SECTION I (50 marks)

Answer all the questions in this section.

1 Evaluate without using Mathematical tables or a calculator, $\dfrac{0.0084 \times 1.23 \times 3.5}{2.87 \times 0.056}$, expressing the answer as a fraction in its simplest form. (2 marks)

2 The size of an interior angle of a regular polygon is $3x°$ while its exterior angle is $(x - 20)°$. Find the number of sides of the polygon. (3 marks)

3 Expand the expression: $(x^2 - y^2)(x^2 + y^2)(x^4 - y^4)$. (2 marks)

4 A Kenyan businessman bought goods from Japan worth 2 950 000 Japanese Yen. On arrival in Kenya, custom duty of 20% was charged on the value of the goods.
If the exchange rates were as follows:

1 US dollar = 118 Japanese Yen
1 US dollar = 76 Kenya shillings

Calculate the duty paid in Kenya shillings. (3 marks)

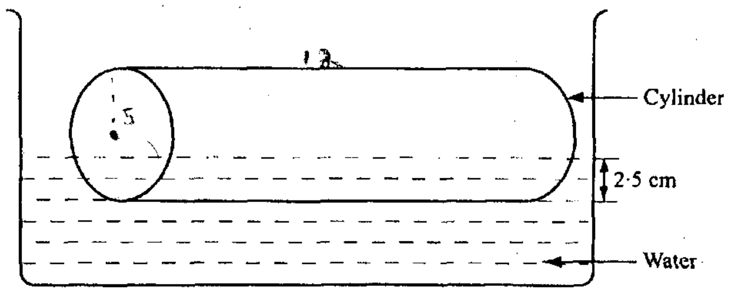
5 The gradient of the tangent to the curve $y = ax^3 + bx$ at the point (1,1) is -5.
Calculate the values of a and b. (4 marks)

6 Simplify the expression: $\dfrac{15a^2b - 10ab^2}{3a^2 - 5ab + 2b^2}$. (3 marks)

7 A square brass plate is 2 mm thick and has a mass of 1.05 kg. The density of the brass is 8.4 g/cm³.
Calculate the length of the plate in centimetres. (3 marks)

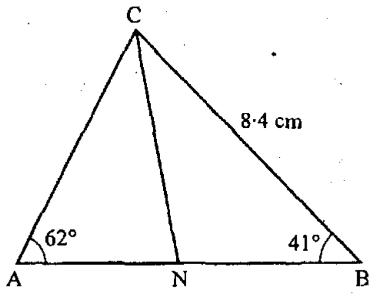
8 Given that x is an acute angle and $\cos x = \dfrac{2\sqrt{5}}{5}$, find without using Mathematical tables or a calculator, $\tan(90 - x)°$. (2 marks)

9 A cylindrical solid of radius 5 cm and length 12 cm floats lengthwise in water to a depth of 2.5 cm as shown in the figure below.



Calculate the area of the curved surface of the solid in contact with water, correct to 4 significant figures. (4 marks)

10 In the figure below $\angle A = 62°$, $\angle B = 41°$, BC = 8.4 cm and CN is the bisector of $\angle ACB$.



Calculate the length of CN to 1 decimal place. (3 marks)

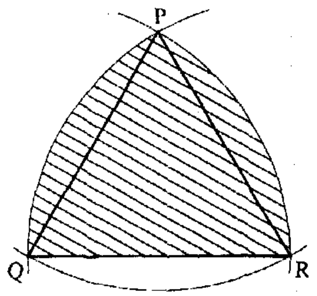
11 In fourteen years time, a mother will be twice as old as her son. Four years ago, the sum of their ages was 30 years. Find how old the mother was, when the son was born. (4 marks)

12. (a) Draw a regular pentagon of side 4 cm. (1 mark)

(b) On the diagram drawn, construct a circle which touches all the sides of the pentagon. (2

13 The sum of two numbers x and y is 40. Write down an expression, in terms of x, for the sum of the squares of the two numbers.
Hence determine the minimum value of $x^2 + y^2$. (4 marks)

14 In the figure below, PQR is an equilateral triangle of side 6 cm. Arcs QR, PR and PQ are arcs of circles with centres at P, Q and R respectively.



Calculate the area of the shaded region to 4 significant figures. (4 marks)

15 Points L and M are equidistant from another point K. The bearing of L from K is 330°. The bearing of M from K is 220°.
Calculate the bearing of M from L. (3 marks)

16 A rally car travelled for 2 hours 40 minutes at an average speed of 120 Km/h. The car consumes an average of 1 litre of fuel for every 4 kilometres.
A litre of the fuel costs Ksh 59.
Calculate the amount of money spent on the fuel. (3 marks)

SECTION II (50 marks)

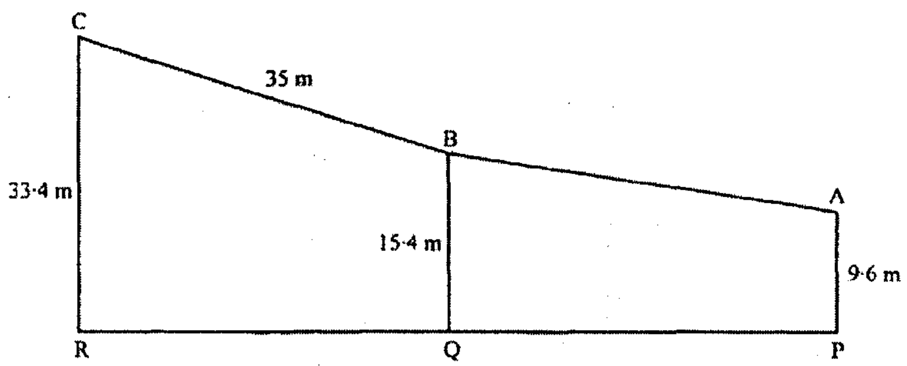
Answer any five questions in this section.

17 Three business partners: Asha, Nangila and Cherop contributed Ksh 60 000, Ksh 85 000 and Ksh 105 000 respectively. They agreed to put 25% of the profit back into business each year. They also agreed to put aside 40% of the remaining profit to cater for taxes and insurance. The rest of the profit would then be shared among the partners in the ratio of their contributions. At the end of the first year, the business realized a gross profit of Ksh 225 000.

(a) Calculate the amount of money Cherop received more than Asha at the end of the first year. (5 marks)

(b) Nangila further invested Ksh 25 000 into the business at the beginning of the second year. Given that the gross profit at the end of the second year increased in the ratio 10 : 9, calculate Nangila's share of the profit at the end of the second year. (5 marks)

18 In the diagram below, PA represents an electricity post of height 9.6 m. QB and RC represent two storey buildings of heights 15.4 m and 33.4 m respectively. The angle of depression of A from B is 5.5° while the angle of elevation of C from B is 30.5° and BC = 35 m.



(a) Calculate, to the nearest metre, the distance AB. (2 marks)

(b) By scale drawing find,

(i) the distance AC in metres. (5 marks)

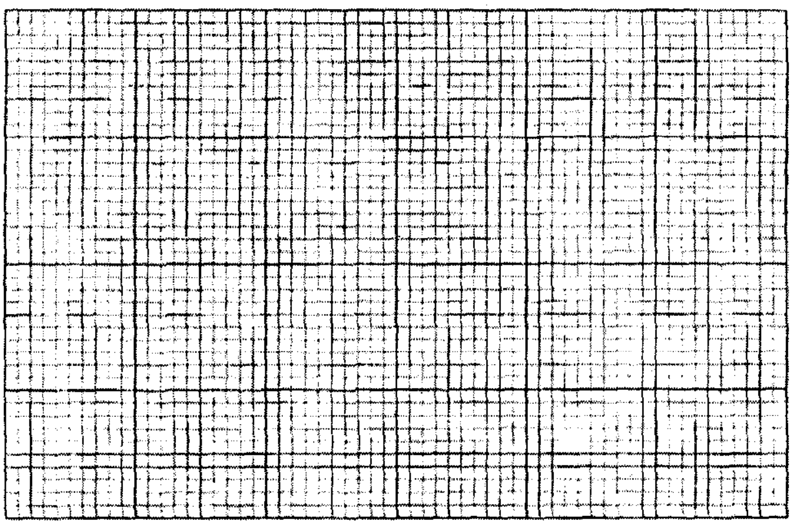
(ii) ∠BCA and hence determine the angle of depression of A from C. (3 marks)

19 A frequency distribution of marks obtained by 120 candidates is to be represented in a histogram. The table below shows the grouped marks, frequencies for all the groups and also the area and height of the rectangle for the group 30–60 marks.

Marks	0–10	10–30	30–60	60–70	70–100
Frequency	12	40	36	8	24
Area of rectangle			180		
Height of rectangle			6		

(a) (i) Complete the table. (4 marks)

(ii) On the grid provided below, draw the histogram. (2 marks)



(b) (i) State the group in which the median mark lies. (1 mark)

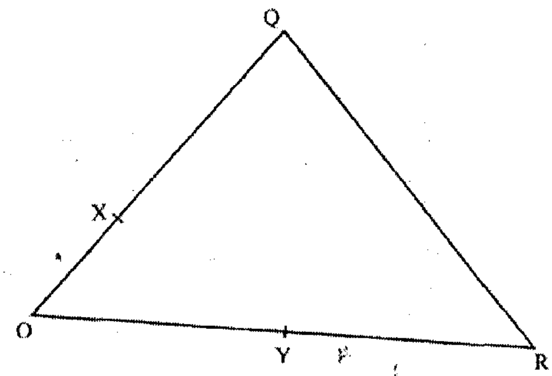
(ii) A vertical line drawn through the median mark divides the total area of the histogram into two equal parts.
Using this information or otherwise, estimate the median mark. (3 marks)

20 A retailer planned to buy some computers from a wholesaler for a total of sh 1 800 000. Before the retailer could buy the computers the price per unit was reduced by sh 4 000. This reduction in price enabled the retailer to buy five more computers using the same amount of money as originally planned.

(a) Determine the number of computers the retailer bought. (6 marks)

(b) Two of the computers purchased got damaged while in store, the rest were sold and the retailer made a 15% profit.
Calculate the profit made by the retailer on each computer sold. (4 marks)

21 In the figure below, **OQ** = **q** and **OR** = **r**. Point X divides OQ in the ratio 1 : 2 and Y divides OR in the ratio 3 : 4. Lines XR and YQ intersect at E.



(a) Express in terms of **q** and **r**:

(i) **XR** (1 mark)

(ii) **YQ**. (1 mark)

(b) If $\mathbf{XE} = m\mathbf{XR}$ and $\mathbf{YE} = n\mathbf{YQ}$, express **OE** in terms of:

(i) **r**, **q** and m (1 mark)

(ii) **r**, **q** and n. (1 mark)

(c) Using the results in (b) above, find the values of m and n. (6 marks)

22 Two cylindrical containers are similar. The larger one has internal cross-section area of 45 cm^2 and can hold 0.945 litres of liquid when full. The smaller container has internal cross-section area of 20 cm^2.

(a) Calculate the capacity of the smaller container. (4 marks)

(b) The larger container is filled with juice to a height of 13 cm. Juice is then drawn from it and emptied into the smaller container until the depths of the juice in both containers are equal.
Calculate the depth of juice in each container. (2 marks)

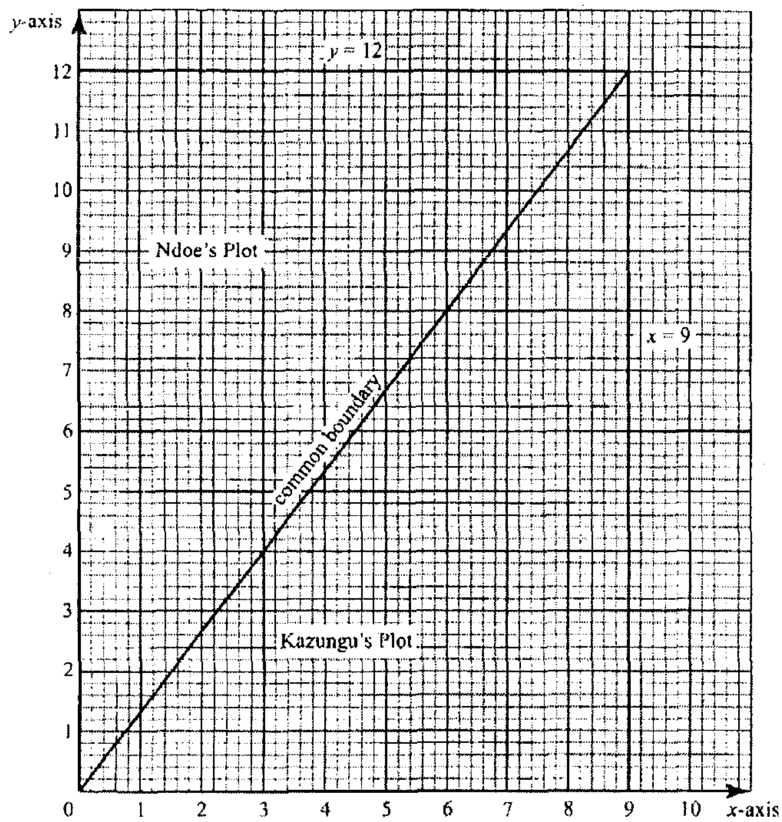
(c) One fifth of the juice in the larger container in part (b) above is further drawn and emptied into the smaller container. Find the difference in the depths of the juice in the two containers. (4 marks)

23 (a) Find the inverse of the matrix $\begin{pmatrix} 9 & 8 \\ 7 & 6 \end{pmatrix}$. (2 marks)

(b) In a certain week a businessman bought 36 bicycles and 32 radios for a total of Ksh 227 280. In the following week, he bought 28 bicycles and 24 radios for a total of Ksh 174 960.
Using matrix method, find the price of each bicycle and each radio that he bought. (4 marks)

(c) In the third week, the price of each bicycle was reduced by 10% while the price of each radio was raised by 10%. The businessman bought as many bicycles and as many radios as he had bought in the first two weeks.
Find by matrix method, the total cost of the bicycles and radios that the businessman bought in the third week. (4 marks)

24 The diagram on the grid below represents an extract of a survey map showing two adjacent plots belonging to Kazungu and Ndoe.



The two dispute the common boundary with each claiming boundary along different smooth curves. Coordinates (x, y_1) and (x, y_2) in the table below, represent points on the boundaries as claimed by Kazungu and Ndoe respectively.

x	0	1	2	3	4	5	6	7	8	9
y_1	0	4	5.7	6.9	8	9	9.8	10.6	11.3	12
y_2	0	0.2	0.6	1.3	2.4	3.7	5.3	7.3	9.5	12

(a) On the grid provided above draw and label the boundaries as claimed by Kazungu and Ndoe. (2 marks)

(b) (i) Use the trapezium rule with 9 strips to estimate the area of the section of the land in dispute. (5 marks)

(ii) Express the area found in b(i) above, in hectares, given that 1 unit on each axis represents 20 metres. (3 marks)