General Mathematics Paper 2, May/June 2009

Question 1

(a) Given that $(\sqrt{3} - 5\sqrt{2})(\sqrt{3} + \sqrt{2}) = a + b\sqrt{6}$, find a and b.

(b) If $\frac{21 - y \times 2y - 1}{2y + 2} = 82 - 3y$, find y.

Observation

The part (a) of this question was well attempted. It involved the expansion of the expression and comparing the coefficients. It did not pose much problems to the candidates. Candidates were able to expand the expression to get $3 - 5\sqrt{6} + \sqrt{6} - 10$ which with a little computation gave a = -7 and b = -4. However many candidates expanded but did not compare the coefficients.

In part (b) of the question, the fundamental laws of indices were required to solve this problem. They were to express the right hand side of the equation in powers of 2 and equate the coefficients of both sides to get y= 1. Most candidates did well in this question but there were a significant number who were not able to apply the laws correctly.

Question 2

(a) If 9 cos x - 7 = 1 and 0° ≤ x ≤ 90°, find x.

(b) Given that x is an integer, find the three greatest values of x which satisfy the inequality 7x < 2x - 13.

Observation

The part (a) of the question was on trigonometry and required the use of tables. Rearranging the equation results in cos x = 0.8889 and from the Mathematical Tables, it showed x = 27.27o.
Most of the candidates scored above average in the question.

In part (b), Candidates were able to solve the expression but were unable to get the three greatest integers required. On solving the inequality, 7x - 2x < -13 gave x < -23/5. The three greatest integers were -3, -4 and -5.

QUESTION 3

The table shows the number of children per family in a community.

No. of children	0	1	2	3	4	5
No. of families	3	5	7	4	3	2

(a) Find the:

(i) Mode;

(ii) third quartile;

(iii) probability that a family has at least 2 children.

(b) If a pie chart were to be drawn for the data, what would be the sectoral angle representing families with one child?

OBSERVATION

The performance of most of the candidates who attempted this question were found to be satisfactory. They were able to determine the mode which was 2. They obtained the number of at least 2 children to be 16. Therefore the probability of at least 2 children = $\frac{16}{24} = \frac{2}{3}$. The number of families with one child = 5 hence the required sectoral angle = $\frac{5}{24}$ x 360° = 75°.

However, a good number of the candidates while calculating the 3rd quartile obtained the position of the third quartile i.e. 3rd quartile = ¾ x 24 = 18th position but failed to obtain the third quartile which was 3.

Question 4

(a)Out of 30 candidates applying for a post, 17 have degrees, 15 diplomas and 4 neither degree nor diploma. How many of them have both?

(b) In triangle PQR, M and N are points on the sides PQ and PR respectively such that MN is parallel to QR. If <PRQ=75o, PN = QN and <PNQ = 125o, determine

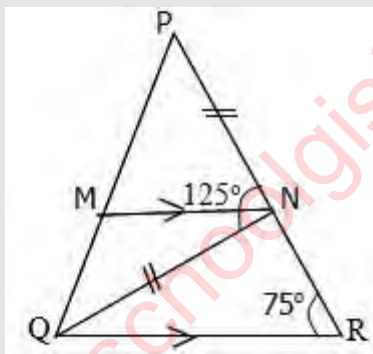
(i) <NQR;

(ii) <NPM>

Observation

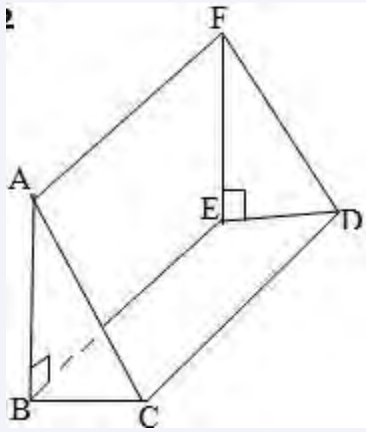
The part (a) of this question was reported to be well attempted and candidates' performance was said to be commendable. They were able to obtain the equation 15 + y -y + 17 -y + 4 = 30 which gave y = 6.

It was also reported that candidates' general performance in part (b) was not as high as it was in part (a). Majority of the candidates could not draw the diagram correctly. Some candidates mistook corresponding angles for alternate angles. They were expected to draw the diagrams as shown



From the diagram, <MNP = <NRQ = 75˚ (corresponding angles as MN is parallel to QR). Therefore <MNQ = 125˚ - 75˚ = 50˚. <NQR = <MNQ = 50˚ (alternate angles, MN//QR). <NPM = (180˚ - 125˚)/2 (base angles of isosceles triangle PNQ) which gives <NPQ = 27.5˚.

Question 5



In the diagram, ABCDEF is a triangular prism. <ABC = <DEF = 90˚, /AB/ = 24cm, /BC/ = 7cm and /CD/ = 40cm.Calculate:

(a) /AC/;

(b)The total surface area of the prism.

Observation

Answering the question required the basic idea of areas of plane/compound shapes. Many candidates could not identify the various faces of the prism hence could not solve the problem. The prism had 3 rectangular faces and 2 triangular faces. Candidates were to find the areas of the respective faces and add them together to get the required surface area = 2408cm2. Some candidates viewed the prism as having only 4 faces and hence could not get the correct answer.

QUESTION 6

(a)If log5 = 0.6990, log7 = 0.8451 and log8 = 0.9031, evaluate:

$\log\left(\frac{35 \times 49}{40 \div 56}\right)$.

(b) For a musical show, x children were present. There were 60 more adults than children. An adult paid D5 and a child D2. If a total of D1280 was collected, calculate the

(i) value of x;

(ii) ratio of the number of children to the number of adults;

(iii) average amount paid per person;

(iv) percentage profit if the organizers spent D720 on the show.

OBSERVATION

Candidates' performance in part (a) of the question was said to be satisfactory. They exhibited a good understanding of the theories of logarithms and were able to apply them correctly. They were able to express the figures in terms of 5, 7 and 8 thus: $\log\left(\frac{35 \times 49}{40 \div 56}\right) = \log\left(\frac{5 \times 7 \times 7 \times 7}{5 \times 8 \div 7 \times 8}\right)$ which on applying the laws of logarithms gives 4log 7 = 4 x 0.8451 = 3.3804.

In the part (b), candidates' performance was reportedly fair. A good number of them were able to get the equation 2x + 5(x + 60) = 1280. Solving it gave x = 140. The ratio was given by $\frac{140}{200}$ = 7:10. Average cost = $\frac{1280}{340}$ = D3.76. The percentage profit = $\frac{(1280 - 720)}{720}$ x 100 = 77.8%.

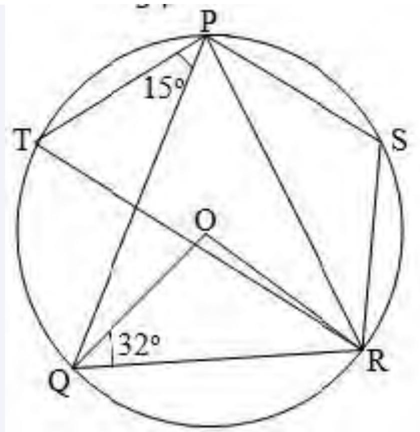
QUESTION 7

(a) A woman looking out from the window of a building at a height of 30m, observed that the angle of depression of the top of a flag pole was 44°. If the foot of the pole is 25m from the foot of the building and on the same horizontal ground, find, correct to the nearest whole number, the

(i) angle of depression of the foot of the pole from the woman;

(ii)height of the flag pole.

(b)



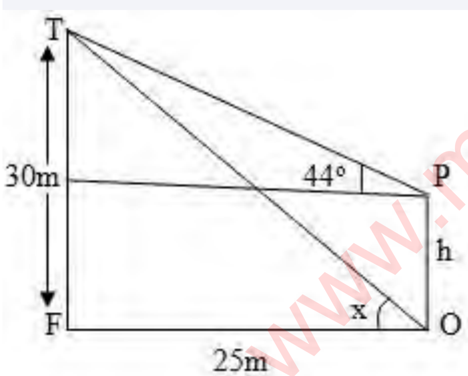
In the diagram, O is the centre of the circle, <OQR = 32° and <TPQ = 15°. Calculate:

(i) <QPR;

(ii) <TQO.

Observation

This question was reported to be quite unpopular among the candidates, and candidates' performance in it was said to be generally poor. Part (a) tested candidates' knowledge of angle of elevation and depression. The main problem with majority of the candidates who attempted the question was on getting the diagram. They therefore scored very low marks. The correct diagram was as shown below:



From the diagram, tan x = $\frac{30}{25}$ = 1.2. Hence x = tan -1(1.2) = 50˚.

Similarly, $\frac{30-h}{25}$ = tan 44˚, therefore, h = 30 - 25tan 44˚ = 6m to the nearest metre.

In part (b), candidates were expected to apply some circle theorems to solve the problem. Many of them could not apply these theorems correctly. For instance <QOR = (180 - 2(32)) = 116˚ (sum of the angles of an isosceles triangle OQR).Hence <QPR = $\frac{116}{2}$ = 58˚ (angle at the centre is twice angle at the circumference) and <TQO = 180 - 32 - <QRP - 15˚ (opposite angles of a cyclic quadrilateralQTPR) = 75˚.

Question 8

The marks scored by 50 students in a Geography examination are as follows:

60	50	40	67	53	73	37	55	62	43
44	69	39	32	45	58	48	67	39	51
46	59	40	52	61	48	23	60	59	47
65	58	74	47	40	59	68	51	50	50
71	51	26	36	38	70	46	40	51	42

(a) Using class intervals 21 - 30, 31 - 40…, prepare a frequency distribution table.

(b) Calculate the mean mark of the distribution.

(c) What percentage of the students scored more than 60%?

Observation

This question was attempted by many candidates and they scored high marks in it. However, some of the candidates could not get the percentage number of candidates who scored more than 60 marks. A few others drew histogram that was not required.

Class I interval	Class mark (x)	Tally	Frequency (f)	Fx
21-30	25.5	11	2	51
31-40	35.5	~~1111~~ ~~1111~~	10	355
41-50	45.5	~~1111~~ ~~1111~~ 11	12	546
51-60	55.5	~~1111~~ ~~1111~~ ~~1111~~	15	832.5
61-70	65.5	~~1111~~ 111	8	524
71-80	75.5	111	3	226.5
			50	**2535**

Mean = $\frac{\Sigma fx}{\Sigma f}$ = $\frac{2538}{50}$ =50.7. The percentage number of students who scored more than 60 marks = 11/50 x 100 = 22%.

QUESTION 9

Simplify $\frac{x + 2}{x - 2} - \frac{x + 3}{x - 1}$

(a)The graph of the equation y = A x2 + B x + C passes through the points (0, 0), (1, 4) and (2, 10). Find the:
(i) value of C;
(ii) values of A and B;
(iii) co-ordinates of the other point where the graph cuts the x-axis.

OBSERVATION

The part (a) of this question attracted majority of the candidates. However, many of them were unable to get the L.C.M. A few others cross multiplied both sides of the minus sign. They were expected to use (x - 2)(x - 1) as L.C.M and obtained

$$\frac{(x+2(x-1) - (x+3)(x-2)}{(x - 2)\ (x - 1)} = \frac{4}{(x - 2)(x - 1)}$$

In part (b), candidates' performance was fair. However, majority of the candidates appeared not to be familiar with coordinate of points on a graph. To find point C, candidates were expected to use x = 0 and y = 0 to get c = 0. Similarly, substituting 1 for x and 4 for y as well as 2 for x and 10 for y gives two equations in A and B i.e. A + B = 4; 4A + 2B = 10. Solving these equations simultaneously gave A = 1, B = 3, which gave the equation as y = x2 + 3x.

To get the 2nd point of intersection with the x - axis, put y = 0, in the equation to get x2 + 3x = 0. Solving this equation gave x = -3, Thus the required point = (-3, 0)

QUESTION 10

(a)Using ruler and a pair of compasses only, construct:
(i) quadrilateral PQRS such that /PQ/ = 10cm, /QR/ = 8cm, /PS/ = 6cm, ÐPQR = 60° and ÐQPS = 75°;
(ii) the locus *l1* of points equidistant from QR and RS;
(iii) locus *l2* of points equidistant from R and S.
(b) Measure /RS/

OBSERVATION

As usual, majority of the candidates did not attempt this question. However, the few who attempted the question performed well. They were able to construct the required angles and line segments.

QUESTION 11

(a) A circle is inscribed in a square. If the sum of the perimeter of the square and the circumference of the circle is 100 cm, calculate the radius of the circle. [Take p = $\frac{22}{7}$]

(b) A rope 60cm long is made to form a rectangle. If the length is 4 times its breadth, calculate, correct to one decimal place, the

(i) length;

(ii) diagonal

of the rectangle.

OBSERVATION

In part (a), majority of the candidates could not translate the question into a meaningful diagram. Others who were able to draw it took the length of the square to be r instead of 2r hence they lost some marks. Perimeter of the square = 8r, circumference of the circle = 2pr. Thus 2pr + 8r = 100 i.e. $\frac{44r}{7}$ + 8r = 100 Þ r = 7cm.

It was reported that majority of the candidates did not attempt the part (b). Some of them who attempted it could not manipulate the algebraic expressions involved. Since the length was said to be four times the breadth, it means that if the breadth = b, then length (L) = 4b. The perimeter was given as 60cm.Therefore, perimeter= 2(L + b) = 2 (4b+b) = 10b = 60. Solving this gave b = 6cm. Hence, length (L) = 6 x 4 = 24cm. Diagonal = √242+62) = 24.7cm.

QUESTION 12

(a)Copy and complete the table of values for y = sin x + 2 cos x, correct to one decimal place.

X	0°	30°	60°	90°	120°	150°	180°	210°	240
Y		2.2				-1.2	-2.0		-1.9

(b) Using a scale of 2 cm to 30° on the x - axis and 2 cm to 0.5 units

on the y-axis, draw the graph of y = sin x + 2cos x for 0° ≤ x ≤ 240°

(c) Use your graph to solve the equation:

(i) sin x + 2cos x = 0;

(ii) sin x = 2.1 - 2cos x.

(d) From the graph, find y when x = 171°.

OBSERVATION

This was another question where candidates' performance was reported to be very poor. Majority of them could not complete the table of values correctly. The few who drew the graph correctly could not read from it. More work should be done by teachers on this area of the syllabus. The expected the table is as shown:

X	0	30	66	90	120	130	180	210	240
Y	2.0	2.2	1.9	1.0	-0.1	-1.2	-2.0	-2.2	-1.9

They were also expected to use the given scale and the table to draw the graph, locate the line y = 2.1 and use it to solve the equation, sin x = 2.1 - 2cos x, to obtain x = 9°, 45°. When x = 171°, y = - 1.75.

QUESTION 13

(a)How many numbers between 75 and 500 are divisible by 7?

(b) The 8th term of an Arithmetic progression (A.P.) is 5 times the third term while the 7th term is 9 greater than the 4th term. Write the first five terms of the A.P.

OBSERVATION

This question posed quite some problems for a good number of candidates who attempted it. In the part (a), some candidates could not recognise the problem, as an A.P. problem. A good number of them counted these numbers out and thereby wasted time. They were expected to recognize the first number divisible by 7 as the first term of the A.P. (i.e. 77) and the last number (497) as the last term and substitute these values in the formula Tn = a+ (n-1)d (where Tn = value of the nth term, a = first term, d = common difference and n = required term) i.e. a = 77, d = 7, Tn = 497 and after a little computation yields n, the required number to be equal to 61.
In part (b) some candidates were able to compare the 3rd term with the 8th term to obtain the equation a + 7d = 5(a + 2d) but could not get the second equation a + 6d = a + 3d + 9. Some others were able to obtain d = 3 by solving the 2nd equation correctly but could not obtain the value of a nor the required 5 terms. From the second equation, bringing the like terms together gave 3d = 9. Hence, d = 3.Similarly, from the first equation, 4a = - 3d. Substituting 3 for d in the equation gave 4a = -3(3) = -9. Therefore, a = - 9/4. The first .five terms of the AP were -9/4, ¾, 15/4, 22/4, 39/4.