RESUME OF THE CHIEF EXAMINERS' REPORTS FOR MATHEMATICS

1. STANDARDS OF THE PAPERS

The Chief Examiners for the Mathematics (Core) 2 and Mathematics (Elective) 2 agreed that the standard of the papers compared favourably with those of previous years.

2. PERFORMANCE OF CANDIDATES

The Chief Examiner for Mathematics (Core) 2 stated that the performance of candidates was average whilst the Chief Examiner for Mathematics (Elective) 2 stated that the performance of the candidates was better than that of the previous years.

3. A SUMMARY OF CANDIDATES' STRENGTHS

(1) The Chief Examiner for Mathematics (Core) 2 listed some of the strengths of candidates as:

- (i) evaluating mathematical expressions involving the application of BODMAS;
- (ii) completing tables of values and drawing graphs of quadratic relation;
- (iii) drawing Venn diagram involving three intersecting sets;
- (iv) carrying out defined operations in Modulo Arithmetic.

(2) The chief Examiner for Mathematics (Elective) 2 listed some strengths of candidates as follows:

- (i) solving quadratic equations;
- (ii) deducing the gradient of a normal to a curve at a given point;
- (iii) integrating a polynomial function;
- (iv) finding the turning point of a curve.

4. A SUMMARY OF CANDIDATES WEAKNESSES

(1) The Chief Examiner for Mathematics (Core) 2 listed the following weaknesses of the candidates:

- (i) writing relevant mathematical equation from given word problems;
- (ii) reading antilogarithm of given numbers from tables;
- (iii) inability to apply circle theorem in finding unknown angles;
- (iv) lack in-depth knowledge in geometry and mensuration;.
- (v) inability to rationalize and simplify surd expressions.

(2) The chief Examiner for Mathematics (Elective) 2 on his part listed the following among others as weaknesses of candidates:

(i) differentiation of a function from first principles;

(ii) finding the equation of a curve from its derived functions;

(iii) inability to use unequal class in drawing histogram;

(iv) inability to solve trigonometric equations involving double angles.

5. SUGGESTED REMEDIES

The Chief Examiners for Mathematics (Core) 2 and Mathematics (Elective) 2 suggested that:

Teachers should pay particular attention to the weaknesses and adopt good and effective methods of teaching mathematical concepts and skills.

MATHEMATICS (CORE)

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of the previous years. The performance of candidates was average.

2. A SUMMARY OF CANDIDATES' STRENGTHS

Candidates strengths were identified in the following areas:

(i) evaluating mathematical expressions involving the application of BODMAS.

(ii) completing tables of values and drawing graph of quadratic relation.

(iii) drawing Venn diagram involving three intersecting sets.

(iv) carrying out defined operations in Modulo Arithmetic.

(v) drawing images of triangles under given transformation.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

Candidates weaknesses were shown in the following areas:

(i) writing relevant equations from given word problems.

(ii) reading antilogarithm of given numbers.

(iii) applying circle theorems in finding angles

(iv) lack of in-depth knowledge in geometry and mensuration.

(v) inability to rationalize and simplify surd expressions.

(vi) inability to use construction to solve practical questions.

4. SUGGESTED REMEDIES

Teachers should take note of the above weaknesses and adopt good and effective teaching methods of mathematical concepts and skills.
Teaching of the mathematical topics should not be skipped but rather be given equal attention in order to equip them in problem solving.

5. DETAILED COMMENTS

Question 1

(a) Simplify: $\left(4\frac{3}{4} - 1\frac{5}{6}\right) \div 1\frac{1}{24} \times \left(1\frac{2}{3} + 2\frac{1}{2}\right)$.

(b) If $\frac{3}{4}$ of a number added to $\frac{5}{6}$ gives the same results as subtracting $\frac{7}{8}$ of the number from $20\frac{1}{3}$, find the number.

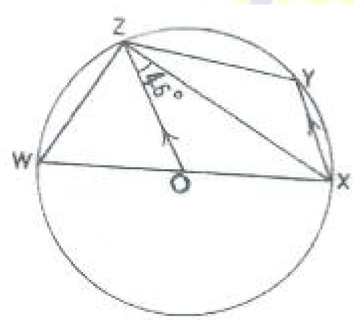
In 1(a) most of the candidates applied the rules of BODMAS to simplify it. They were able to convert the mixed fractions into improper fractions and manipulated them correctly. Even though they made frantic effort to simplify the expression, some messed up with the rules of BODMAS

The part (b) was poorly done since most of the candidates were unable to write down the relevant equation from the word problem.
Candidates still have problems in solving expressions involving fractions, however, few candidates were able to write the relevant equation and solved them correctly.

Question 2

(a) The ratio of the present ages of Kwasi and Yaw is 2:9. Four years ago, the sum of their ages was 47 years. How old is Yaw now?

**(b) In the diagram, *O* is the centre of the circle, *W, X, Y, Z* are points on the circle such that $\overline{WZ}$ is parallel to $\overline{XY}$, $\overline{WX}$ is a diameter and $<OZX$ = 46°.
Calculate $< ZWO$.**



In part (a) most of the candidates could not write algebraic equations from the word problem, let alone solve them correctly. Majority of them used the ratio 2 : 9 as basis for dividing the total age of Kwasi and Yaw, which was unacceptable. Few candidates who understood the question came out with the relevant algebraic equations and solved them correctly.

Majority of the candidates attempted the part (b) since at a glance they were able to identify that $<WZX = 90^o$, but in solving for $\angle$ ZWO they failed to recognized that $\angle$ZWO and $\angle$ WZO are base angles of isosceles triangle $\angle$WZO, hence their inability to solve for $\angle$ ZWO. The performance was not encouraging. However, few candidates who analyzed the diagram critically were able to calculate $\angle$ZWO so correctly.

Question 3

(a) **Evaluate, correct to two decimal places**

$q = \frac{y(x-m)}{m-p}$ **, when $y = 2.5$, m = 15, $x = 10$ and $p = 18$**

(b) ***PQR* is a triangle in which |*PQ*| = |*PR*| and *S* is a point on *PR* such that |*QS*| = |*QR*|. If $\angle PQS = 30^o$, calculate $\angle QPR$.**

The performance of candidates in part (a) was quite impressive since candidates were able to do correct substitution and evaluation. Few of the candidates overlooked the proviso that the answer, should be corrected to two decimal places.

In part (b) most of the candidates could not draw the required diagram that was critical to the calculation of $\angle$QPR. This adversely affected their performance. Few candidates were able to come out with correct sketches which enabled them to calculate the angle correctly.

Question 4

(a) **Without using tables or calculator, simplify** $\frac{\sin 45^o + \tan\ 30^o}{\tan 45^o\ \cos 60^o}$

(b) **A small stone is tied to a point P vertically above it by an inelastic string 102 cm long. If the string is moved such that it is inclined at an angle of 50^o to the vertical, how high does the stone rise? [Correct your answer to two decimal places].**

In part (a) most of the candidates attempted the question and the performance was average.

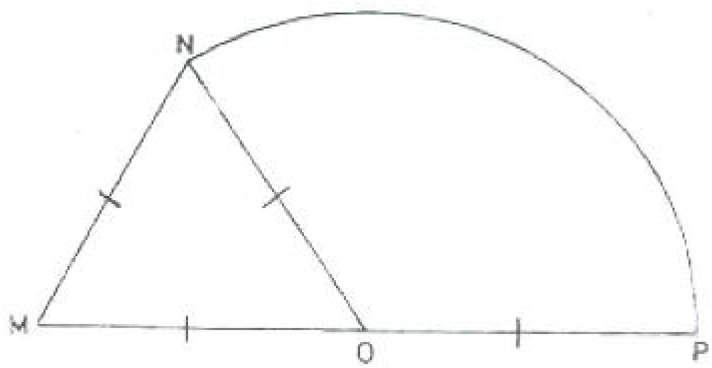
Candidates were able to recall that Sin $45^o = \frac{\sqrt{2}}{2}$, Cos $60^o = \frac{1}{2}$,

tan $45^o \leq 1$ and tan $\frac{\sqrt{3}}{3}$ =, and substituted these values in the given expression. Some candidates however, were unable to handle the surds that were involved in the simplification of the expression.

The (b) part of the question was poorly answered since candidates did not illustrate the problem with a diagram, which was critical to the solution.

<u>**Question 5**</u>

(a) In the diagram, $|MN| = |MO| = |NO| = |OP| =$ 3.5 cm. If *NP* is an arc of a circle centre *O*,
Calculate the perimeter of *MNPOM*.



(b) A box contains 25 balls of which *y* are red.

(i) If a ball is selected at random from the box, what is the probability that it is red?

(ii) When 15 more balls of which 7 are red are added, the probability of selecting a red ball become $\frac{5}{8}$. Find the number of red balls altogether in the box.

Part (a) of the question was fairly handled by most of the candidates and the performance was average. They recognize that $\angle$ NOP = 120^{o}, hence the ability to use the arc length formula to calculate the length of arc NP and added other segments to find the required perimeter of the diagram.

In part (b) most of the candidates failed to tackle the problem systematically. As a result they combined data in (i) and (ii) to determine the probability of selecting a red ball as required in (i). This obviously affected the accurate solution for b (i). In Solving b(ii) candidates failed to write the relevant equation given the
probability of $\frac{5}{8}$ when 15 more balls were added.

<u>**Question 6**</u>

(a) If $\log_{10}$N = 2.7526, find the value of N in standard form.

(b) Given that $425_6 = 320_x$, evaluate $123_x - 34_x$.

(c) A man invested a certain amount of money in two separate projects in the ratio 3 : 2. His profit was calculated on interest rates of 5% and 4% simple interest, respectively. If after two years, he received a sum of GH¢9200.00 as his profit for the two projects, calculate the total amount he invested in the two projects.

In part (a) most of the candidates failed to read the antilog of the given number correctly. It could be inferred that candidates were not conversant with the use of log tables.

The part (b) was well answered and the performance was good. Only few candidates were not able to determine that the required base should be a positive number.

Part (c) was poorly answered by candidates who attempted it. They could not find the interest on each of the projects given the percentage rates and the amounts invested in each project. Perhaps the ratio 2:3 in the question confused them.

Question 7

(a) (i) Solve the inequality: $0.5(2x + 1) \quad 0.3x + 1.9$

(ii) illustrate your answer on the number line.

(b) Copy and complete the table of values for the equation $y = x^2 + 3x$ for $-4 \quad x \quad 4$.

x	-4	-3	-2	-1	0	1	2	3	4
y				-2	0	10		18	

(i) Using scales of 2 cm to 1 unit on the x-axis, and 2cm to 5 units on the y-axis plot the graph of the relation $y = x^2 + 3x$.

(ii) using your graph, find
(α) the minimum value of *y*;
(β) the value of y when $x = 1.5$

In part (a) the inequality problem was well answered by all the candidates who atempted it and the performance was encouraging.

Most of the candidates answered the part (b) and the performance was good. Candidates copied and completed the table for the given relation. However, some failed to indicate the given scale correctly on the *Ox* and *Oy* axes. Again, some of the candidates did not show any evidence of reading from the graph in an attempt to answer the (α) and (β) parts of the question.

Question 8

Town *M* is 20 km from town *N* and 22 km from town *P* while *N* is 18 km from *P*. A market is to be built to serve the three towns. It is to be located such that traders from *N* and *M* will always travel equal distance to access the market while traders from *P* will travel exactly 10 km to reach the market.

(a) Using ruler and a pair of compasses only, find by construction, the possible locations for the market. Use a scale of 1 cm to 2 km.
(b) How many of such locations are there?
(c) Measure and record the distances of the locations from town N.
(d) Which of the locations would be convenient for all the three towns?

Generally, most of the candidates did not attempt this question since they could not apply the combination of knowledge in geometry and construction to the answer the question.

However, few candidates who attempted it exhibited skills in construction and understanding in solving practical problems.

Question 9

(a) A container in the form of a cube of side 24 cm is three-quarters full of water. How many litres of water does it hold?

(b) The perimeter of a circle is 88 cm. A and B are points on the circumference of the circle such that is a chord which subtends an angle of 70° at the centre of the circle. Calculate, correct to three decimal places, the
(i) length of the chord AB,
(ii) area of the minor segment cut off by the chord.
[Take $\pi = \frac{5}{8}$]

Performance in part (a) was good since most of the candidates who attempted it recognized that it was about the volume of a cuboid.

The part (b) was quite challenging and demanding so most of the candidates did not attempt it at all.

Question 10

Table 1

⊕	0	1	2	3	4	5
0	0	1	2	3	4	5
1	1	2	3	4	5	0
2	2	3	4	5	0	1
3	3	4	5	0	1	2

4	**4**	**5**	**0**	**1**	**2**	**3**
5	**5**	**0**	**1**	**2**	**3**	**4**

Table 2

□	**0**	**1**	**2**	**3**	**4**	**5**
0	**0**	**0**	**0**	**0**	**0**	**0**
1	**0**	**1**	**2**	**3**	**4**	**5**
2	**0**	**2**	**4**	**0**	**0**	**1**
3	**0**	**3**	**0**	**3**	**0**	**3**
4	**0**	**4**	**2**	**0**	**4**	**2**
5	**0**	**5**	**4**	**3**	**2**	**1**

Tables 1 and 2 are the addition ⊕ and □ multiplication tables for modulo six respectively.

(i) **Find the value of *a* in Table 2.**

(ii) **If 5 ⊕** (m □ 3) = 2, find the values of *m*.

(b) **Given that x □ y = $2x - y$, where x and y are real numbers, find the value of**

(i) **5 □ (4 □ 5).**

(ii) **y if y □ (3 □ y) = 6**

Generally, almost all the candidates attempted this question and the performance was very encouraging .

In part (a)(i) candidates read off the value of ‘a’ in the given table correctly, and by inspection or trial and error method they were able to find the values of m.

In part (b) candidates evaluated the b(i) correctly under the given operation, but failed in obtaining the correct relation that would enable them solve the given equation.

Question 11

(a) **If tan $x = \frac{15}{8}$, $0^o \leq x \leq$ find the value of cos x.**

(b) **Two vertical poles, 3m and 7m long are on the same straight line with a point *P* on the ground. The shorter pole is 20 m from *P* and is between *P* and the longer pole.**

The angle of elevation of the top *T* of the longer pole from the top *R* of the shorter one is 30^o. Calculate

(i) **$|RT|$;**
(ii) **the horizontal distance from P to the longer pole, correct to three significant figures;**
(iii) **the angle of the elevation of T from P, correct to the nearest degree.**

In part (a) most of the candidates who attempted it were able to sketch and find the value of cos *x* so easily. The performance was quite good.

The part (b) was challenging and demanded very good knowledge in trigonometry since it involved sketching before the question could be answered correctly.

Most of the candidates did not make any attempt to answer it but those who attempted it could not draw any meaningful diagram to help them solve the problem.

__Question 12__

Using a scale of 1cm to 1 unit on each axis, draw two perpendicular axes Oy and Ox for -6 y 6 and -5x 5 on a graph sheet.

(a) **Draw on the same graph sheet, labelling all vertices clearly together with their coordinates**
  (i) **triangle *PQR* with vertices *P*(-3, 3), *Q*(-1, -2) and *R*(3, -1);**
  (ii) **triangle *UVW* with vertices *U*(-2, 6), *V*(0, 1) and *W*(4, 2)**

(b) **Deduce the transformation that maps triangle *PQR* onto triangle *UVW*.**

(c) **Draw, labelling all the vertices together with their coordinates**

  (i) **the image $U_1V_1W_1$ of triangle *UVW* under a rotation of 180^o about the origin where $U \rightarrow U_1$, $V \rightarrow V_1$ and $W \rightarrow W_1$;**
  (ii) **the image $U_2V_2W_2$ of triangle $U_1V_1W_1$ under a reflection in the line $x = 0$, where $U_1 \rightarrow U_2$, $V_1 \rightarrow V_2$ and $W_1 \rightarrow W_2$.**

Generally, majority of the candidates attempted this question and the performance was good. Candidates drew the given triangles and transformed them correctly. Few candidates failed to label the diagrams even though all the specifications were given in the question. Also candidates were unable to deduce the transformation that mapped triangle *PQR* onto the triangle *UVW*.

It appeared candidates were only taught how to draw objects and their images under given transformation without closely observing the relationships between them.

Question 13

Out of 40 customers in a shop, 25 bought plantain, 16 bought yam and 21 bought corn. Each of the customers bought at least one of the three items. Eight bought both plantain and yam, 11 bought plantain and corn and 6 bought yam and corn.

(a) (i) Represent the information on a Venn diagram

(ii) How many customers bought all the three items?

(b) What is the probability that a customer selected at random bought

(i) either plantain only or corn only?

(ii) at least two items.

This was a very popular question, and the performance of most candidates who attempted it was good. Candidates were able to illustrate the given information clearly on the Venn diagram. The sub-questions were answered correctly. On the other hand candidates were confused in finding the probability of at least two items. They thought ‘at least two items’ meant exactly two items, without taking into consideration that ‘at least two items’ meant two or more items.

MATHEMATICS (ELECTIVE)

1. **GENERAL COMMENTS**

The standard of the paper compared favourably with that of the previous years. Candidates' performance was better than that of the previous years.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

Candidates' strengths were evident in the following areas:-

(i) solving quadratic equations.
(ii) deducing the gradient of a normal to a curve at a given point.
(iii) integrating a polynomial function.
(iv) finding the turning point of a curve.
(v) resolution of forces into components.
(vi) correct use of the questions of motion.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

Candidates weaknesses were shown in the following areas:-
(i) differentiation of a function from first principles.
(ii) finding the equation of a curve from its derived function.
(iii) use of unequal class intervals in drawing histogram.
(iv) solving trigonometric equations involving double angles.
(v) curve sketching.
(vi) integrating a rational function.

4. **SUGGESTED REMEDIES**

Both teachers and candidates should take note of the above weaknesses so that with the guidance of teachers, candidates could solve problems involving these weaknesses and be able to overcome them.

5. **DETAILED COMMENTS**

Question 1

A binary operation * is defined on the set R of real numbers by $p * q = p^2 - 2pq$.

(a) Determine whether or not the operation * is communicative.
(b) Find the truth set of $p * 4 = 9$.

In part (a) most of the candidates who attempted it were able to show that the operation was not communicative since $p - 2pq \neq q - 2qp$.

Part (b) was well solved by most of the candidates, however, a few of them omitted the curly bracket sign and got penalized for that.

Question 2

Given that α and β are the roots of $2x^2 + 11x + 9 = 0$, find the values of 8 $(\alpha^2 + \beta^2)$

This was a very popular question and candidates performance was very good. Most of the candidates were able to deduce that $\alpha + \beta = \frac{11}{2}$
and $\alpha\, \beta = \frac{9}{2}$.

Again they were able to quote $\alpha^2 + \beta^2 = (\alpha + \beta)^3 - 3\,\alpha\beta(\alpha + \beta)^3$.
With the correct substitution most of them worked to obtain the correct answer.

Question 3

Find from the first principles, the derivative of $1x^2$ + with respect to x.

Most of the candidates who attempted the question used $\frac{dy}{dx} = \frac{lim}{h\to 0}\left(\frac{(x+h)^2 + \frac{3}{x+h} - \left(x^2 + \frac{3}{x}\right)}{h}\right)$.

A lot of them attempted putting all the numerator over a common denominator resulting in so many terms with the very high chance of making mistakes in their simplification.

Question 4

The gradient of a curve at any point (x, y) is given by $2(x - 3)$.

Find
(a) the equation of the curve if it passes through the point (3, 1).
(b) the equation of the normal to the curve at the point (1, 5).

The question was popular. Candidates performance was quite good. Few candidates, however, did not seem to realize the integral of $2(x - 3)$ at the point (3, 1) was required before the equation of the curve could be obtained. Part (b) was quite easily handled by most of the candidates.

Question 5

(a) A body of mass 3kg is placed on a smooth plane inclined at an angle of 40^0 to the horizontal. Find, correct to one decimal place, the magnitude of the force required to keep the body in equilibrium (Take g = 10 ms^{-2}).

In part (a) most candidates could not calculate the required force, which should be mg Sin
i.e. $3x$ 10Sin 40^o.

In the (b) part, the balls were moving in opposite directions before collision which implied a negative sign for one of the velocities. Many of the candidates made both velocities positive and they were penalized for that.

<u>Question 6</u>

Given that $p = \begin{pmatrix}2\\3\end{pmatrix}$, $q = \begin{pmatrix}4\\2\end{pmatrix}$ and r = $\begin{pmatrix}3\\-2\end{pmatrix}$ find

(a) **$4p - 2q + 5r$.**

(b) **the position vector which divides *p* and *q* in the ratio 2: 3.**

The part (a) part was well done by most of the candidates that attempted it.

In part (b) most of the candidates had difficulty finding the position vector.

<u>Question 7</u>

If $^{n+1}C_{n-1} = 15$, find the value of *n*.

Most of the candidates were able to expand $^{n+1}C_{n-1}$ properly and the resulting quadratic equation, after simplification was easily factorized. This yielded 5 and -6 as the values of *n*, but *n* cannot be negative hence $n = 5$

<u>Question 8</u>

The table below shows the distribution of marks scored by 20 candidates in Mathematics test.

Marks	**0-4**	**5-9**	**10-14**	**15-19**	**20-29**
Frequency	**3**	**4**	**7**	**2**	**4**

Draw a histogram for distribution.

This is a question on unequal intervals and candidates were expected to use frequency densities to draw the histogram. However, most of them failed to do so and rather drew the histogram using the raw frequencies, which was unacceptable.

Question 9

The gradient of a curve which passes through the point (2,0) is given by $3x^2 - 4x - 4$. Find the

(a) equation of a curve

(b) coordinates of the
- **(i) turning points**
- **(ii) minimum point**

Most of the candidates realised in part (a) that the expression for the gradient was to be integrated in order to get the equation of the curve. This they did and were able to obtain the equation of the curve.

Again in (b) most of the candidates realised that the expression for the gradient should be equated to zero and, the x-component of the turning point solved for. The x values were then used to find the coordinates of the turning point.

Most of the candidates were able to find the component of the turning point. However, some of the candidates mistook the expression for $\frac{dy}{dx}$ for y. Therefore in finding the turning point

they differentiated the expression.

Question 10

Two linear transformation P and Q are given by:
$P(x, y)$: $(3x - 2y, x - 5y)$
$Q(x, y)$: $(-2x + y, 3x - y)$

(a) Write down the matrices P and Q
(b) Find the matrix R if $PQ + R = P + Q$
(c) Find the image of the point (3, 4) under the transformation $2P + 3Q$.

In part (a) most of the candidates were able to write down the matrices P and Q, and solved for the matrix R in (b).

In part (c) however, a few of the candidates left their answers as vectors instead of coordinates.

Question 11

(a) One of the polynomial $x^3 - 2x^2 - px + q$ where p and q are constants $(x + 2)$. The remainder when $f(x)$ is divided by $(x - 2)$ is $- 4$. Find the zeros of the polynomial.

(b) **Solve Cos $\boldsymbol{\theta}$ + 50 $\boldsymbol{\theta}$ = 2 for $0^0 < \boldsymbol{\theta} < 360^0$**

Most of the candidates were able to use the remainder and factor theorems appropriately and were able to find the zeros of the polynomial.

In part (b) however, candidates were not able to solve the trigonometric equation. Cos 2 should have been expressed as $2\text{Cos}^2 - \boldsymbol{\theta}$ 1 before using it to solve the equation. A solution is presented below

$\text{Cos}^2\,\theta + 5\text{ Cos }\theta = 2$

$2\text{ Cos}^2\,\theta - 1 + 5\text{ Cos }\theta - 2 = 0$

$2\text{ Cos}^2 - \theta + \text{Cos }\theta - 3 = 0$

Let $y = \text{Cos }\theta$

$2y^2 + 5y - 3 = 0$

$2y(y + 3) - 1(y + 3) = 0$

$(2y - 1)(y + 3) = 0$

$y = \frac{1}{2}$

<u>Question 12</u>

(a) **Evaluate** $\int_1^3 \frac{x^2+x^2+3}{x^2}\,dx$

(b) **(i)** **Sketch he graph of $y = (1 - 3x)x + 2)$.**
(ii) **Calculate the area of the finite region bounded by the curve y and the x-axis.**

Most of the candidates who attempted part (a) of the question recognized that the numerator should be divided through by the denominator before carrying out the integration. And having carried out the simplification, the value for the integral was quite easily obtained.

Few of them, however, integrated the numerator and the denominator separately. This was unacceptable.

In 12(b) candidates were able to find the x and y intercepts properly. They were able to find the turning point after expanding the expression for y and differentiating it with respect to x. Investigating to find whether the turning point was maximum/minimum was also done properly. Some of them failed to mark 0 as one of the x values of the intercepts on the x-axis. Some also failed to write the coordinates of the turning point on the curve. All of these attracted penalties.

In (ii) finding the area of the finite region required was quite well done.

Question 13

Marks	**21 - 30**	**31 - 40**	**41 -50**	**51 - 60**	**61 - 70**	**71 -80**	**81 - 90**	**91 - 100**
Frequency	**2**	**7**	**6**	**7**	**8**	**5**	**3**	**2**

Using assumed mean of 65.5, calculate

(a) **the mean of the distribution;**
(b) **the standard deviation of he distribution.**

This was a very popular question and candidates performance was very good.
Candidates were able to find the mean and standard deviation of the distribution.

Question 14

(a) **A box contains 12 identical balls, three of which are defective. A random sample of 5 balls is drawn from the box one after the other with replacement. Find the probability that**
(i) **exactly one is defective;**
(ii) **at most two are defective.**

(b) **In a school out of every 8 students wear wrist watches. If 5 are selected at random from the school, find, correct to two decimal places, the probability that**
(i) **exactly two of them wear wrist watches;**
(ii) **less than half of them wear wrist watches;**
(iii) **at least three of them wear wrist watches.**

Candidates' performance in this question was very poor.
Most of the few candidates that attempted the question did not recognize the distribution as a binomial. A solution is presented below.

(a) $P(D) = \frac{3}{12} = \frac{1}{4}$

$P(\bar{D})\frac{3}{4}$

(i) $P(x = 1) = {}^5C_1 \left(\frac{1}{4}\right)^1 \left(\frac{3}{4}\right)^4$

$\frac{405}{1025} = 0.3955$

(ii) $P(x \leq 2) = P(x + 2)$

$^5C_0 \left(\frac{1}{4}\right)^0 \left(\frac{3}{4}\right)^5 + \left(\frac{1}{4}\right)^2 \left(\frac{3}{4}\right)^3$

$= 0.2373 + 0.3955 + 0.2637$
$= 0.8965$

(b) (i) $P(G) = \frac{3}{8}$, $P(G) = \frac{5}{8}$

$P(x = 2) = {}^5C_2 \left(\frac{3}{8}\right)^2 \left(\frac{5}{8}\right)^3 = 10 \left(\frac{9}{64}\right)\left(\frac{125}{512}\right)$

$= 0.3433$
$= 0.34$ (to 2 dec. pl.)

(ii) $P(x \leq 2) = \text{P}(x - 2)\ {}^5C_1 \left(\frac{3}{8}\right)^1 \left(\frac{5}{8}\right)^4 + 3433$
$= 0.0954 + 0.2861 + 0.3433 = 07248$
$= 0.72$ (2 dec. pl.)

(iii) P(at least 3) $= 1 – 0.7248 = 0.2752$
$= 0.28$ (to 2 dec. pl.)

Question 15

The probability that a football team wins a match is $\frac{2}{3}$, loses a match $\frac{1}{4}$ is and draw a match is $\frac{1}{12}$.
If the team plays three matches, what is the probability that

(a) it wins all three?
(b) it wins one, loses one and draws one?
(c) it wins the first and third matches only?

The question was an unpopular one. Only few candidates attempted it and their performance was average.

In part (a) most of the few candidates who attempted it were able to answer it correctly. However, in part (b) candidates did not realize that P(win) x P(loses) x P(drew) would occur 3! times.

Question 16

(a) $A(3,4)$, $B(1,1)$ and $C(6,2)$ are three points in the x - y plane

(i) If T and U are the mid points of AB and AC respectively write down
(ii) Use your answer in (i) to show that $TU = \frac{1}{2}BC$

(b) The position vectors of points P and Q are p = i - 77j and q = 4i + kj, respectively, where k is a constant.
If the unit vector $\overline{PQ}$ in the direction is 0.6i + 0.8j, find the values of k.

The part (a) was satisfactorily answered. A few candidates were writing coordinates of points as vector which is unacceptable.

The part (b), which involved a unit vector in the direction of another given vector was poorly done.

Question 17

(a) **Forces $A(Sn, 030^o)$ and $B(10N, 150)$ act on a particle. Find the magnitude and direction of resultant force.**

(b) **A body of mass 6kg hangs from a fixed point by a light inextensible string. A horizontal force is applied to the body such that the body is in equilibrium when the string is inclined at 35^o to the vertical.**

Find, correct to one decimal place

(i) **the horizontal force**

(ii) **the tension in the string [Take g = $10ms^{-2}$).**

Though the question was very popular, candidates performance was below average.
In part (a), the forces were satisfactorily resolved and the resultant calculated, however many of the candidates had problems finding the direction of the resultant vector.

Question 18

(a) **A stone is dropped from the top of the hill 40m high from the ground. Calculate**

(i) **the time it takes the stone to hit the ground.**

(ii) **the velocity with which the stone hits the ground.**
[Take g = $10ms^{-2}$]

(b) **A particle moves with velocity $(p + qt^2)$ ms^{-1}, where t is the time in seconds. Its acceleration after 3 seconds is 12 ms^{-2} and its displacement during the first three seconds is 20m.**

Calculate

(i) **the values of the constant P and Q.**

(ii) **its velocity after 2 seconds.**

Candidates performance in question 18 was very good.
In (a) most of the candidates who attempted it were able to use the correct equation of motion.

Part (b) saw a lot of the candidates differentiating the velocity to obtain the correct expression for the acceleration.