

4.1.4 Mathematics Alt. B Paper 2 (122/2)

SECTION I (50 Marks)

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

1 Round off each of the numbers in the expression  $169.2 + \frac{92.4 \times 4.9}{14.7}$  correct to one significant figure. Hence find the approximate value of the expression. (3 marks)

2 Make  $n$  the subject of the formula

$$P = \frac{mn}{m^2 - n} \quad (3 \text{ marks})$$

3 The width of a rectangular garden is 3m shorter than its length. The area of the garden is  $108\text{m}^2$ . Find the length of the garden. (3 marks)

4 The marks scored by 36 students in a mathematics test are:

46	45	17	35	30	25	16	23	46	36	35	30
45	15	8	44	25	11	9	30	18	42	32	35
31	25	23	19	20	30	47	35	15	10	30	33

Using equal class intervals and starting with the class 1 - 10:

(a) represent the above data in a frequency distribution table; (2 marks)

(b) State the modal class. (1 mark)

5 Ndegborrowed Ksh 120 000 from a financial institution which charged a simple interest rate per annum. He repaid a total of Ksh 195 600 after  $3\frac{1}{2}$  years. Find the rate of interest charged. (3 marks)

6 Using a ruler and a pair of compasses only:

(a) Construct triangle ABC such that  $AB = 7\text{cm}$ , angle  $CAB = 30^\circ$  and angle  $ABC = 45^\circ$ . (2 marks)

(b) Construct a circle that passes through the vertices of triangle ABC in (a) above. (2 marks)

7 Solve the simultaneous equations

$$2x + y = 5$$

$$11x + 4y = 17$$

(3 marks)

8 Two points A and B are such that  $\mathbf{OA} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$  and  $\mathbf{AB} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ . Point M is the midpoint of  $\mathbf{OB}$ .  
Determine the coordinates of M. (3 marks)

9 Three machines A, B and C can complete some work in 10 hours, 15 hours and 18 hours respectively. If all the machines work together for 4 hours, find the fraction of work done. (2 marks)

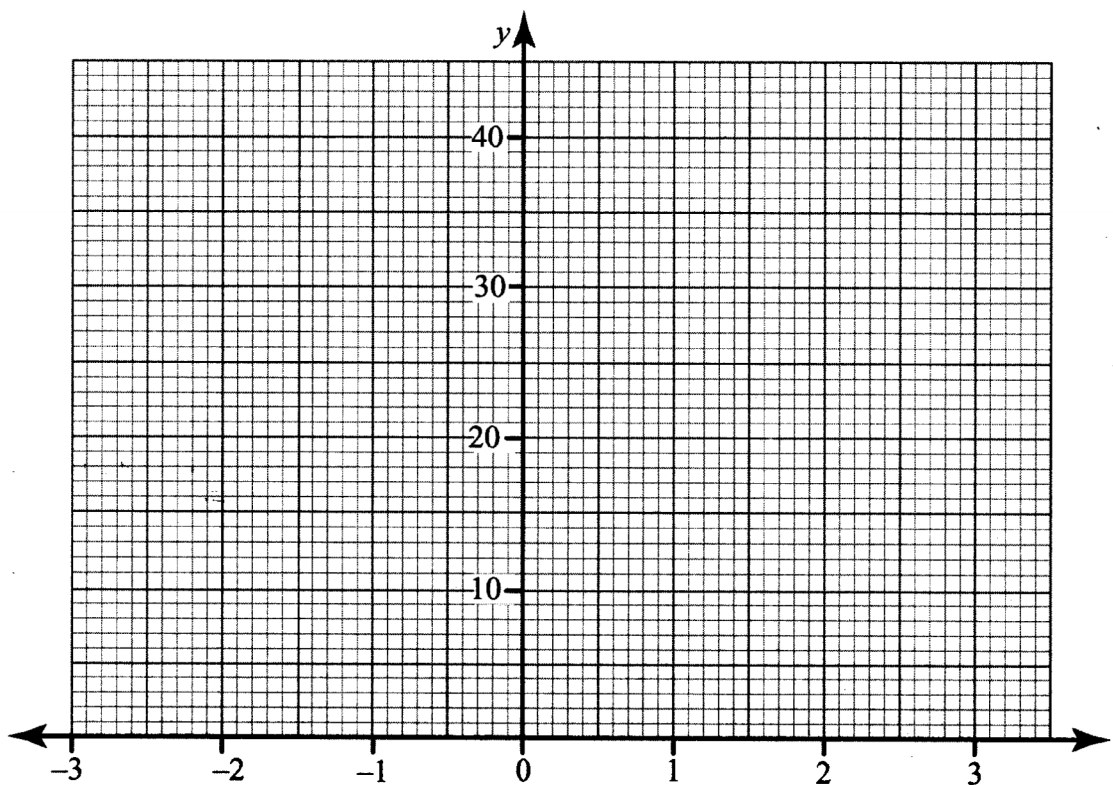
10 A triangle ABC is such that  $AB = 8\text{cm}$ ,  $BC = 6\text{cm}$  and angle  $ABC = 120^\circ$ . Calculate the length of AC correct to 2 decimal places. (3 marks)

11 The equation of a curve is given by  $y = 3x^2 + 8$

(a) Complete the table below for values of y. (1 mark)

x	-3	-2	-1	0	1	2	3
y	35		11			20	

(b) On the grid provided, draw the graph of  $y = 3x^2 + 8$  for  $-3 \leq x \leq 3$  (2 marks)

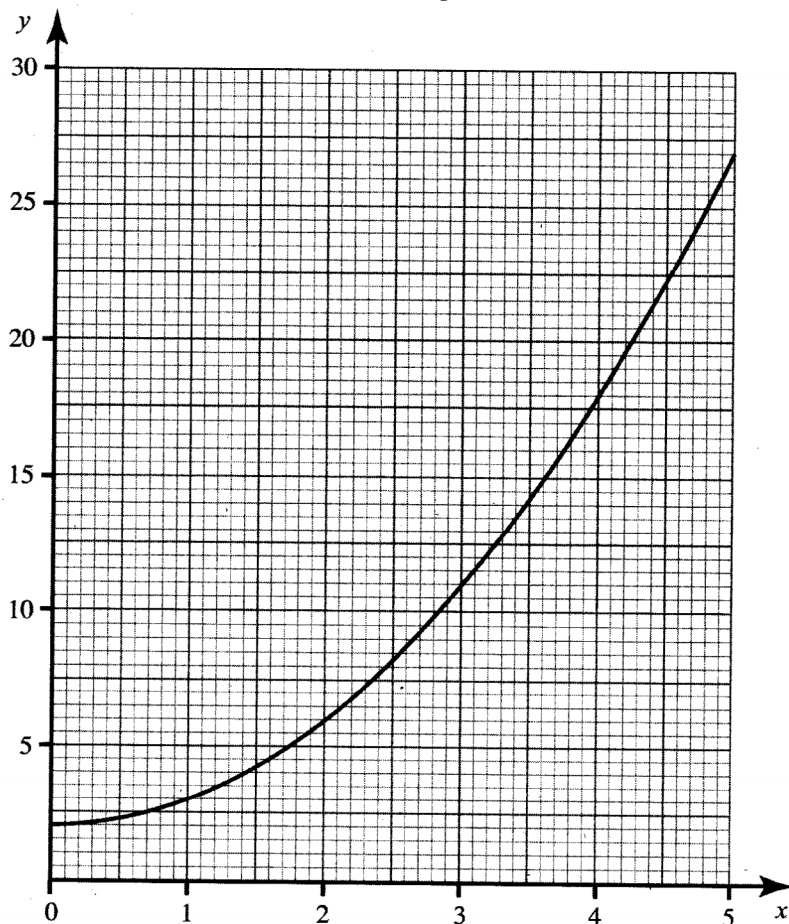


- 12 In a certain year, Income Tax Rates were as shown in the table below:

Monthly Income (Ksh)	Tax Rate in each shilling
Upto 9680	10%
from 9681 to 18 800	15%
from 18 801 to 27 920	20%
from 27 921 to 37 040	25%
from 37 041 and above	30%

In July that year, Fatuma earned a salary of Ksh 16 420. She was allowed a personal relief of Ksh 1056 per month. Calculate Fatuma's net tax for that month. (4 marks)

- 13 An agent was paid a commission of Ksh 50 000 per annum. The commission was increased by 10% annually. Calculate the total amount of money the agent was paid in 3 years. (3 marks)
- 14 A point R is on longitude  $6^\circ$  E while a point S is on longitude  $15^\circ$  W. If the local time at S is 8.30pm, determine the local time at R. (3 marks)
- 15 The vertices of a triangle are P(-3, 1), Q(1, 3) and R(4, -2). The vertices of its image under a transformation are P' (6, -2), Q' (-2, -6) and R' (-8, 4). Determine the transformation matrix that maps PQR onto P'Q'R'. (4 marks)
- 16 The graph below represents a curve of an equation.



Use the trapezium rule with 5 strips of equal width to estimate the area, in  $\text{cm}^2$ , bounded by the curve, the  $x$  - axis,  $x = 0$  and  $x = 5$ . (3 marks)

**SECTION II (50 marks)**

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

**17** A coffee agent has two types of coffee, type X and type Y. Type X costs Ksh 150 per Kg and type Y cost Ksh 240 per Kg.

- (a) The agent mixed type X and type Y in the ratio 7:3 to make a 20Kg mixture.
- (i) Calculate the mass of each type in the mixture. (2 marks)
- (ii) The agent sold the mixture at a profit of 25%. Find the selling price of the mixture. (3 marks)
- (b) The agent later mixed type X and type Y in the ratio a:b. The cost of the mixture was Ksh 186 per Kg.

Determine:

- (i) the ratio a:b; (3 marks)
- (ii) the mass of type X coffee needed to prepare a 500g packet of the mixture. (2 marks)

**18** (a) Given that matrix  $\mathbf{R} = \begin{pmatrix} x & 3 \\ 2x & 3x \end{pmatrix}$  is a singular matrix, find the value of  $x$ . (3 marks)

(b) Matrices  $\mathbf{A}$ ,  $\mathbf{B}$  and  $\mathbf{P}$  are such that  $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$ ,  $\mathbf{B} = \begin{pmatrix} 2 & -1 \\ 0 & 1 \end{pmatrix}$  and  $\mathbf{P} = \mathbf{BA} - 3\mathbf{B}$ .

Determine:

- (i)  $\mathbf{BA}$ ; (1 mark)
- (ii)  $3\mathbf{B}$ ; (1 mark)
- (iii)  $\mathbf{P}$ ; (2 marks)
- (iv) inverse of  $\mathbf{P}$ . (3 marks)

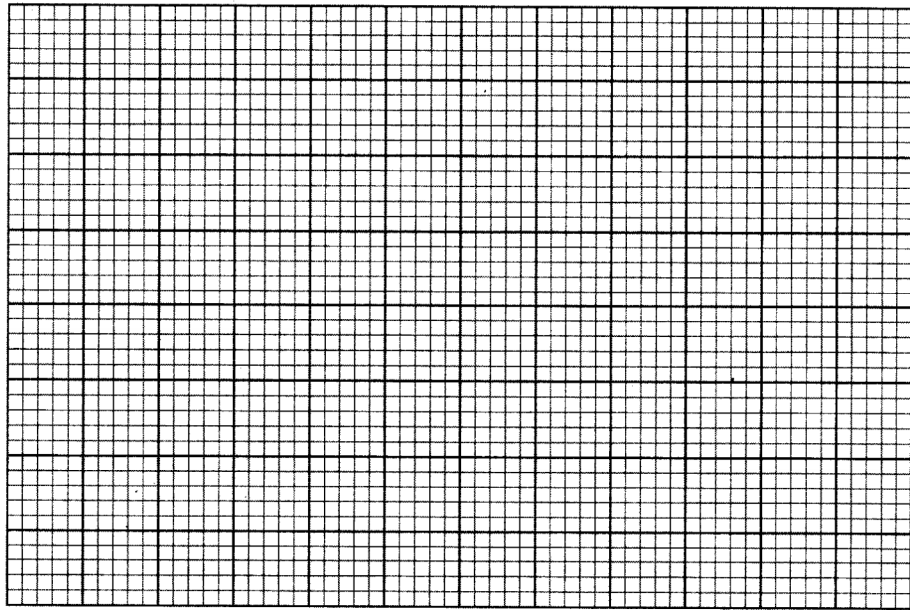
**19** A curve is represented by the equation  $y = \sin x^\circ$ .

(a) Complete the table below for  $y = \sin x^\circ$  giving your answer correct to 2 decimal places. (2 marks)

$x^\circ$	0	30	60	90	120	150	180	210	240	270
$y = \sin x^\circ$	0		0.87	1		0.50	0			

(b) On the grid provided below, draw the graph of  $y = \sin x^\circ$  for  $0^\circ \leq x \leq 270^\circ$

(4 marks)



(c) Use the graph in (b) above to:

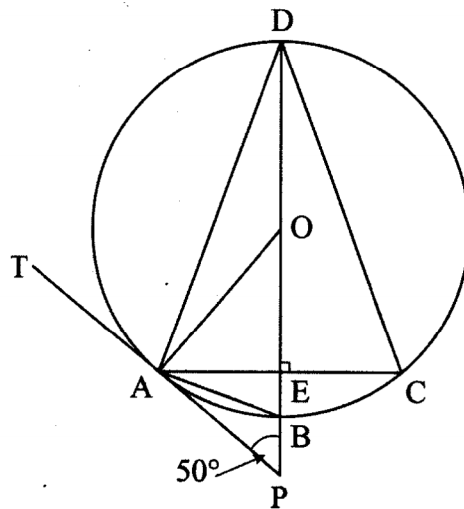
(i) determine the value of  $x^\circ$  when  $y = 0.7$ ;

(2 marks)

(ii) solve the equation,  $5\sin x^\circ = -2$ .

(2 marks)

20 In the figure below, O is the centre of the circle of radius 2.5cm. DOBP is a straight line and is perpendicular to the chord AC at E. Line TP is a tangent to the circle at A and angle  $APD = 50^\circ$ .



(a) Calculate, correct to 2 decimal places, the length of:

- (i) OP;
- (ii) AP;
- (iii) AC.

(2 marks)

(2 marks)

(2 marks)

- (b) Determine the size of:
- (i) angle ADC; (2 marks)
  - (ii) angle ACD. (2 marks)

**21** Mutuku bought a car for Ksh 500 000. The value of the car depreciated at the rate of 10% p.a for 3 years.

- (a) Determine the value of the car at the end of the 3 years. (3 marks)
- (b) Mutuku sold the car at the value calculated in (a) above and used the money to buy a piece of land. The value of the land appreciated at the rate of 15% p.a. for the first year.
- (i) Calculate the value of the land at the end of the first year. (2 marks)
  - (ii) The value of the land then appreciated at the rate of 12% p.a. in the next two years. Calculate the value of the land, to the nearest shilling, at the end of the two years. (2 marks)
- (c) Determine, to 3 significant figures, the percentage gain in Mutuku's land investment at the end of the 3 years. (3 marks)

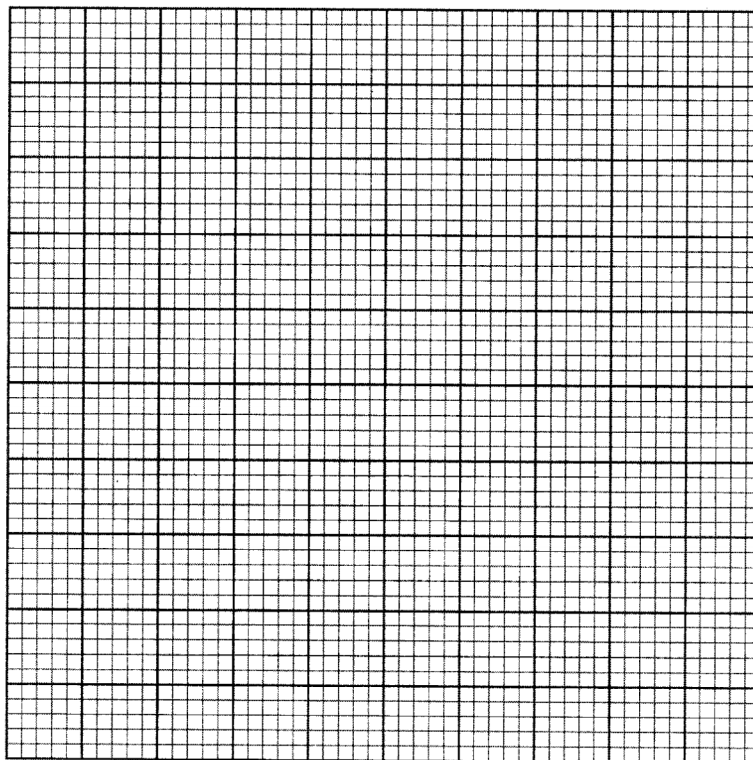
**22** A box contains 3 red balls, 3 blue balls and 2 green balls. All the balls are identical except for the colour. Two balls are picked at random from the box one at a time without replacement.

- (a) Using a tree diagram, show all the possible outcomes. (2 marks)
- (b) Use the tree diagram to calculate the probability that:
- (i) both balls are red; (2 marks)
  - (ii) one ball is red and the other is green; (3 marks)
  - (iii) both balls are of different colours. (3 marks)

- 23 The table below shows masses, to the nearest Kg, of patients who visited a health centre on a certain day.

Mass (Kg)	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79	80 – 89	90 – 99
Frequency ( $f$ )	2	5	25	60	27	12	5

- (a) On the grid provided below draw a cumulative frequency curve for the data. (6 marks)



- (b) Use the graph to estimate:
- (i) the median mass; (2 marks)
  - (ii) the number of patients whose mass was less than or equal to 50.5Kg. (2 marks)

- 24 Three variables  $S$ ,  $T$  and  $R$  are such that  $S$  varies directly as  $T$  and inversely as  $R$ .  
When  $S = 18$ ,  $T = 9$  and  $R = 4$ .

- (a) (i) Determine the constant of proportionality. (3 marks)  
(ii) Express  $S$  in terms of  $T$  and  $R$ . (1 mark)  
(iii) Find the value of  $T$  when  $S = 108$  and  $R = 6$ . (3 marks)
- (b) Determine the percentage change in  $S$  if  $R$  is increased by 20%. (3 marks)