

A

SECTION I (50 MARKS)

Answer all the questions in this section.

(3mks)

1. Simplify the expression

$$\frac{3\sqrt{150}}{5\sqrt{6} - 2\sqrt{24}}$$

$$\frac{3 \times \sqrt{25} \times \sqrt{6}}{5\sqrt{6} - 2 \times \sqrt{4} \times \sqrt{6}}$$

$$\frac{3 \times 5 \times \sqrt{6}}{5\sqrt{6} - 4\sqrt{6}}$$

$$\frac{15\sqrt{6}}{\sqrt{6}}$$

$$\frac{15\sqrt{6}}{\sqrt{6}}$$

$$15$$

2. Nombafu bought 24 trays of eggs at Sh. 225 each. Each tray contains 30 eggs, but 54 eggs broke during transportation. At what price must she sell each egg in order to realize a profit of 22% giving your answer to the nearest to Ksh1.00. (3mks)

$$24 \times 225 = 5400$$

$$30 \times 24 = 720$$

$$- 54$$

$$666$$

$$666 \times x = 5400 \times 1.22$$

$$666x = 6588$$

$$x = \frac{6588}{666}$$

$$x = 9.89$$

$$x = 10$$

3. Factorize completely the expression $75x^2 - 27y^2$

(2 mks)

$$75x^2 - 27y^2$$

$$3(25x^2 - 9y^2)$$

$$3(5x + 3y)(5x - 3y)$$

Turn over

4. The cost of providing a commodity consists of transport, labour and raw materials in the ratio 8:4:12 respectively. If the transport cost increases by 12% labour cost 18% and raw materials by 40%, Find the percentage increase of producing the new commodity (4mks)

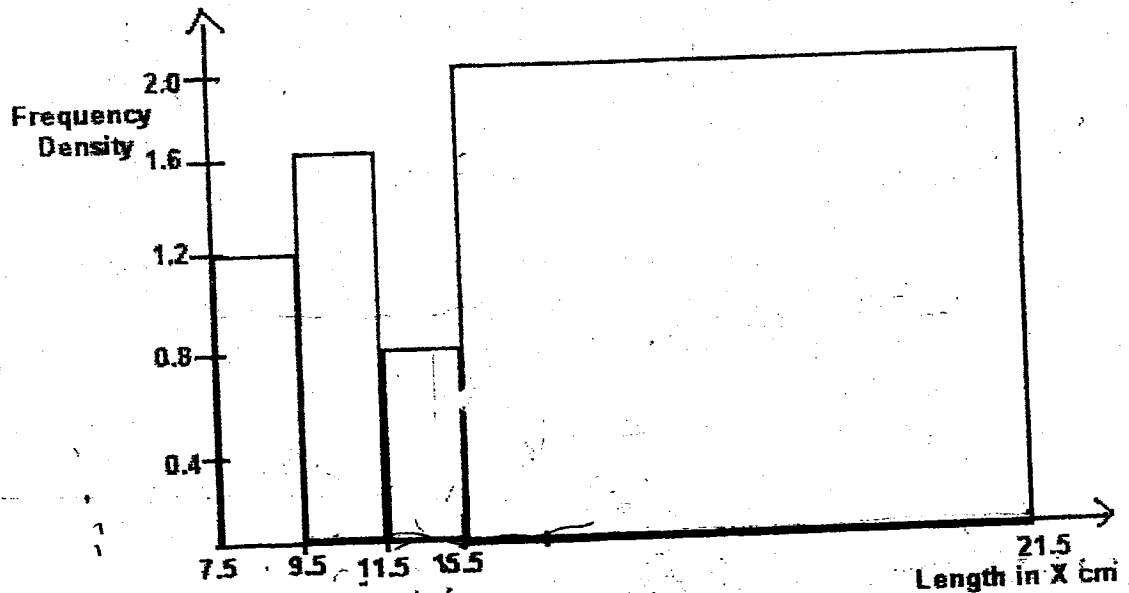
$$T : L : R = 8 : 4 : 12$$

$$T = \frac{8}{24}$$

$$L = \frac{4}{24}$$

$$R = \frac{12}{24}$$

5. The figure below shows a histogram.



Fill in the table below the missing frequencies:

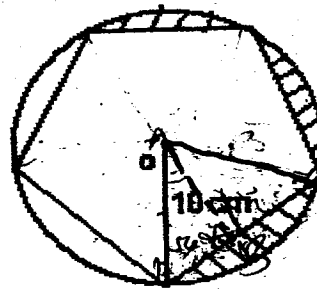
Length 10xcm	Frequency
$7.5 \leq x \leq 9.5$	12
$9.5 \leq x \leq 11.5$	
$11.5 \leq x \leq 15.5$	
$15.5 \leq x \leq 21.5$	

- 20 →
6. Two consecutive positive odd numbers are such that the difference of twice the larger number and thrice the smaller number is 21. Find the product of the numbers. (2mks)

$$\begin{aligned} x, x+2 \\ 2(x+2) - 3x &= 21 \\ 2x+4 - 3x &= 21 \\ -x &= 17 \end{aligned}$$

$$\begin{aligned} 3x - 2x + 4 &= 21 \\ x &= \underline{17} \end{aligned}$$

7. The diagram below, not drawn to scale, is a regular pentagon circumscribed in a circle of radius 10 cm at centre O.



Find.

- a. The side of the pentagon

$$\begin{aligned} \frac{360}{5} &= 72 \\ 180 - 72 &= \frac{108}{2} \\ \underline{54}^\circ \\ \cos a &= \frac{adj}{hyp} \end{aligned}$$

$$\cos 54 = \frac{x}{10}$$

(2mks)

$$x = 10 \cos 54$$

$$x = 10 \times 0.588$$

$$x = 5.88 \times 2 = \underline{11.76 \text{ cm}}$$

- b. The area of the shaded region

(3mks)

$$\begin{aligned} \frac{72}{360} \times \frac{1}{2} \times 10 \times 10 \\ = \underline{62.84 \text{ cm}^2} \end{aligned}$$

$$\begin{aligned} 62.84 \text{ cm}^2 \\ - 47.55 \text{ cm}^2 \\ \hline \underline{15.29 \text{ cm}^2} \end{aligned}$$

$$\begin{aligned} \frac{1}{2} \times 10 \times 10 \sin 72 \\ 50 \times 0.9511 \\ = \underline{47.55 \text{ cm}^2} \end{aligned}$$

8. Two passenger trains A and B which are 240M apart are traveling at 164 Km/h and 88 km/h respectively approach one another on a straight railway line. Train A is 150 metres long and train B is 100metres long.. Determine the time in seconds that elapses before the two trains completely pass each other. (3mks)

$$D = 150 + 100 \\ = 250M \\ + 240M \\ \hline D = 490M$$

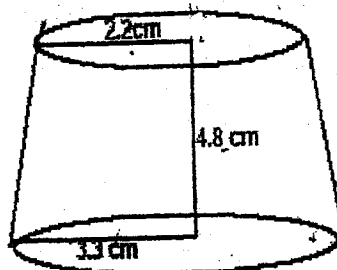
$$R.S = 164 + 88 \\ = 252 \text{ km/h}$$

$$S = \frac{D}{T} \\ T = \frac{D}{S}$$

$$\frac{0.49}{255} \\ \hline 0.001922760$$

$$\underline{\underline{0.115 \text{ min}}}$$

9. The figure below shows a frustum



Find volume of the frustum

$$L.S.T. \quad \frac{3.3}{2.2} = \frac{4.8+x}{x}$$

$$3.3x = 2.2(4.8+x)$$

$$3.3x = 10.56 + 2.2x$$

$$1.1x = 10.56$$

$$x = 9.6 \text{ cm}$$

$$\frac{1}{3} \times 3.142 \times 3.3 \times 3.3 \times 14.4 \\ \underline{\underline{164.24 \text{ cm}^3}}$$

$$\frac{1}{3} \times 2.2 \times 2.2 \times 3.142 \times 9.6 \quad (4 \text{ mks}) \\ \underline{\underline{48.66 \text{ cm}^3}}$$

$$= \frac{164.24 \text{ cm}^3}{48.66 \text{ cm}^3} \\ \underline{\underline{115.58 \text{ cm}^3}}$$

10. Every time an insect jumps forward the distance covered is half of the previous jump. If the insect initially jumped 8.4cm, calculate

- i. To the nearest two decimal places distance of the sixth jump. (1mk)

$$Q = 8.4$$

$$r = \frac{1}{2}$$

$$8.4 \times (1 - 0.5^6) \\ \hline 1 - 0.5^6$$

$$8.4 \times 0.015625$$

$$8.4 \times (4.2 + 2.1 + 1.05 + 0.525 + 0.2625)$$

$$16.275$$

$$+ 8.4$$

$$\underline{\underline{24.675}}$$

Turn over

14. Evaluate $\frac{3}{8}$ of $\left\{7\frac{3}{5} - \frac{1}{3}\left(1\frac{1}{4} + 3\frac{1}{3}\right) \times 2\frac{2}{5}\right\}$

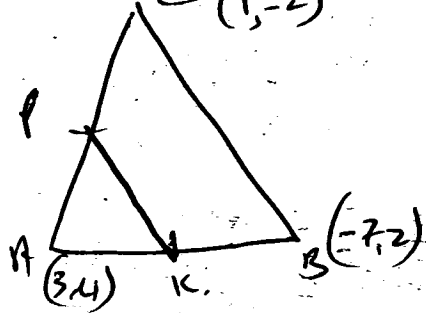
(2mks)

$$\begin{aligned} & \frac{5}{4} + \frac{10}{3} \frac{15+60}{12} \\ & \frac{55}{12} \\ & \frac{3}{8} \left\{ \frac{38}{5} - \frac{1}{3} \left(\frac{55}{12} \right) \times \frac{12}{5} \right\} \\ & \frac{3}{8} \left(\frac{38}{5} - \frac{55}{25} \times \frac{12}{5} \right) \\ & \frac{3}{8} \left(\frac{38}{5} - \frac{11}{3} \right) = \frac{114-55}{15} \\ & \frac{3}{8} \times \frac{59}{15} = \frac{59}{40} \end{aligned}$$

15. A triangle ABC is formed by the points A(3,4), B(-7,2) and C(1,-2).

a) Find the co-ordinates of the mid-points K of AB and P of AC

(1mk)



$$\left(\frac{-7+3}{2}, \frac{4+2}{2} \right) \Rightarrow \left(\frac{-4}{2}, \frac{6}{2} \right)$$

$$K(-2, 3)$$

$$P \Rightarrow \frac{1+3}{2}, \frac{-2+4}{2}$$

$$P = (2, 1)$$

b) Find the equation of the perpendicular bisector of the line KP.

(2mks)

$$C_1 = \frac{3-1}{-2-2} = \frac{2}{-4}$$

$$C_1 = -\frac{1}{2}$$

$$C_1 = \underline{\underline{2}}$$

$$C(0, 2)$$

$$\frac{y-2}{x-0} = 2$$

$$y-2 = 2x$$

$$\underline{\underline{y = 2x + 2}}$$

ii. The total distance covered after the sixth jump.

(2mks)

11. Oluoch paid Ksh. 450 for a trouser after getting a discount of 10%. The retailer still made a profit of 25% on the sale of this trouser. What profit would the retailer have made if no discount was allowed? (3mks)

$$\begin{aligned} & \frac{450 \times 100}{90} \\ & \underline{500 \text{ K}} \\ & 450 - 125 \\ & \quad ? = 100 \\ & 450 \times \frac{100}{125} \end{aligned}$$

$$\begin{aligned} & \frac{45000}{125} \\ & 360 \text{ K} \\ & - 500 \\ & \underline{52140} \end{aligned}$$

12. The dimensions of a rectangle are 10cm and 15cm. If there is an error of 5% in each of the measurements. Find the percentage error in the area of the rectangle. (4mks)

$$\begin{array}{rcl} \text{Dim} & \text{min} & \text{max} \\ & 9.5 & 10.5 \\ & 14.25 & 17.25 \\ \hline & 135.375 & 181.125 \end{array}$$

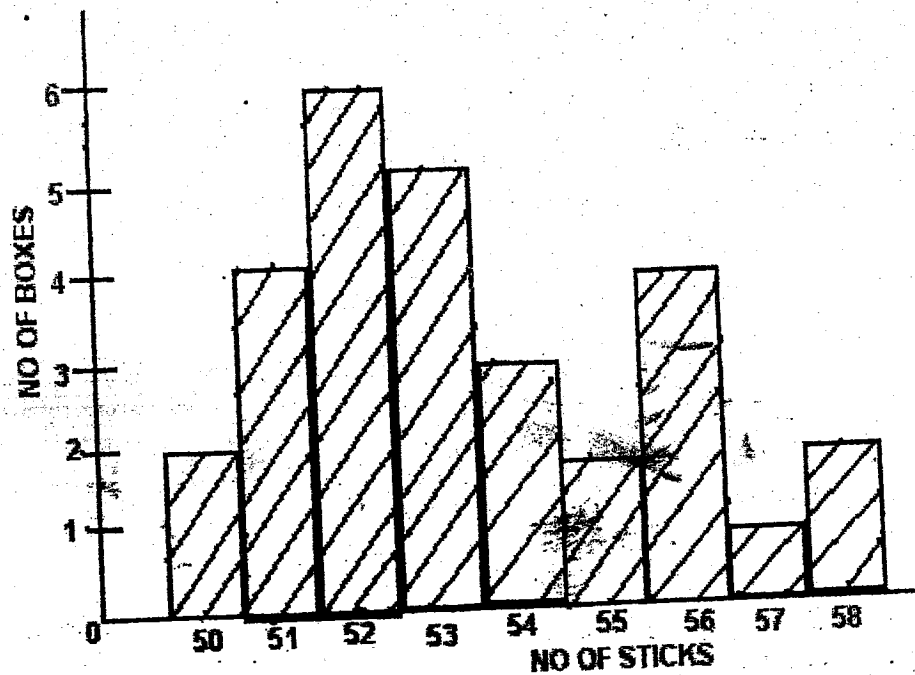
$$\begin{aligned} & 31.125 + 14.425 \\ & \frac{45.75}{2} = \frac{22.875}{150} \times 100 \\ & 0.1525 \times 100 \\ & = 15.25\% \end{aligned}$$

13. The velocity of water flowing through a pipe is inversely proportional to the square of the radius of the pipe. If the velocity of the water is 30cm/s when the radius of the pipe is 2cm. Find the velocity of water when the radius of the pipe is 4cm. (3mks)

$$\begin{aligned} & v \propto \frac{1}{r^2} \\ & v = \frac{k}{r^2} \\ & 30 = \frac{k}{4} \\ & \underline{k = 120} \end{aligned}$$

$$\begin{aligned} & v = \frac{120}{r^2} \\ & v = \frac{120}{16} \\ & \underline{v = 7.5 \text{ cm/s}} \end{aligned}$$

16. The chart below shows the number of sticks contained in a match box.



Find

a. The number of boxes

(1mk)

30

b. The mean number of sticks in each box.

(2mks)

$$\begin{array}{r}
 2 \times 50 = 100 \\
 4 \times 51 = 204 \\
 6 \times 52 = 312 \\
 5 \times 53 = 265 \\
 3 \times 54 = 162 \\
 2 \times 55 = 110 \\
 4 \times 56 = 224 \\
 1 \times 57 = 57 \\
 2 \times 58 = 116 \\
 \hline
 1550
 \end{array}$$

$$\begin{array}{r}
 1550 \\
 30 \\
 \hline
 52
 \end{array}$$

17

(a) Complete the table below for the function $y = 2x^3 + 4x^2 - 5x - 8$ (3 mks)

	-4	-3	-2	-1	0	1	2
$2x^3$	-128	-27	-16	-1	0	2	16
$4x^2$	64	36	16	4	0	4	16
$-5x$	20	15	10	5	0	-5	-10
-8	-8	-8	-8	-8	-8	-8	-8
y	52	-11	2	0	-8	-7	14

(b) On the grid provided draw the graph of $y = 2x^3 + 4x^2 - 5x - 8$ (3 mks)
 Scale: x-axis; 2cm represents 1 unit
 y-axis; 1 cm represents 5 units

(c) By drawing appropriate straight lines, solve the equations. (2 mks)

i. $2x^3 + 4x^2 - 9x - 7 = 0$

$2x^3 + 4x^2 - 5x - 7 = y$

$4x + 1 = y$

$y = 4x + 1$

x	-2	-1	0	1	2
y	-7	-3	1	5	9

ii. $2x^3 + 4x^2 - 10x + 4 = 0$

$y = 2x^3 + 4x^2 - 5x - 8$

$0 = 2x^3 + 4x^2 - 10x + 4$

$y = 5x - 12$

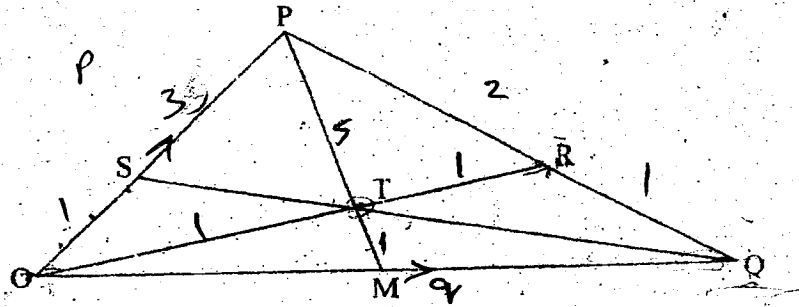
x	0	1	2	3	4
y	-12	-7	-2	3	8

Attempt only 5 Questions in this Section.

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17

The figure below shows a triangle of vectors in which $OS:SP = 1:3$, $PR:RQ = 2:1$ and T is the midpoint of OR .



a) Given that $OP = p$ and $OQ = q$, express the following vectors in terms of p and q

(i) $OR = OP + PR$
 $p + \frac{2}{3}p$
 $p + \frac{2}{3}(p - p)$

$OR = p + \frac{2}{3}q - \frac{2}{3}p$ (2 mks)
 $OR = \frac{2}{3}q + \frac{1}{3}p$

(ii) $QT = OQ + OT$
 $-q + \frac{1}{2}OR$

$-q + \frac{1}{2}(\frac{2}{3}q + \frac{1}{3}p)$
 $-q + \frac{1}{3}q + \frac{1}{6}p$

$\frac{1}{6}p - \frac{2}{3}q$ (2 mks)

b) Express TS in terms of p and q and hence show that the points Q , T and S are collinear. (3 mks)

$TS = TQ + \frac{1}{4}p$

$TS = -\frac{1}{2}(\frac{2}{3}q + \frac{1}{3}p) + \frac{1}{4}p$

$\frac{1}{4}p - \frac{1}{3}q - \frac{1}{6}p = TS$

$\frac{1}{4}p - \frac{1}{6}p - \frac{1}{3}q$

$\frac{3p - 2p}{12} = \frac{p}{12} - \frac{1}{3}q$

$TS = \frac{1}{12}(p - 4q)$

$QT = \frac{1}{6}(p - 4q)$

$\frac{1}{2}QT = TS$

$2TS = QT$

c) M is a point on OQ such that $OM = kOQ$ and PTM is a straight line. Given that $PT:TM = 5:1$, find the value of k . (3 mks)

18 a using a ruler and pair of compasses only, construct a parallelogram PQRS where $PQ=8\text{cm}$ $QR=5\text{cm}$ and $\angle PQR=120^\circ$. Bisect $\angle PQR$ AND $\angle SPQ$ so that the angle bisectors meet at x. (6mks)

b. construct a perpendicular from x to meet PQ at M. (2mks)

c. calculate the area of triangle PXQ (2MKS)

19.a) show by shading the unwanted region the area represented by the inequalities below.

$$4y < x + 11 \quad x > 1 \quad x + y < 9 \quad 5y > 3x - 3$$

b) calculate the area enclosed (10mks)

$$4y = x + 11$$

$$y = \frac{1}{4}x + \frac{11}{4}$$



$$y = 9 - x$$

x	-1	0	1	2	3	4
y	10	9	8	7	6	5

$$5y = 3x - 3$$

$$y = \frac{3}{5}x - \frac{3}{5}$$

$$y = \frac{3}{5}x - 0.6$$

x	-5	0	5	10
y	-3.6	-0.6	2.4	5.4

20. the diagram below show a bucket with top diameter 40cm and bottom 25cm. the height of the bucket is 28CM



Find the capacity of the bucket in litres (5mks)

$$\frac{20}{12.5} = \frac{28+x}{x}$$

$$20x = 12.5(28+x)$$

$$20x = 250 + 12.5x$$

$$7.5x = 250$$

$$x = \frac{250}{7.5} = 33.33\text{cm}$$

$$\frac{20}{12.5} = \frac{28+x}{x}$$

$$20x = 12.5(28+x)$$

$$20x = 250 + 12.5x$$

$$7.5x = 250$$

$$x = \frac{250}{7.5} = 33.33\text{cm}$$

$$x = 50$$

$$\frac{1}{3} \times 3.142 \times 400 \times 78$$

$$32,676.8\text{cm}^3$$

$$\frac{1}{3} \times 3.142 \times 156.25 \times 50$$

$$8,182.29\text{cm}^3$$

$$32,676.80$$

$$- 8,182.29$$

$$24,494.51\text{cm}^3$$

$$1000$$

$$24.495\text{L}$$

Find the area of the metal sheet required to make a hundred such buckets taking 10% extra for overlapping and wastage (5mks)

$$\pi r L$$

$$400 + 6080 =$$

$$\sqrt{6484}$$

$$\sqrt{(2.5)^2 + 50^2}$$

21. waniru travelled to London with kshs 500,000. she exchanged the kshs for sterling pound on arrival when the exchange rate was 1 pound sterling = kshs 104. (4mks)

Determine to the nearest pound how much he received if the bank charged him a commission (4mks)

$$\frac{500,000}{104} = \underline{\underline{4808}}$$

b. In London she spent pounds 3150 and travelled to Washington where she exchanged the balance of his money for us dollars the rate of exchange was 1 sterling pound = 1.6 us dollars. how much did she receive in us dollars assuming no commission was charged (3mks)

$$\begin{array}{r} 4808 \\ - 3150 \\ \hline 1658 \text{ s.f.} \end{array}$$

$$1 = 1.6 \text{ USD}$$

$$1.6 \times 1658 = \underline{\underline{2652.8}}$$

c). She spent $\frac{1}{4}$ of the money and then travelled back to Nairobi. She exchanged the remaining dollars to kshs at the rate of 1 us dollar = kshs 73.25. how much did she receive in kshs assuming that no commission was charged (3mks)

$$\frac{1}{4} \times 2652.8$$

$$663.2 \times 73.25$$

$$\text{Sh } \underline{\underline{48,579.40}}$$

22. In a research carried out to try a drug on treatment of malaria a sample of 45 cows was diagnosed to have the disease. 25 cows were treated with drug and the rest were not. The probability of a cow being treated and dying is $\frac{4}{15}$ and that of not treated and dying is $\frac{13}{15}$.

a) Calculate the probability that a cow picked at random is

1) treated with the drug and will die

$$\frac{25}{45} \times \frac{5}{9}$$

2) a cow will not die (3 mks)

$$\left(\frac{5}{9} \times \frac{4}{15} \right) + \left(\frac{20}{45} \times \frac{13}{15} \right)$$

$$\frac{4}{9} + \frac{52}{135}$$

b) The research found out that if a cow is treated the probability of it dying is $\frac{4}{5}$ while if not treated it is $\frac{2}{3}$. Find the probability that a cow picked at random from the 45 cows

1) treated with the drug and will die

2) not treated with the drug and will not die