General Mathematics Paper 2,May/June. 2007

Question 1

(a). Evaluate, without using mathematical tables or calculator,

(3.69 x 105) / (1.64 x 10-3), leaving your answer in the standard form.

(b). A man invested N20,000 in bank A and N25,000 in bank B at the beginning of a year. Bank A pays simple interest at a rate of y% per annum and B pays 1.5% per annum. If his total interest at the end of the year from the two banks was N4,600, find the value of y.

Observation

Many candidates performed poorly in the (a) part on simple numerical exercise. They evaluated the division using calculators when the rubrics of the question stated otherwise. This cost them some marks.

Majority of the candidates had unsatisfactory presentations in the (b) part. They were expected to use the simple interest relation $\left\{ I = \frac{PRT}{100} \right\}$ to solve the problem.

$$\text{Interest in A} = \frac{20,000 \times y \times 1}{100} = 200y$$

$$\text{Interest in B} = \frac{25,000 \times 1.5y \times 1}{100} = 375y$$

$$\text{Total interest} = 200y + 375y = 4600$$

$$575y = 4600$$

$$y = \frac{4600}{575} = 8.$$

Question 2

(a) Simplify: $\frac{x^2 - 8x + 16}{x^2 - 7x + 12}$.

(b) If ½, 1/x, 1/3 are successive terms of an arithmetic progression (A.P.), show that $\frac{2 - x}{x - 3} = \frac{2}{3}$

OBSERVATION

Majority of the candidates found the question on simplification of quadratic expression very easy and scored full marks.

The question on Arithmetic progression was not well handled by the candidates. They were unable to recall that since ½, 1/x, 1/3 were terms of an A.P., hence 1/x - ½ = 1/3 - 1/x.

Thus $\frac{2 - x}{2x} = \frac{x - 3}{3x}$

which by cross multiplying and simplifying leads to $\frac{2 - x}{3 - x} = 2x/3x$

= 2/3 as required.

QUESTION 3

The diagram shows the cross-section of a railway tunnel. If |AB| = 100m and the radius of the arc is 56m, calculate, correct to the nearest metre, the perimeter of the cross-section.

OBSERVATION

Many candidates were unable to interprete the diagram correctly. While some treated it as a circle, others considered it to be a sector but they were asked to find the perimeter of a segment of a circle. AB is a chord with length 100m. This served as a clue to finding the angle (x) subtended at the centre by the arc AB as shown below. Hence, length of chord AB = 2r Sin x/2 where r = radius of the circle.

Thus, 100m = 2(56) Sin x/2 >> Sin x/2 = 100/112 and x = 126.48˚. The angle which the arc AB subtends at the centre would be 360 - 126.48 = 233.52˚. The perimeter of the shape would also be $\frac{233.52}{360} \times 2 \times \frac{22}{7} \times \frac{56}{1} + 100$ = 328m to the nearest metre.

QUESTION 4

Y is 60 km away from X on a bearing of 135˚. Z is 80 km away from X on a bearing of 225˚. Find the:

(a) distance of Z from Y;
(b) bearing of Z from Y.

OBSERVATION

This question was well attempted by the candidates though many could not draw the diagram correctly. The diagram actually reduced to a right angled triangle with |ZY| as hypothenus. Hence ZY = √ 802 + 602 = 100 km. The angle between XY and ZY = tan-1 (80/60) = 53.12˚. Thus the bearing of Z from Y is given by

315 - 53.12 = 261.88°.

QUESTION 5

Out of the 24 apples in a box, 6 are bad. If three apples are taken
From the box at random, with replacement, find the probability that:

(a) the first two are good and the third is bad;
(b) all the three are bad;
(c) all the three are good.

OBSERVATION

This question was very popular among the candidates and majority scored full marks however a few of them mixed up the concept. They failed to recognize that the apples were drawn with replacement.

QUESTION 7

(a) With the aid of four-figure logarithm tables, evaluate (0.004592).1/3.

(b) If log10y + 3log10x = 2, express y in terms of x.

(c) Solve the equations:
$3x - 2y = 21$
$4x + 5y = 5.$

OBSERVATION

The (a) and (c) parts were very well handled by most candidates but the (b) part was not handled well. They were expected to state thus:

(a) Log (0.004592) from the tables gives 3.6620. Hence from the law of logarithms, log(0.004592)1/3 = 3.6620 ÷ 3 = 1.2207. The antilog from the tables give 0.1663.

(b) Log10y + 3log10x = 2 implies that $\log 10yx^3 = \log_{10}100$.
Hence $yx^3 = 100$. Thus $y = 100/x^3$.

(c) Multiplying 3x - 2y = 21 by 5 and multiplying 4x + 5y = 5 by 2, enables us to eliminate y. Thus by solving x = 5. By substituting for x in any of the equation y = -3.

QUESTION 8

1. A cylinder with radius 3.5 cm has its two ends closed. If the total surface

area is 209 cm², calculate the height of the cylinder.

(Take π $\frac{22}{7}$)

(b) In the diagram, O is the centre of the circle and ABC is a tangent at B. If BDF = 66° and DBC = 57°, calculate

(i) EBF and
(ii) BGF.

OBSERVATION

In the (a) part, they were required to find the height of a closed cylinder given the total surface area. Thus from the formula; total surface area A = 2 πr(r + h) >> h = A/2πr - r =
$\frac{209 \times 7}{2 \times 22 \times 3.5} - 3.5 = 6.0$ cm.

In the (b) part of the question, the candidates were required to determine the size of the given angles using circle theorems. They were expected to show that: < EDB = 90° (< on a semi circle). <EDF = 90 - 66 = 24°. Thus, <EBF = 24° (< in the same segment as <EDF). ÐBFD = 57° (< in alternate segment to <DBC)

$\therefore$ <BGF = 180 - (57 + 24) = 99°. This question was very unpopular among the candidates.

QUESTION 9

(a) Using a ruler and a pair of compasses only, construct:
(i) a triangle PQR such that |PQ| = 10 cm, |QR| = 7 cm and PQR = 90°;
(ii) the locus l1 of points equidistant from Q and R;
(iii) the locus l2 of points equidistant from P and Q.

(b) Locate the point O equidistant from P, Q and R.
(c) With O as centre, draw the circumcircle of the triangle PQR.
(d) Measure the radius of the circumcircle.

OBSERVATION

This question tested the skills of basic construction. Candidates were required to construct a right angled triangle PQR, bisect PQ and QR, use the point of intersection of *l1* and *l2* to circumscribe the triangle.

Many candidates avoided this question. However, the few who attempted it gave a good account of themselves.

QUESTION 10

(a) Simplify $\frac{x^2 - y^2}{3x + 3y}$.

(b) In the diagram, PQRS is a rectangle. |PK| = 15 cm, |SK| = |KR| and PKS = 37°. Calculate, correct to three significant figures:

(i) |PS|;
(ii) |SK| and
(iii) the area of the shaded portion.

OBSERVATION

In the (a) part, candidates were expected to factorize the numerator and the denominator respectively and cancel out the common factors. Thus: $x^2 - y^2 = (x + y)(x - y)$. $3x + 3y = 3(x + y)$.
Therefore, $\frac{x^2 - y^2}{3x+3y} = \frac{x - y}{3}$.

This was well handled by the candidates.

Candidates did not fare so well as their performance was poor. They were supposed to use trigonometrical ratios to get|PS| and|SK| thus,

(i) |PS| = 15 sin 37° = 15 x 0.6018 = 9.027 = 9.03 cm to 3 sf.
(ii) |SK| = 15 cos 37° = 15 x 0.7986 = 11.979 = 12.0 cm to 3 sf.
(iii) Area of shaded portion = Area of PQRS - Area of PKS
= (9.027 X 11.979 X 2) - (1/2 X 11.979 X 9.027) =
216.26887 - 54.067216
= 162.20165 = 162 cm2 to 3 significant figures.

QUESTION 11

a). In the diagram, AOB is a straight line, <AOC = 3(x + Y)°, <COB = 45°, <AOD = (5x + y)° and <DOB = y°. Find the values of x and y.

b). From two points on opposite sides of a pole 33 m high, the angles of elevation of the top of the pole are 53° and 67°. If the two points and the base of the pole are on the same horizontal level, calculate, correct to three significant figures, the distance between the two points.

OBSERVATION

This question on the angles at a point did not pose any problem to majority of the candidates $3(x + y) + 45 = 180^\circ$ >> $3x + 3y = 135 = x + y = 45$ ……….. (i)
$5x + 2y = 180$ … (ii). Putting (i) into (ii) gives
$5x + 2(45 - x) = 180$ >> $3x + 90 = 180$. Hence $x = 30$ and from (i), $y = 15$.

The (b) part was not well handled. Many of the candidates could not draw the correct diagram.

$$XZ = XP + PZ = \frac{33}{\tan 53^\circ} + \frac{33}{\tan 67^\circ} = 38.9 \text{ m to 3 sf.}$$

QUESTION 12

(a). The 3rd and 8th terms of an arithmetic progression (A.P.) are - 9 and 26 respectively. Find the:

(i) common difference;
(ii) first term.

(b). In the diagram, PQ||YZ, |XP| = 2 cm, |PY| = 3 cm, |PQ| = 6 cm and the area of Triangle XPQ = 24 cm². Calculate the area of the trapezium PQZY.

OBSERVATION

This question on Arithmetic Progression was well attempted and candidates performed creditably well.

$a + 2d = -9$ … (i)
$a + 7d = 26$ … (ii)
(ii) - (i) gives $5d = 35$ >> $d = 7$.
From (i), $a + 2(7) = -9$ >> $a = -9 - 14 = -23$.

Candidate’s performance in the (b) part was poor. They were required to find the scale factor and use it to find the missing sides and the area of the trapezium. Many candidates were able to find the scale factor but could not apply it appropriately in finding the area of the trapezium. By the characteristics of similar triangles,

$\frac{\text{Area of triangle XPQ}}{} = \frac{|XP|^2}{}$ i.e $\frac{24}{} = \frac{2^2}{} = \frac{4}{}$

Area of triangle XYZ |XY|² Area of XYZ 52 25

Area of DXYZ = $\frac{24 \times 25}{4}$ = 150 cm^2

Area of PQZY = Area of DXYZ - Area of DXPQ = 150 - 24
= 126cm^2

QUESTION 13

In a College, the number of absentees recorded over a period of 30 days was as shown in the frequency distribution table.

Number of absentees	0-4	5-9	10-14	15-19	20-24
Number of days	1	5	10	9	5

Calculate the:
(a) mean;
(b) standard deviation, correct to two decimal places.

OBSERVATION

This question was on statistics, requiring the calculation of mean and standard deviation. It was well attempted by most candidates who were able to get the mean but failed to get the standard deviation. They were supposed to get the mid-values of the class interval (x), multiply each mid-value by its corresponding class interval frequency (fx), add these products (Σfx) and divide the result by the total frequency (Σf) i.e $\frac{\Sigma fx}{\Sigma f}$. This gives the mean. Σfx = 420, Σf = 30.

Therefore mean (x) = $\frac{420}{30}$ = 14.

To get the standard deviation, for each value of x, calculate its deviation from the mean (x) i.e (x - x), square it (i.e $(x - x)^2$), and multiply by its corresponding class frequency i.e $f(x - x)^2$.
Add all these product values together ($\Sigma f(x - x)^2$ and divide by the total frequency to get the variance i.e

$$\frac{\Sigma f(x - x)^2}{\Sigma f} = \frac{830}{30} = \frac{83}{3}$$

standard deviation = $\sqrt{83/3}$ = 5.26 to 2 decimal places.