MATHEMATICS

SUBJECT 4008/4028

GENERAL COMMENTS

There was an overall improvement in the marks of candidates. This shows that there was thorough preparation on the part of teachers and the candidates. Very few students got zeros and very low marks. There were also very few high marks I the range 80 to 100. Majority of candidates had marks greater than 30.

Presentation of work still remains a problem with some candidates dividing pages, making it difficult for examiners to mark and allocate marks. Centres should discourage candidates from dividing pages. Straight lines to be drawn using a ruler.

The following parts of the syllabus require special attention from teachers. Performance by candidates in these areas was poor showing that these concepts were not understood well by candidates.

(i) MENSTRUATION

Questions on menstruation of solid shapes, where candidates have to operate in three-dimensions are hardly attempted and for those that attempt, performance is very low. Candidates are unable to calculate accurately, especially for those not using calculators.

(ii) ANGLES

Circle theorems problems are very popular with candidates but can apply the theorems properly and accurately. Some are measuring from diagrams instead of calculating for the diagrams are not to scale. Teaches should give more questions on applications of different theorems in one diagram.

(iii) FUNCTIONAL GRAPHS

Most graphs are not smooth and some use rulers to join the plotted points. Graphs of asymptotic graphs are poorly done especially when graphs are separated by the asymptote. Teachers are encouraged to give candidates more practice in such graphs. Checking of syllabus on functional graphs is necessary such that no concept is left out.

(iv) **VECTORS**

Candidates need to understand the concept well so that only linear expressions are used and that there is no division of vectors. Equating of equal vectors and their corresponding scalars are to be used to form equations. Properties of shapes to be revised thoroughly so that they can be used in vector applications.

(v) **TRANSFORMATIONS**

Plotting and joining of points is done very well by candidates cannot recognize the type of transformations from the diagrams or from matrices given. Transformation descriptions are not complete with some giving the examiner a choice of answers. In this case, candidates do not score anything for the examiner cannot choose from more than one answer.

(vi) **STATISTICS**

Finding the estimated mean from grouped data has been problematic for candidates. Many cannot calculate … centres and other use the boundaries. Accuracy is also a problem especially for those not using calculators.

Use of the cumulative curve to find the median has also been a problem to candidates. Most use ½n instead of ½(nh). There is no evidence of using the graph as shown by lines or marks on the graph. These marks and lines form part of evidence of using their own graphs.

Calculation of probabilities is not being done fully with most candidates failing to realise the reduction in totals and the other alternatives. Answers are left not in their lowest terms. Those that give their answers in decimal form, prematurely approximate leaving answers out of range.

(vii) **SETS**

Most sets are … without brackets and separators for elements. Elements should be separated using a semi-colon. Drawing of Venn diagrams from given sets has been done poorly. Candidates are to be encouraged to identify types of sets and how they are represented by the Venn diagram.

B. QUESTION BY QUESTION ANALYSIS

QUESTION 1

(a) The examiners expected the candidates to remove and supply the brackets accurately. Performance in this question was good but a few failed to remove accurately the last bracket resulting in $15 - 3x - 2x^2 - 6 = q - 3x - 2x^2$. This did not score. Others left in unsimplified form $15 - 3x - 2x^2 - 6x$, scoring only 1 mark.

$15 - 9x - 2x^2$.

(b) (i) Emphasis was on largest volume of y that was negative and Z^2 positive. Not done very well with 0 as the most common answer.

– 72

(ii) Emphasis was on double negative giving a positive number. Four (4) was the most common answer. This was done well by most students.

(c) The examiner was looking for complete factorization and recognition of the difference of two squares. A mark was given for each correct factor. Most candidates left it as $5p\,(25p^{z-1})$, who got only 1 mark.

$5p - (5p - 1)(5pH)$.

Overall performance in the whole question was good with most candidates getting more than 5 marks. No penalty was given for omitted working as all could be done mentally.

QUESTION 2

(a) Candidates were expected to express 252 as a product of prime factors and recognition of what prime factors are. Most included one as a prime factor. Others left it in the working stage without expanding. These did not score. The use of 1 had no penalty, but there is need to emphasise the 1 is not a prime number.

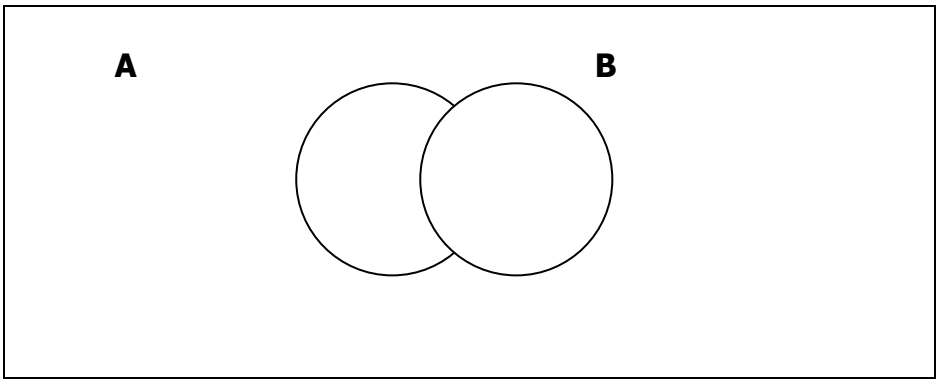
2	252
2	126
3	63
3	21
7	7
	1

2 x 2 x 3 x 3 x 7 or 2^2 x 3^2 x 7

(b) Candidates had to know the formula calculating density and converting kg to g and m^3 *to* cm^3. Most candidates knew the formula but failed due to conversions. Moist common answer was $30g/cm^3$, scoring one mark for the method.

0,3 g/cm3

(c) (i) There was need to recognize that C was a subset of B but not intersecting with A. Common diagrams had the 3 intersecting but with nothing in AnC. This scored full marks. Correct labeling was expecting but some did not label resulting in confusion as to which set is which one. One mark was deducted if it was not clear.



(ii) Candidates expected to find elements and understanding the meaning of C′. Most gave only the complement of C. they did not score anything. Brackets for the set were missing in many sets. There was no penalty for missing brackets.

{ 3 } = AnBnC

(iii) Most candidates included all the elements in $\mathcal{E}$ = {1;2;3;5;7;8;9;}. A mark was deducted from every wrong or missing element. Performance was poor in this question. Separation of elements should be by use of semi-colon and not a gap.

This question was not done well by most candidates. This shows lack of understanding of set theory.

QUESTION 3

(a) (i) The examiner was looking for understanding of properties of an isosceles triangle and its angle properties. This was not done well by most candidates with following wrong responses very common.

(a) $180° - 2x$ (b) $180° - x°$ (c) $180° - 3x°$

These responses got no mark. Some left part (c) not simplified, that is $360° - (180° + 4x°)$ which did not score.

(a) $CBD = 2x°$ (b) $DCE = 3x°$ (c) $BCD = 180° - 4x°$

(ii) Candidate were expected to add all the angles of Δ ADC to add the angles of Δ ADC to get $180°$, after realizing that it is an Isosceles triangle. Most common equation was $3x = 180°$ which did not score.

$x° + 2\ x° + 2\ x° = 180°$

$x = 36°$

(b) (i) Candidates were to make M the subject of the equation. Many used an arbitrary matrix M = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ forming equations.
And solving them to find values of a, b, c and d. Some solved the equations but did not then substitute the values of a, b, c and d to form a matrix. These scored one mark. Some sighs were wrong due to the amount of equations needed to be solved. This part was done well by majority of candidates.

M = $\begin{pmatrix} -2 & 1 \\ -\frac{3}{2} & 0 \end{pmatrix}$

(ii) There was need to multiply the matrix N by N. Examiner was testing matrix multiplication. Some candidates just squared the elements and scored nothing. Done very well by the candidates.

$N^2 = \begin{pmatrix} 10 & -8 \\ 12 & -6 \end{pmatrix}$

This equation was done poorly in (a) but good in part (b). This showed better understanding of matrix concepts but not so good for triangle proportions.

QUESTION 4

(a) Examiner was looking for type of variation and not a description. Spelling problems were evident in many responses. No penalty was given a long as it was clear and not ambiguous.

Partial variation.

(b) The candidates were expected to calculate the interceptions and then express them as coordinates. Many just calculated the interception but did not give them in coordinate form. They scored one mark. Performance was poor with many giving the origin, which scored nothing.

(i) (o;c) (ii) $\left(-\frac{c}{k};o\right)$

(c) Candidates were expected to express V in terms of R, k and c. This part was done very well although some made k the subject, scoring all marks since the concept involved was the same.

V = $\frac{R-C}{K}$

(d) The candidates were expected to form two equations and solve them simultaneously. This was done very well and solving was accurately done. Some used the matrix method while the majority used elimination method.

(ii) c = 5
K = $1\frac{1}{2}$

Question was done very well with most candidate scoring high marks.

QUESTION 5

(a) (i) The examiner expected the candidates to calculate the number of boys and then those suspended. This could be done in one stop but majority did it in two stages. Candidates did very well in this question. However some calculated a $\frac{1}{4}$ of 1050 getting 262,5. No mark was credited for this
150 boys suspended.

(ii) Candidates were expected to calculate the number of girls and express as a fraction of remaining students. Method was emphasized by the examiner such that those who got $\frac{1}{2}$ from $\frac{300}{600}$ did not score. Some gave the answer as a percentage i.e 50%. Examiners had to accept this as an equivalent form. Candidates performed very well.

$\frac{1}{2}$

(iii) Candidates were to calculate the probability accurately with consideration for the two sexes. Most did not subtract one and others did not multiply by two. Candidates performed badly in this part of the question.

$\frac{449}{899}$

(a) The candidates were expected to use various circle theorems to calculate the angles. This was poorly done with most candidates showing little understanding at circle theorems. Many just copied 54^o through out. Follow through marks were given for proper application of theorems.

(i) $R\hat{O}S = 54^o$
(ii) $RPS = 27^o$
(iii) $PQS = 63^o$

Overall performance in this question was good with candidates getting high marks.

QUESTION 6

(a)(i) The examiner expected the candidates to contract accurately the quadrilateral showing all construction acrs. Lous given was to be constructed using bisection of sides and angles. These bisections were to be done showing clearly all the arcs. Some showed that they had no instruments, leaving the question or having free hand lines. Some had different diagram instead of one resulting in each diagram being credited. This was a worse of time on the candidate. The diagrams in general were full size and neat.

(ii) Perpendicular bisector of line joining B and C.
(iii)_ IBisector of angle ADC.

(b)(i) Candidates were expected to mark and label P on the intersection of their loci. Many labelled but did not mark the point. A mark was only given if the position was not ambiguous. Circles were passing through B and C as long as they were an accurate bisector of the BC. Measurement of PC was accurate.

(ii) $5,2\begin{matrix}4\\0\end{matrix}$ cm

This question was done very well with the majority getting full marks. This shows that candidates had a good understanding of constructions. Neat work was presented.

QUESTION 7

(a) Candidates were expected to express the given vectors in terms of a and /or b and only lines expressions could score. The answers were to be simplified. Since the other vectors depended on $\overrightarrow{PQ}$, follow through marks were awarded. This was done very well although some did not simplify their answer.

(i) $\overrightarrow{PR}$ = 2a + 3b

(ii) $\overrightarrow{PM}$ = $-\frac{2}{3}$a + b

(iii) $\overrightarrow{OM}$ = $\frac{4}{3}$ a + b

(b) The examiner expected the candidates to express the vectors in terms of a, b and scalars k and l. They were supposed to use the imposition given to form the expressions for $\overrightarrow{PQ}$. Candidates performed very well. Some did not simplify their work resulting in them not scoring.

(i) (a) $\overrightarrow{PQ}$ = 3hb

(b) $\overrightarrow{OQ}$ = 2a + 3ab

(ii) $\overrightarrow{OQ}$ = $\frac{4}{3}$ka = kb

(c) Candidates were supposed to equate the two vectors for $\overrightarrow{PQ}$, then equate the coefficients forming two equations in k and l, then use them to fend the numerical values of k and h. This was not done well, with some dividing vectors. Those who formed equations could solve them accurately.

2 = $\frac{4}{3}$k and 3h = k

k = $\frac{3}{2}$

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

(d) Candidates were to use their value of k or h to write $\overrightarrow{OQ}$ in terms of a and b. May just substituted and got the answer. Others started from the beginning eventually getting the answer but wasted their time.

$\overrightarrow{OQ}$ = 2a + $\frac{3}{2}$ b

(e) Candidates were expected to recognize that the triangle OPQ and trapezium OPQR were between the same parallel lines OR and PQ hence had to use their areas with the same height, plus the given values of R and K. Many failed to do this and just pucked some fractions at random very few got the correct answer.

$\frac{Area\ of\ \Delta\ OPQ}{Area\ of\ trapezium\ OPQR} = \frac{1}{3}$ (from $\frac{3}{9}$)

1: 3 was accepted.

This was a very popular question and the question was done in parts a, and b but a few got the last parts.

QUESTION 8

Candidates were expected to draw the x and y axes using correct scale and with uniform scale. Cases of reversed axes were encountered and these were not penalized if they were labelled. Wrong scales and non-uniform scales had penalties of one point each.

(a) ABC was drawn well to make letter V but some formed the three sides to form a triangle, also penalty was given for this. This was done very well.

(b)(i) Drawing of A,B,C was done well but the decimal coordinates proved difficult for some who could not follow the scale given.

(ii) The examiner expected a complete description of the transformation. Many took it as a rotation. Some had a reflection but could not get the equation of the line of reflection.

Reflection in line y = 2 x + 2.

(c) Candidates were expected to calculate the coordinates of A,B,C and join the points to form the letter V. Some had the coordinates but never and they plotted. These scored a mark for the coordinates.

A_2 (+1;-1) B_2 ($1\frac{1}{2}$;- x) C_2 ($\frac{1}{2}$; $-2\frac{1}{2}$)

(d) Candidates were to calculate the coordinates of $A_3B_3C_3$, Mot the points and join to form the vactor V. Some calculated the coordinates and never plotted them. They got a mark for the coordinates.

$A_3(-2;-2)$ $B_3(-3;-1)$ $C_3(-1;3)$

Question was done well by those who attempted but nothing of fractional coordinates proved difficult for the majority.

QUESTION 9

Cases of reversed non-uniform and reversed axes were met. For this question reversed axes had a mark deducted even though labelled. Non uniform scale on horizontal axes before 10 was not taken as part of the graph, hence no penalty was given. Most graphs could not fit due to numbering starting from 0.

(a) Correct value was got by many but had the value of 5. Value accepted even on the table.

Q = 10

(b) Done well by many candidates but some used the cumulative frequency table and had $x \leq 19$ which did not score 12 – 14 was accepted for the model class.

Modal class = $12 < x \leq 14$

(c) Scale on the vertical axis proved tricky to some for they could not plot (11;17), (14;31) and (16;37). Graphs were not smooth. Very few candidates earned the graph mark.

(d)(i) Candidates were expected to use their graph to answer the question and there had to be evidence of use as seen by line from 20.5 to curve and down to horizontal axis, and also from 15 on horizontal axis to curve and to vertical axis. Some had this line but never answered the question. They earned the marks for the lines. Many for the median used 20 which is $\frac{1}{2}$n instead of $\frac{1}{2}$ (n+1). Some for part (ii) got 34 or 35 but never subtracted from 40.

(ii) Median = 12.1^5
(iii) Number of students = 5 or 6.

(e) Candidates had to calculate the estimated mean using the class centres. Marks were given for correct class-centres. They had to divide by 40 but others used 140 from the cumulative table. The candidates performed badly with very few getting the accurate mean mark.

Estimated mean mark = 15.625

The question was very popular with candidates and those who attempted got high marks. There is need to help candidates to draw smooth curves and calculate the mean from grouped data.

QUESTION 10

(a) The examiner expected candidates to separate the inequalities, solve them, combine the solutions to form one inequality and then represent it correctly on the number line. Many could separate and solve, the good ones solved them as combined. Some answers could be got after some errors and these did not score e.g.

$\frac{7-3}{2} < \frac{2x <}{2} < > = 2 < x < 7$

When 7 was not added on the other side and 2 not dividing on that side as well. Many could represent their solutions on the number line.
(i) $2 < x \leq 7$ (ii) 2 7

(b)(i) Candidates had to find area of triangle and then equate it to $4m^2$. Many worked from the answer and scored nothing. This part was not done very well. Many never attempted it.

$\frac{1}{2} x (3x - 5) = 4$ had to be seen and
$3x^2 - 5x - 8 = 0$

(ii) The equation could be solved by factorization but many used the quadrative formula. Problems of a short division due were not and marks were only awarded when everything was under the denominator 2a. Marks were not given for answers not to 2 decimal places but $2\frac{2}{3}$ was attempted.

x = -1 or 2,67

(iii) Candidates had to use $2\frac{2}{3}$ or 2.67 to find the distance A from BC but some used -1 getting negative length. This did not score.

A from BC = 3m

Question was attempted by many candidates and they performed very well. A very popular question.

QUESTION 11

(a)(ii) Candidates had to divide the cross-section into shapes they could find the area. Many could not visualize the shape of the cross section hence poor performance by majority of candidates. Calculations were not accurate showing poor multiplication skills.

$125m^2$

(ii) They had to multiply their area by 40m and change the units to kilolitres. Most candidates could not find this conversation.

5 0000kl.

(iii) They had to recognize a right-angled triangle, find the two lengths to then see Pythagoras theorem to find DE. This was not attempted by many.

10.2m

(b)(i) Candidates had to find the total area of the virtual walls. Many could not do it while some used the cuboids formula.

450m

(ii) The Examiner wanted the candidates to find the number of 5 litre tins. Many just divided their area by 5 without first finding the number of litres. No marks were given for this wrong working.

63 tins

(iii) They has to multiply their number of tins by $27 000. There was poor multiplication especially for those few, poor performance was seen.

QUESTION 12

(a) Candidates were expected to substitute and find the value of p. The draw the graph as smooth as they could without joining the two parts of graph. Graphs were not smooth and many joined the two portions of the graph. This showed lack of exposure to such graphs. Very few had good graphs.

(i) $p = -1\frac{1}{2}$

(b) They had to draw a straight line crossing both sections of the graph. Some did not use a ruler while some lines never crossed both of the graphs. They only earned marks of the line was at least 3cm long and crossed the graph at least once.

(c) Candidates had to equate the equation of the curve to that the straight line and simplify or use the $x$values of where the graphs intersected in the form of $(x - p)(x - q) = 0$ Many never attempted this part.

$2x^2 + 7x + 3$ from $2x + 3 = \frac{3}{x+2}$

or

$(x + 3)(x + \frac{1}{2}) = 0$

(d) Candidates had to draw a tangent and then find the gradient of the tangent. There was to be evidence of dividing gradient of line by either a right-angled triangle or two points on the line. Many did not recognised that it was a negative gradient.

Gradient = $-0.3^{5}0$

Attempted by many candidates and scored high marks from plotting of graphs. However graphs were not smooth, and the straight line was drawn without the use of a ruler. Candidates are encouraged to use a ruler for straight lines.