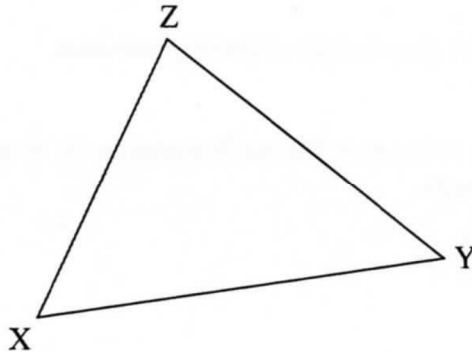


4.1.2 Mathematics Alt. A Paper 2 (121/2)

SECTION I (50 marks)

Answer **all** the questions in this section in the spaces provided.

- 1 The sum of  $n$  terms of the sequence; 3, 9, 15, 21, ... is 7500. Determine the value of  $n$ . (3 marks)
- 2 A quadratic curve passes through the points  $(-2, 0)$  and  $(1, 0)$ . Find the equation of the curve in the form  $y = ax^2 + bx + c$ , where  $a$ ,  $b$  and  $c$  are constants. (2 marks)
- 3 Make  $d$  the subject of the formula,  
$$P = \frac{1}{2}mn^2 - \frac{qd^2}{n}$$
 (3 marks)
- 4 Solve the equation  
$$2 \log x - \log (x - 2) = 2 \log 3.$$
 (3 marks)
- 5 (a) Using a pair of compasses and ruler only, construct an escribed circle to touch side XZ of triangle XYZ drawn below. (3 marks)



- (b) Measure the radius of the circle. (1 mark)
- 6 The equation of a circle is given by  $x^2 + 4x + y^2 - 2y - 4 = 0$ . Determine the centre and radius of the circle. (3 marks)
- 7 (a) Expand  $(1 - x)^5$ . (1 mark)  
(b) Use the expansion in (a) up to the term in  $x^3$  to approximate the value of  $(0.98)^5$ . (2 marks)
- 8 The position vectors of points F, G and H are  $\mathbf{f}$ ,  $\mathbf{g}$  and  $\mathbf{h}$  respectively. Point H divides FG in the ratio 4: -1. Express  $\mathbf{h}$  in terms of  $\mathbf{f}$  and  $\mathbf{g}$ . (2 marks)

- 9 Two machines, M and N produce 60% and 40% respectively of the total number of items manufactured in a factory. It is observed that 5% of the items produced by machine M are defective while 3% of the items produced by machine N are defective. If an item is selected at random from the factory, find the probability that it is defective. (3 marks)
- 10 Two taps A and B can each fill an empty tank in 3 hours and 2 hours respectively. A drainage tap R can empty the full tank in 6 hours. Taps A and R are opened for 5 hours then closed.
- (a) Determine the fraction of the tank that is still empty. (2 marks)
- (b) Find how long it would take to fill the remaining fraction of the tank if all the three taps are opened. (2 marks)
- 11 Simplify the expression  $\frac{\sqrt{48}}{\sqrt{5} + \sqrt{3}}$ , leaving the answer in the form  $a\sqrt{b} + c$  where a, b and c are integers. (3 marks)
- 12 A point P moves inside a sector of a circle, centre O, and chord AB such that  $2\text{ cm} < OP \leq 3\text{ cm}$  and angle APB =  $65^\circ$ . Draw the locus of P. (4 marks)
- 13 The table below shows income tax rates in a certain year.

Monthly income in Kenya shillings	Tax rate in each shilling
Up to 9 680	10%
from 9 681 to 18 800	15%
from 18 801 to 27 920	20%
from 27 921 to 37 040	25%
over 37 040	30%

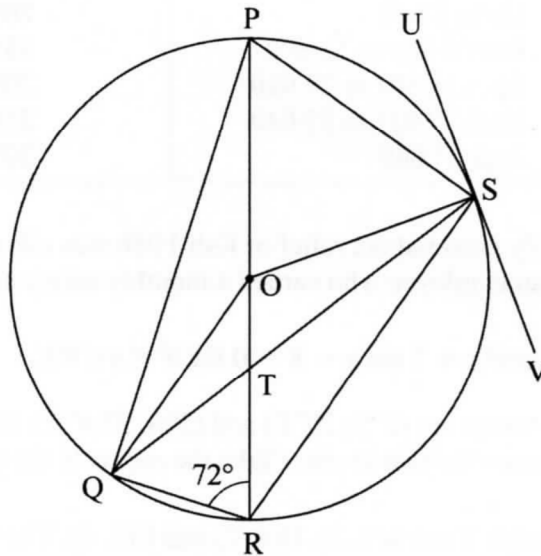
- In that year, a monthly personal tax relief of Ksh 1 056 was allowed. Calculate the monthly income tax paid by an employee who earned a monthly salary of Ksh 32 500. (4 marks)
- 14 Solve the equation  $6 \cos^2 x + 7 \sin x - 8 = 0$  for  $0^\circ \leq x \leq 90^\circ$ . (4 marks)
- 15 The positions of two towns are ( $2^\circ\text{S}, 30^\circ\text{E}$ ) and ( $2^\circ\text{S}, 37.4^\circ\text{E}$ ). Calculate, to the nearest km, the shortest distance between the two towns. (Take the radius of the earth to be 6 370 km) (2 marks)
- 16 The vertices of a triangle T are A(1, 2), B(4, 2) and C(3, 4). The vertices of triangle T', the image of T are  $A'(\frac{1}{2}, 1)$ ,  $B'(2, 1)$  and  $C'(\frac{3}{2}, 2)$ . Determine the transformation matrix  $M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$  that maps T onto T'. (3 marks)

**SECTION II (50 marks)**

*Answer only five questions from this section in the spaces provided.*

- 17** The Hire Purchase (H.P.) price of a public address system was Ksh 276 000. A deposit of Ksh 60 000 was paid followed by 18 equal monthly instalments. The cash price of the public address system was 10% less than the H.P. price.
- (a) Calculate:
- (i) the monthly instalment; (2 marks)
- (ii) the cash price. (2 marks)
- (b) A customer decided to buy the system in cash and was allowed a 5% discount on the cash price. He took a bank loan to buy the system in cash. The bank charged compound interest on the loan at the rate of 20% p.a. The loan was repaid in 2 years. Calculate the amount repaid to the bank by the end of the second year. (3 marks)
- (c) Express as a percentage of the Hire Purchase price, the difference between the amount repaid to the bank and the Hire Purchase price. (3 marks)

- 18** In the figure below, PR is a diameter of the circle centre O. Points P, Q, R and S are on the circumference of the circle. Angle  $\text{PRQ} = 72^\circ$ ,  $\text{QS} = \text{QP}$  and line USV is a tangent to the circle at S.



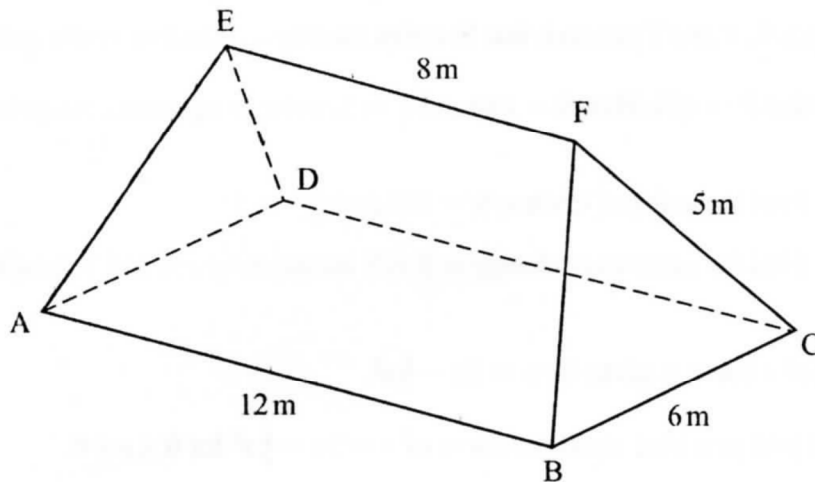
Giving reasons, calculate the size of:

- (a)  $\angle \text{QPR}$ ; (2 marks)
- (b)  $\angle \text{PQS}$ ; (2 marks)
- (c)  $\angle \text{OQS}$ ; (2 marks)
- (d)  $\angle \text{RTS}$ ; (2 marks)
- (e)  $\angle \text{RSV}$ . (2 marks)

- 19 (a) Complete the table below for  $y = x^3 + 4x^2 - 5x - 5$ . (2 marks)

$x$	-5	-4	-3	-2	-1	0	1	2
$y = x^3 + 4x^2 - 5x - 5$			19			-5		

- (b) On the grid provided, draw the graph of  $y = x^3 + 4x^2 - 5x - 5$  for  $-5 \leq x \leq 2$ . (3 marks)
- (c) (i) Use the graph to solve the equation  $x^3 + 4x^2 - 5x - 5 = 0$ . (2 marks)
- (ii) By drawing a suitable straight line on the graph, solve the equation  $x^3 + 4x^2 - 5x - 5 = -4x - 1$ . (3 marks)
- 20 The figure ABCDEF below represents a roof of a house.  $AB = DC = 12\text{ m}$ ,  $BC = AD = 6\text{ m}$ ,  $AE = BF = CF = DE = 5\text{ m}$  and  $EF = 8\text{ m}$ .



- (a) Calculate, correct to 2 decimal places, the perpendicular distance of EF from the plane ABCD. (3 marks)
- (b) Calculate the angle between:
- (i) the planes ADE and ABCD; (2 marks)
- (ii) the line AE and the plane ABCD, correct to 1 decimal place; (2 marks)
- (iii) the planes ABFE and DCFE, correct to 1 decimal place. (3 marks)



- 21 (a) Complete the table below, giving the values correct to 1 decimal place. (2 marks)

$x^\circ$	0	40	80	120	160	200	240
$2 \sin (x + 20)^\circ$	0.7		2.0		0.0		- 2.0
$\sqrt{3} \cos x$	1.7	1.3		- 0.9		- 1.6	

- (b) On the grid provided, using the same scale and axes, draw the graphs of  $y = 2 \sin (x + 20)^\circ$  and  $y = \sqrt{3} \cos x$  for  $0^\circ \leq x \leq 240^\circ$ . (5 marks)
- (c) Use the graphs drawn in (b) above to determine:
- (i) the values of  $x$  for which  $2 \sin (x + 20) = \sqrt{3} \cos x$ ; (2 marks)
- (ii) the difference in the amplitudes of  $y = 2 \sin (x + 20)$  and  $y = \sqrt{3} \cos x$ . (1 mark)
- 22 Three quantities R, S and T are such that R varies directly as S and inversely as the square of T.
- (a) Given that  $R = 480$  when  $S = 150$  and  $T = 5$ , write an equation connecting R, S and T. (4 marks)
- (b) (i) Find the value of R when  $S = 360$  and  $T = 1.5$ . (2 marks)
- (ii) Find the percentage change in R if S increases by 5% and T decreases by 20%. (4 marks)
- 23 The equation of a curve is given by  $y = 5x - \frac{1}{2}x^2$ .
- (a) On the grid provided, draw the curve of  $y = 5x - \frac{1}{2}x^2$  for  $0 \leq x \leq 6$ . (3 marks)
- (b) By integration, find the area bounded by the curve, the line  $x = 6$  and the x-axis. (3 marks)
- (c) (i) On the same grid as in (a), draw the line  $y = 2x$ . (1 mark)
- (ii) Determine the area bounded by the curve and the line  $y = 2x$ . (3 marks)

24 The table below shows marks scored by 42 students in a test.

35	49	69	57	58	75	48
40	46	86	47	81	67	63
56	80	36	62	49	46	26
41	58	68	73	65	59	72
64	70	64	54	74	33	51
73	25	41	61	56	57	28

- (a) Starting with the mark of 25 and using equal class intervals of 10, make a frequency distribution table. (2 marks)
- (b) On the grid provided, draw the ogive for the data. (4 marks)
- (c) Using the graph in (b) above, estimate:
- (i) the median mark; (2 marks)
- (ii) the upper quartile mark. (2 marks)