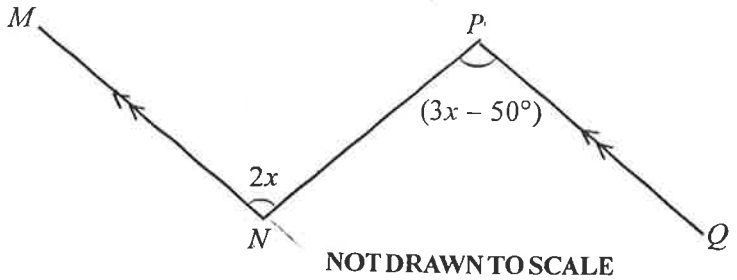
A. 18

B. 24

C. 36

D. 30

30.



NOT DRAWN TO SCALE

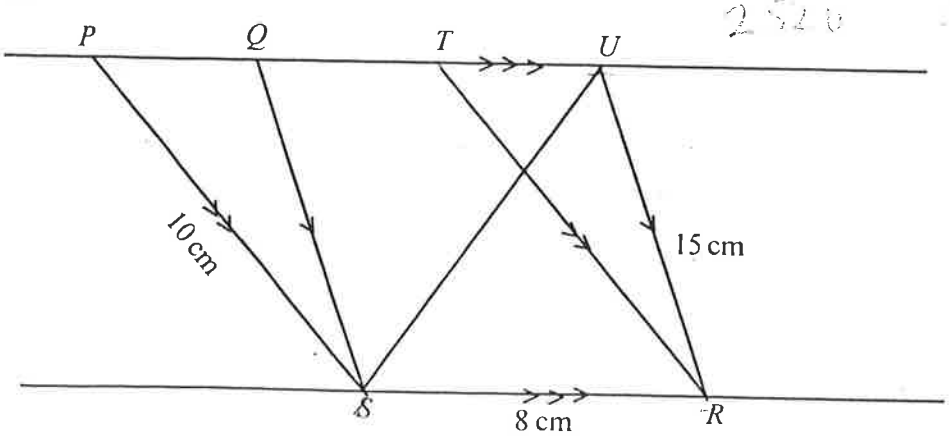
In the diagram, $\overline{MN} // \overline{PQ}$, $\angle MNP = 2x$ and $\angle NPQ = (3x - 50°)$. Find the value of $\angle NPQ$.

A. 100°
B. 120°
C. 150°
D. 200°

31. The length of an arc of a circle of radius 3.5 cm is $1\frac{19}{36}$ cm. Calculate, correct to the **nearest** degree, the angle subtended by the arc at the centre of the circle. [Take $\pi = \frac{22}{7}$]

A. 22°
B. 25°
C. 36°
D. 55°

32.

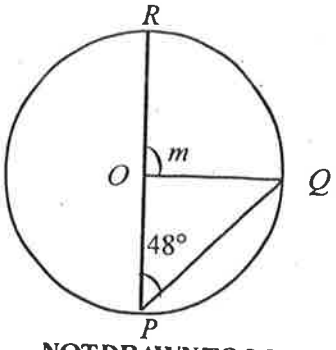


NOT DRAWN TO SCALE

In the diagram, $\overline{PU} // \overline{SR}$, $\overline{PS} // \overline{TR}$, $\overline{QS} // \overline{UR}$, $|\overline{UR}| = 15$ cm, $|\overline{SR}| = 8$ cm, $|\overline{PS}| = 10$ cm and area of $\Delta SUR = 24$ cm^2. Calculate the area of $PTRS$.

A. 120 cm^2
B. 80 cm^2
C. 48 cm^2
D. 40 cm^2

33.



NOT DRAWN TO SCALE

In the diagram PQR is a circle with centre O. If $\angle OPQ = 48°$, find the value of m.

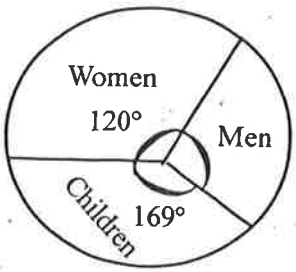
A. 42°

B. 68°

C. 90°

D. 96°

34



NOT DRAWN TO SCALE

The pie chart shows the population of men, women and children in a city. If the population of the city is 1,800,000, how many men are there?

A. 250,000

B. 355,000

C. 600,000

D. 845,000

35. The mean of the numbers 15, 21, 17, 26, 18 and 29 is 21. Calculate the standard deviation.

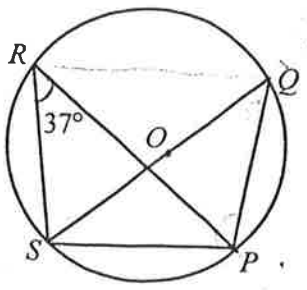
A. 0

B. 5

C. 6

D. 9

36.



NOT DRAWN TO SCALE

In the the diagram, O is the centre of the circle. SOQ is a diameter and $\angle SRP = 37°$. Find $\angle PSQ$?

A. 37°

B. 53°

C. 65°

D. 127°

37. Find the sum of the interior angles of a pentagon.

A. 550°

B. 540°

C. 350°

D. 340°

38. The diameter of a sphere is 12 cm. Calculate, correct to the **nearest** cm^3, the volume of the sphere.
[Take $\pi = \frac{22}{7}$]

A. 906 cm^3

B. 905 cm^3

C. 904 cm^3

D. 903 cm^3

A box contains 12 identical balls, of which 5 are red, 4 blue and the rest are green.
Use this information to answer questions **39** *and* **40**.

39. If a ball is selected at random from the box, what is the probability that it is green?

A. $\frac{1}{4}$

B. $\frac{1}{3}$

C. $\frac{1}{2}$

D. $\frac{3}{4}$

40. If two balls are selected at random one after the other **with replacement**, what is the probability that both are red?

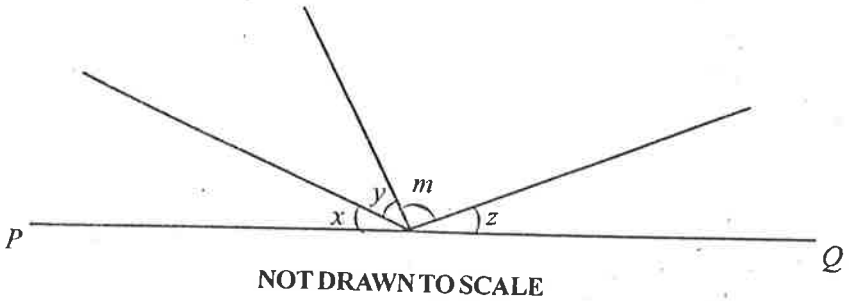
A. $\frac{103}{132}$

B. $\frac{5}{6}$

C. $\frac{5}{33}$

D. $\frac{25}{144}$

41.



NOT DRAWN TO SCALE

In the diagram, PQ is a straight line. If $m = \frac{1}{2}(x + y + z)$, find the value of m.

A. 100°

B. 90°

C. 60°

D. 45°

42.

x	6.20	6.85	7.50
y	3.90	5.20	6.50

The points on a linear graph are as shown in the table. Find the gradient (slope) of the line.

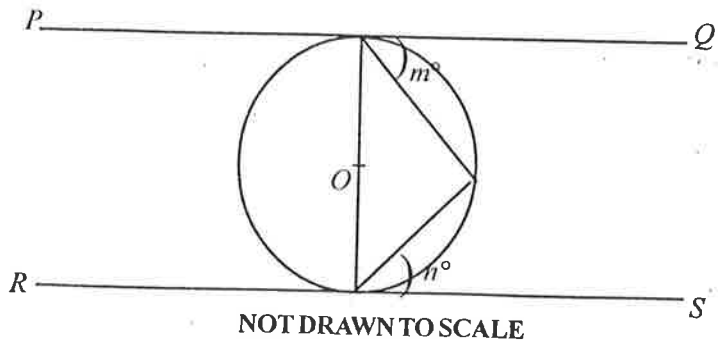
A. $\frac{1}{2}$

B. 1

C. 2

D. $2\frac{1}{2}$

43.



NOT DRAWN TO SCALE

In the diagram, O is the centre of the circle, $\overline{PQ}$ and $\overline{RS}$ are tangents to the circle. Find the value of $(m + n)$.

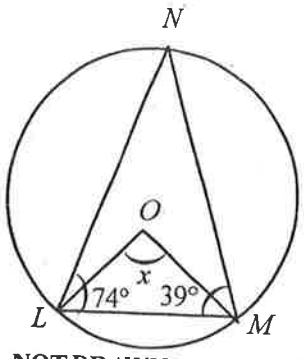
A. 60°

B. 75°

C. 90°

D. 120°

44.



NOT DRAWN TO SCALE

In the diagram, O is the centre of the circle. If $\angle NLM = 74°$, $\angle LMN = 39°$ and $\angle LOM = x$, find the value of x.

A. 106°
B. 113°
C. 126°
D. 134°

45. Which of the following is **not** a sufficient condition for two triangles to be congruent?

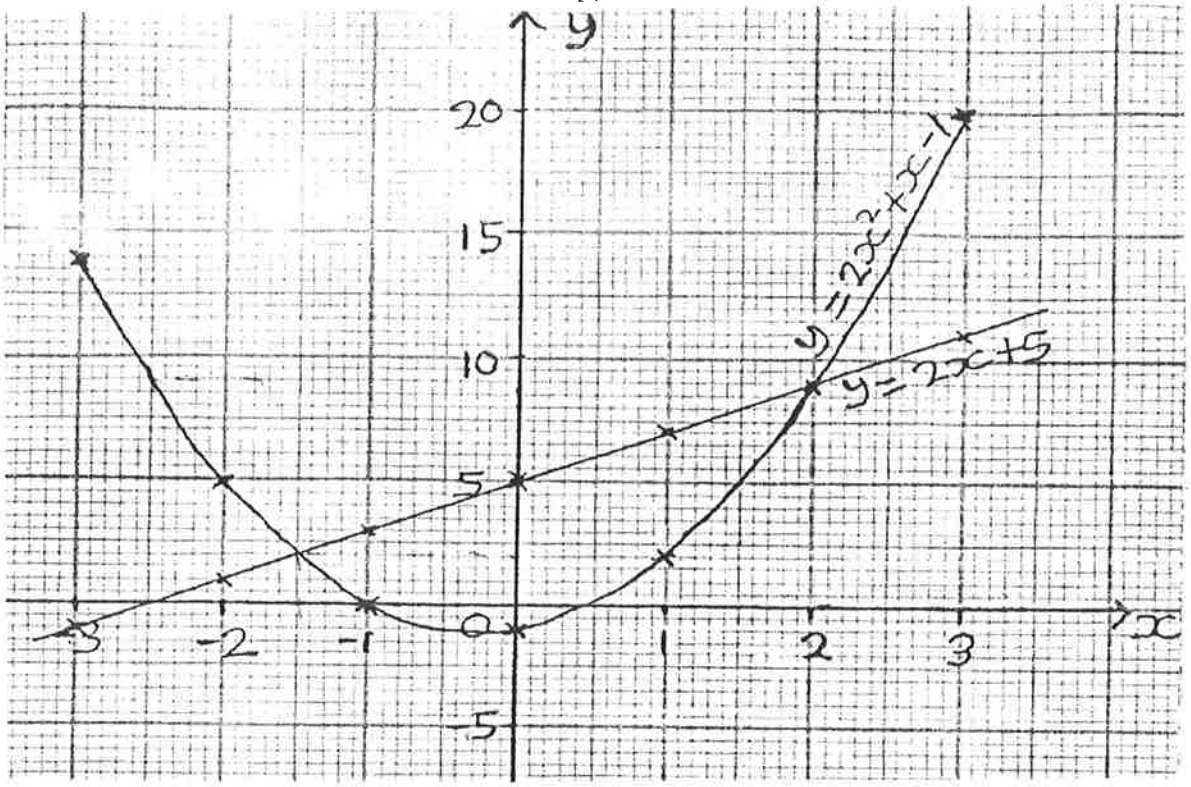
A. *SSA*
B. *SAS*
C. *SSS*
D. *AAS*

46. A woman received a discount of 20 % on a piece of cloth she purchased from a shop. If she paid $ 525.00, what was the oringinal price?

A. $ 616.25
B. $ 656.25
C. $ 660.25
D. $ 675.25

47. The interquartile range of a distribution is 7. If the 25th percentile is 16, find the upper quartile.

A. 9
B. 23
C. 30
D. 35



The graphs of the equations $y = 2x + 5$ and $y = 2x^2 + x - 1$ are shown.
Use the information to answer questions **48** *and* **49**.

48. Find the points of intersection of the two graphs.

A. (2.0, 7.5) and (−1.5, 2.5)
B. (2.0, 8.0) and (−1.5, 2.5)
C. (2.0, 8.5) and (−1.5, 2.0)
D. (2.0, 9.0) and (−1.5, 2.0)

49. If $x = -2.5$, what is the value of y on the curve?

A. $y = 9.5$
B. $y = 9.0$
C. $y = 8.5$
D. $y = 8.0$

50. If $(x + 2)$ is a factor of $x^2 + px - 10$, find the value of p.

A. −7
B. 7
C. −3
D. 3

END OF PAPER

SC4022
WASSCE 2020
MATHEMATICS
(CORE) 2
2½ hours

2

THE WEST AFRICAN EXAMINATIONS COUNCIL

West African Senior School Certificate Examination for School Candidates

SC 2020 — MATHEMATICS (CORE) 2 — 2½ hours

[100 marks]

Write your **name** *and* **index number** *in* **ink** *in the spaces provided above.*

Answer **ten** *questions in all.* **All** *the questions in Section* A *and* **five** *questions from Section* B.

In each question, all necessary details of working, including rough work, **must** *be shown with the answer.*

Give answers as accurately as data and tables allow.

Graph papers are provided for your use in the examination.

The use of non-programmable, silent and cordless calculator is allowed.

SECTION A
[40 marks]

Answer **all** *the questions in this section. All questions carry equal marks.*

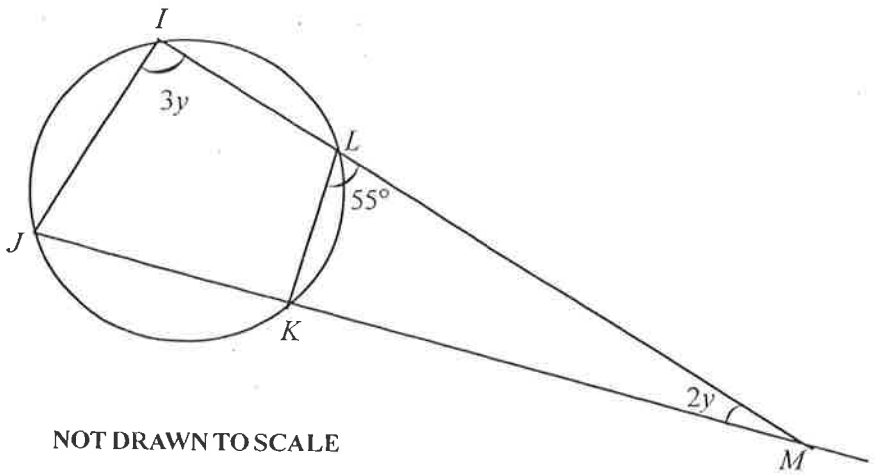
1. (*a*) In a small town, 68 % of the people owned Television, 72 % owned Radio and 12 % owned neither Television nor Radio.
(i) Represent the information on a Venn diagram.
(ii) What percentage of the population owned Television **only**?

(*b*) Boadu and Ansah formed a company and agreed that their annual profit will be shared in the ratio 4 : 5 respectively. If at the end of the year, Ansah received GH¢ 5,000.00 more than Boadu, how much was Boadu's share?

2. (*a*) Make y the subject of the relation: $p = 2x\sqrt{\dfrac{q\left(1+\dfrac{r^2}{y^2}\right)}{S}}$

(*b*) Given that $m = 3$, $n = -2$ and $x = -1$, evaluate $\dfrac{2mn^2x}{3m-n}$.

3. (*a*)



NOT DRAWN TO SCALE

In the diagram $IJKL$ are points on a circle such that $\angle JIL = 3y$ and $\angle KML = 2y$.
If $\angle KLM = 55°$, find the value of y.

(*b*) Given that $\tan x = 1$, $0° \leq x \leq 90°$, evaluate $\dfrac{1-\sin^2 x}{\cos x}$.

4. (*a*) A cone and a pyramid have equal heights and volumes. If the base area of the pyramid is 154 cm^2, find the radius of the cone. [Take $\pi = \frac{22}{7}$]

(*b*) A spherical bowl of radius r cm is a **quarter** full when 6 litres of water is poured into it. Calculate, correct to **three** significant figures, the diameter of the bowl. [Take $\pi = \frac{22}{7}$]

5.

Class	JHS 1	JHS 2	JHS 3
Boys	32	26	26
Girls	28	44	36

The table above shows three classes: JHS 1, JHS 2 and JHS 3 in a school. The three classes were combined to select a prefect. What is the probability that the prefect will be:

(*a*) a boy?

(*b*) a girl in JHS 2?

SECTION B
[60 marks]

Answer **five** *questions* **only** *from this section.* **All** *questions carry* **equal** *marks.*

6. (*a*) Copy and complete the table of values for the relation $y = 7\cos x - 3\sin x$.

x	0°	30°	60°	90°	120°	150°
y	7.0	4.6	0.9	−3.0	−6.1	−7.6

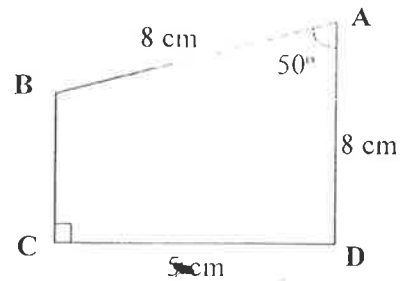
(*b*) Using a scale of 2 cm to 30° on the x-axis and a scale of 2 cm to 2 units on the y-axis, draw the graph of $y = 7\cos x - 3\sin x$ for $0° \leq x \leq 150°$.

(*c*) Use the graph to solve the equations:

(i) $7\cos x = 3\sin x$;

(ii) $7\cos x = 3.2 + 3\sin x$.

7. (*a*)



NOT DRAWN TO SCALE

In the diagram $|\overline{AB}| = |\overline{AD}| = 8$ cm and $|\overline{CD}| = 5$ cm. If $\angle BCD = 90°$ and $\angle BAD = 50°$, calculate, correct to the **nearest** whole number:

(i) $|\overline{BD}|$;

(ii) the area of ΔBCD.

(*b*) A man is five times as old as his son. In three years time, the product of their ages will be 380. Find their present ages.

8. (*a*) A market woman purchased a number of plates for GH¢ 150.00. Four of the plates got broken while transporting them to her shop. By selling the remaining plates at a profit of GH¢ 1.00 on **each**, she made a total profit of GH¢ 6.00. How many plates did she purchase?

(*b*) If $\frac{1}{32}$, m, $\frac{1}{8}$, n, ... are in Geometric Progression (G.P), find the values of m and n.

9. (*a*) Two points X and Y, 7 metres apart are on the same horizontal ground. The angles of elevation of a point P from X and Y are 50° and 70° respectively. Q is a point on XY produced such that $\angle YQP = 90°$.

(i) Illustrate the information in a *diagram*.

(ii) Calculate, correct to **two** decimal places, the length:

(α) $\overline{XP}$;

(β) $\overline{YQ}$.

(*b*) Solve the equation: $\frac{3x}{1-x} + \frac{2x}{x+1} = 2$.

10. The table shows the age distribution of workers in a company.

Age (years)	26-30	31-35	36-40	41-45	46-50	51-55	56-60
Number of Workers	11	24	29	15	10	9	2

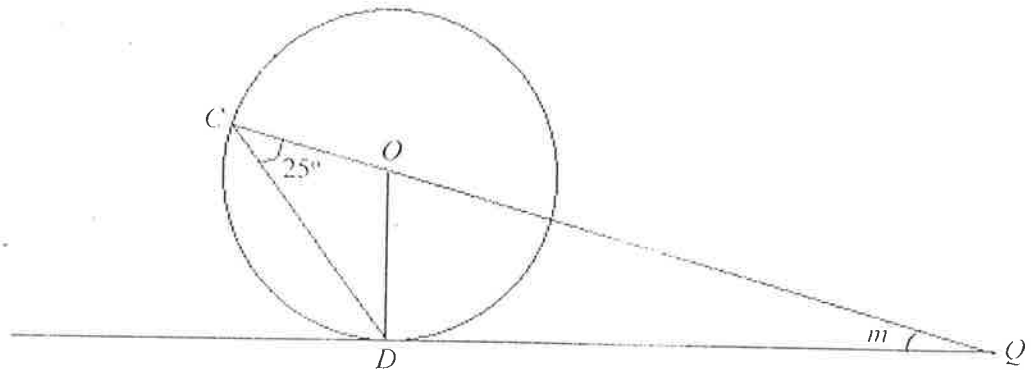
(*a*) Construct a cumulative frequency table and use it to draw a cumulative frequency curve.

(*b*) Use the curve to estimate the:

(i) probability of selecting a worker whose age is **not** more than 45 years;

(ii) number of workers who will retire if the retiring age is 50 years and above.

11. (*a*)



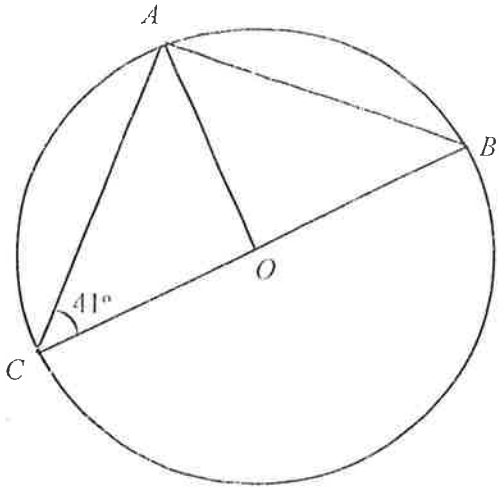
NOT DRAWN TO SCALE

The diagram shows a circle, centre O, with C and D as points on the circumference. $\overline{DQ}$ is a tangent produced at Q. Find the value of m.

(*b*) Find the equation of the line which has the same gradient (slope) as $2y + x = 6$ and passes through the point $(-2, 3)$.

(c) The ratio of the profit, cost of materials and labour in the production of an article is 5 : 7 : 13 respectively. If the cost of materials is Le 840 more than that of labour, find the total cost of producing the article.

12 (a)



NOT DRAWN TO SCALE

In the diagram, O is the centre of the circle ABC and $\angle BCA = 41°$.
Find:

(i) $\angle BOA$;

(ii) $\angle BAO$.

(b) The angle of depression of a point, P, on the ground from the top, T, of a building is 23.6°. If the horizontal distance from P to the base of the building is 50 m, calculate, correct to **three** significant figures, the height of the building.

(c) A cow is tied to a post at the centre of a square grazing field of side 25 m by a rope 10 m long. Find, correct to **two** decimal places the percentage of the field the cow is able to graze on. [Take $\pi = \frac{22}{7}$]

13 (a) Given that $f: x \to x + 3$ and $g: x \to x^2$,

(i) find $g(f(x))$,

(ii) evaluate $g(f(2))$.

(b) Find what values of x is $\frac{1}{x} + \frac{1}{x+2}$ undefined?

(c) Given that $f(x) = \frac{k}{x+1} + \frac{6}{x+2}$ and $f(5) = 8$, find the value of k.

END OF PAPER