

SACHO HIGH SCHOOL

Kenya Certificate of Secondary Education

121/1 - MATHEMATICS - Paper 1

KASSU JET

June, 2023 - $2\frac{1}{2}$ Hours

Name..... MARKING SCHEME Adm.....

Serial No..... Signature..... Date.....

Instructions to Candidates

- Write your name and Admission number in the spaces provided above.
- This paper consists of two sections: **Section I** and **Section II**.
- Answer **ALL** questions in **section I** and **ANY** five questions in **section II**.
- All answers and workings must be written on the question paper in the spaces provided below each question.
- Show **all the steps** in your calculation, giving your answer at each stage in the spaces below each question.
- Non - Programmable silent electronic calculators and KNEC mathematical tables may be used, except where stated otherwise.

FOR EXAMINER'S USE ONLY

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL

Section II

17	18	19	20	21	22	23	24	TOTAL

Grand Total

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SECTION I (50 MARKS)

Answer all questions in this section

1. Evaluate $2 \left(\frac{2.3 + 0.21}{0.45} \right)$

$$k = 2.3333...$$

$$10k = 23.333$$

$$9k = 21$$

$$k = \frac{21}{9} = \frac{7}{3}$$

$$k = 0.21111$$

$$10k = 2.11111$$

$$100k = 21.1111$$

$$90k = 19$$

$$k = \frac{19}{90}$$

$$k = 0.45454545$$

$$100k = 45.454545$$

$$99k = 45$$

$$k = \frac{45}{99} = \frac{5}{11}$$

$$2 \left[\left(\frac{7}{3} + \frac{19}{90} \right) \div \frac{5}{11} \right] \quad (3 \text{ marks})$$

$$2 \left[\frac{229}{90} \times \frac{11}{5} \right]$$

$$= 11 \frac{44}{225}$$

2. Given that $x^\circ, x + 40^\circ, x + 70^\circ, x + 20^\circ, x - 30^\circ, 2x + 40^\circ$ and $3x - 40^\circ$ are interior angles of a certain polygon. Give the name of the polygon hence, find the value of x .

Name Heptagon

Sum of Interior angles

$$(n-2)180^\circ$$

$$(7-2)180 = 900^\circ$$

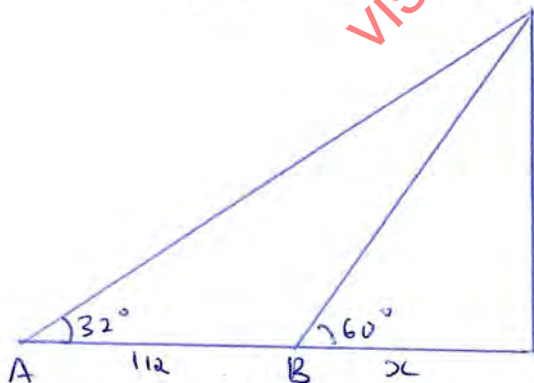
$$x + x + 40 + x + 70 + x + 20 + x - 30 + 2x + 40 + 3x - 40 = 900$$

$$10x + 100 = 900$$

$$10x = 800$$

$$x = \frac{800}{10} = 80$$

3. At point A, Roberto observed the top of a tall building at an angle of 32° . After walking for 112 meters towards the foot of the building he stopped at point B where he observed it again at an angle of 60° . Calculate the height of the building giving your answer to the nearest whole number.



$$\tan 32^\circ = \frac{h}{112 + x} \quad \text{--- (i)}$$

$$h = \tan 32 (112 + x) \quad \text{--- (ii)}$$

$$\tan 60^\circ = \frac{h}{x}$$

$$h = x \tan 60^\circ \quad \text{--- (iii)}$$

Equating (ii) and (iii)

$$\tan 32 (112 + x) = x \tan 60^\circ$$

$$112 \tan 32 + x \tan 32 = x \tan 60$$

$$x \tan 60 - x \tan 32 = 112 \tan 32$$

$$x = \frac{112 \tan 32}{\tan 60 - \tan 32}$$

$$x = \frac{112 \times 0.6249}{1.7321 - 0.6249}$$

$$x = 63.2124 \text{ m}$$

$$h = 63.2124 \times 1.7321$$

$$h = 109.490198 \text{ m}$$

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Height
 $h = 109 \text{ m}$

4. Simplify the

$$\frac{6x^2 - 10x - 2}{3x^2 - 12}$$

(3 marks)

$$\frac{2(3x^2 - 5x - 1)}{3(x^2 - 4)}$$

$$\frac{6x^2 - 12x + x - 2}{3(x-2)(x+2)}$$

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

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

$$\begin{aligned} &= \frac{6x+1}{3(x+2)} \\ &= \frac{6x+1}{3x+6} \end{aligned}$$

5. Find the gradient of the tangent to the curve $y = 2x^3 + 2x - 1$ at $x = -1$, hence find the equation of the normal to the curve at the tangent point. (3 marks)

$$\frac{dy}{dx} = 6x^2 + 2$$

$$G = 6x^2 + 2$$

$$\text{at } x = -1$$

$$6(-1)^2 + 2$$

$$6 + 2$$

$$G = 8$$

$$\text{When } x = -1$$

$$y = 2(-1)^3 + 2(-1) - 1$$

$$-2 - 2 - 1$$

$$y = -5$$

$$(-1, -5)$$

$$(-1, -5) (x, y)$$

$$\frac{y+5}{x+1} = -\frac{1}{8}$$

$$8(y+5) = -1(x+1)$$

$$8y + 40 = -x - 1$$

$$8y = -x - 41$$

$$y = -\frac{1}{8}x - \frac{41}{8}$$

6. A Kenyan bank buys and sells foreign currencies as shown below.

	Buying in Ksh.	Selling in Ksh.
1 Hongkong dollar	16.98	17.54
1 South African rand	6.84	7.17

A tourist arrives in Kenya with 106,000 Hongkong dollars and changed the 60% of the amount to Kenya shillings. While in Kenya she spent Ksh. 408,889 and changed the balance to South African rand before leaving for south Africa. How much altogether did he have in South African rands. (4 marks)

$$\frac{60}{100} \times 106,000$$

$$63,600 \text{ HKD}$$

2

$$1 \text{ HKD} = \text{Ksh } 16.98$$

$$63,600 \text{ HKD}$$

$$63,600 \times 16.98$$

$$= \text{Ksh. } 1,079,928$$

Remaining

$$1,079,928 - 408,889$$

$$\text{Ksh. } 671,039$$

$$1 \text{ SR} = \text{Ksh } 7.17$$

$$\text{in } 671,039$$

$$\frac{671039}{7.17}$$

$$= 93,589.82 \text{ South African Rands}$$

$$93,589.82$$

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7. If $x = 7$, $y = 6$ and $z = 4$, evaluate

(3 marks)

$$\frac{xy}{4} + \frac{x-y}{2z}$$

$$\frac{(7)6}{4} + \frac{7-6}{2(4)}$$

$$\frac{42}{4} + \frac{1}{8} = \frac{84+1}{8} = \frac{85}{8} = 10\frac{5}{8}$$

8. Josephat makes a basic monthly salary of Ksh. 2,700. As a vendor, he must sell Ksh. 30,000 worth of items per month. He also makes a 10% commission on all sales beyond the monthly quota. There is also an additional 10% bonus on top of the normal commission rate for any sales beyond Ksh. 39,000. If Jose sold Ksh. 42,000 worth of items this month, what is his total salary for the month to the nearest shillings? (3 marks)

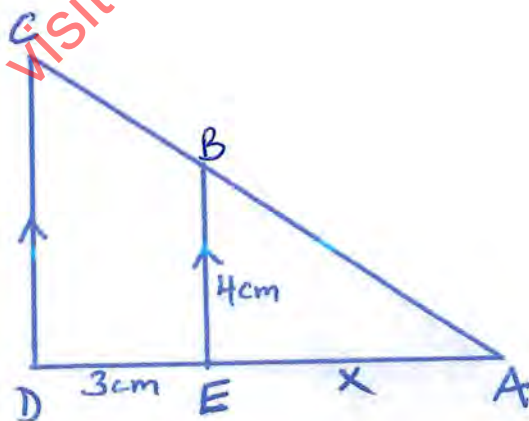
$$\frac{10}{100} \times 12,000 = \text{Ksh } 1200$$

$$\frac{10}{100} \times 3000 = \text{Ksh } 300$$

$$\text{Total Commission} = \text{Ksh } 1500$$

$$\text{Total Earning } 1500 + 2700 = \text{Ksh } 4200$$

9. Given that the area of the trapezium CDEB is 15.6 cm^2 , find the length EA marked X. (3 marks)



$$\frac{1}{2} (DC + 4) \times 3 = 15.6$$

$$DC + 4 = 10.4$$

$$DC = 10.4 - 4 = 6.4 \text{ cm.}$$

$$\frac{x+3}{x} = \frac{6.4}{4}$$

$$4(x+3) = 6.4x$$

$$4x + 12 = 6.4x$$

$$6.4x - 4x = 12$$

$$2.4x = 12$$

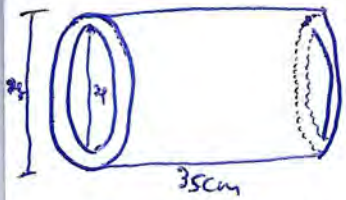
$$x = \frac{12}{2.4}$$

$$x = 5$$

$$\text{length EA} = 5 \text{ cm}$$

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10. The inner diameter of a cylindrical wooden pipe is **24 cm** and its outer diameter is **28 cm**. The length of the pipe is **35 cm**. Find the mass of the pipe, if **1 cm³** of wood has a mass of **0.6 g**. (3 marks)



$$\begin{aligned} \text{Volume } (\pi R^2 - \pi r^2) \times 35 \\ \frac{22}{7} (14 \times 14 - 12 \times 12) \times 35 \\ 110 (196 - 144) \end{aligned}$$

$$\begin{aligned} 110 \times 52 \\ = 5720 \text{ cm}^3 \\ 1 \text{ cm}^3 = 0.6 \text{ g} \\ 5720 \text{ cm}^3 = \\ 5720 \times 0.6 \text{ g} \\ = 3432 \text{ grams} \end{aligned}$$

11. Without using tables or calculators evaluate : $\sqrt{\frac{0.18 \times 0.0432}{2.16}}$ (3 marks)

$$\left(\frac{18 \times \frac{2}{32} \times 100}{216 \times 10000} \right)^{\frac{1}{2}}$$

$$= \left(\frac{36}{10000} \right)^{\frac{1}{2}}$$

$$= \frac{6^{2 \times \frac{1}{2}}}{100^{2 \times \frac{1}{2}}}$$

$$= \frac{6}{100}$$

$$= 0.06$$

12. A two-digit number is such that three times the sum of its digits is less than the value of the number by 8 when the order of the two digits is reversed, the value of the number increases by 9. Find the number. (3 marks)

Let no. xy

$$3(x+y) = 10x+y-8$$

yx

$$10y+x - (10x+y) = 9$$

$$3x+3y = 10x+y-8$$

$$-7x+2y = -8 \quad \text{--- (i)}$$

$$9y-9x = 9$$

$$y-x = 1 \quad \text{--- (ii)}$$

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Solving (i) and (ii) $y = x+1$

$$-7x + 2(x+1) = -8$$

$$-7x + 2x + 2 = -8$$

$$-5x = -10$$

$$x = \frac{-10}{-5} = 2$$

$$y = 2+1$$

$$y = 3$$

$$\text{NO. } \frac{23}{2}$$

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6329
17
1346

13. Use tables of reciprocals and cube roots to evaluate $\frac{1.8}{15.84} + \sqrt[3]{68.41}$ to 2 decimal places. (3 marks)

$$1.8 \left(\frac{1}{1.584 \times 10^1} \right) +$$

$$1.8 \times \frac{0.6346}{10} +$$

$$1.8 \times 0.06346 + 4.089$$

$$0.114228 + 4.089$$

$$= 4.203228 \quad \underline{\quad} \quad \underline{\quad} \quad 4.20$$

14. A trader bought two brands of coffee P and Q. Brand P costs Ksh 80 per kg and brand Q costs Ksh. 100 per kg. She mixed the two brands and sold the mixture at Ksh. 110 per kg. If she made a 25% profit, determine the ratio P : Q per kilogram in the mixture. (3 marks)

let the ratio be x:y
P:Q

$$\frac{100}{125} \times 110 = 88$$

$$\frac{80x + 100y}{x + y} = 88$$

$$80x + 100y = 88x + 88y$$

$$12y = 8x$$

$$\frac{x}{y} = \frac{3}{2}$$

OR

800	1000	
	88	
12	8	
	3:2	

15. Solve the following linear inequalities and represent the solution as a combined inequality (3 marks)

$$x - 2 < 3x + 4$$

$$5x - 3 \leq x + 5$$

$$-2x < 6$$

$$x > -3$$

$$4x \leq 8$$

$$x \leq 2$$

$$-3 < x \leq 2$$

16. Given that $P = \begin{pmatrix} 3 & -1 \\ x & 5 \end{pmatrix}$ and $Q = \begin{pmatrix} x & -11 \\ 8 & 18 \end{pmatrix}$ find x if $|P^2 - Q^2| = 1$ (4 marks)

$$P^2 = \begin{pmatrix} 3 & -1 \\ 2 & 5 \end{pmatrix} \begin{pmatrix} 3 & -1 \\ 2 & 5 \end{pmatrix} = \begin{pmatrix} 9-x & -8 \\ 8x & -x+25 \end{pmatrix} \checkmark$$

$$Q^2 = \begin{pmatrix} x & -11 \\ 8 & 18 \end{pmatrix} \begin{pmatrix} x & -11 \\ 8 & 18 \end{pmatrix} = \begin{pmatrix} x^2-88 & -11x-198 \\ 8x+144 & 236 \end{pmatrix}$$

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$$\begin{pmatrix} 9-x-88 & -8-11x-198 \\ 8x-2125 & 236 \end{pmatrix} - \begin{pmatrix} x^2-88 & -11x-198 \\ 8x+144 & 236 \end{pmatrix} = \begin{pmatrix} -x^2-x+97 & 11x+190 \\ -x-19 & -x-211 \end{pmatrix}$$

$$\begin{vmatrix} -x^2-x+97 & 11x+190 \\ 144 & -x-211 \end{vmatrix} = 1$$

det = 1

6

SECTION II (50 MARKS)

Answer any **FIVE** questions in this section

17. The heights of 100 maize plants were measured to the nearest centimeter and the results recorded in the table shown below.

Height (cm)	x	Frequency (f)	Mid point	t=x-A	ft	t ²	ft ²	Ukr	Cf
25 - 29		5	27	-11	-55	121	605	29.5	5
30 - 34		12	32	-6	-72	36	432	34.5	17
35 - 39		18	37	-1	-18	1	18	39.5	35
40 - 44		30	42	4	120	16	480	44.5	65
45 - 49		17	47	9	153	81	1377	49.5	82
50 - 54		11	52	14	154	196	2156	54.5	93
55 - 59		7	57	19	133	361	2527	59.5	100
		$\Sigma f = 100$			$\Sigma ft = 415$		$\Sigma ft^2 = 7595$		

(a) Calculate to 2 d.p.

(i) the mean using assumed mean of 38

(2 marks)

$$\bar{X} = A + \frac{\Sigma ft}{\Sigma f}$$

$$38 + \frac{415}{100}$$

$$38 + 4.15$$

$$= 42.15$$

(ii) the standard deviation

(3 marks)

$$s = \sqrt{\frac{\Sigma ft^2}{\Sigma f} - \left(\frac{\Sigma ft}{\Sigma f}\right)^2}$$

$$= \sqrt{\frac{7595}{100} - \left(\frac{415}{100}\right)^2}$$

$$= \sqrt{75.95 - 17.2225}$$

$$= \sqrt{58.7275}$$

$$= 7.66338698$$

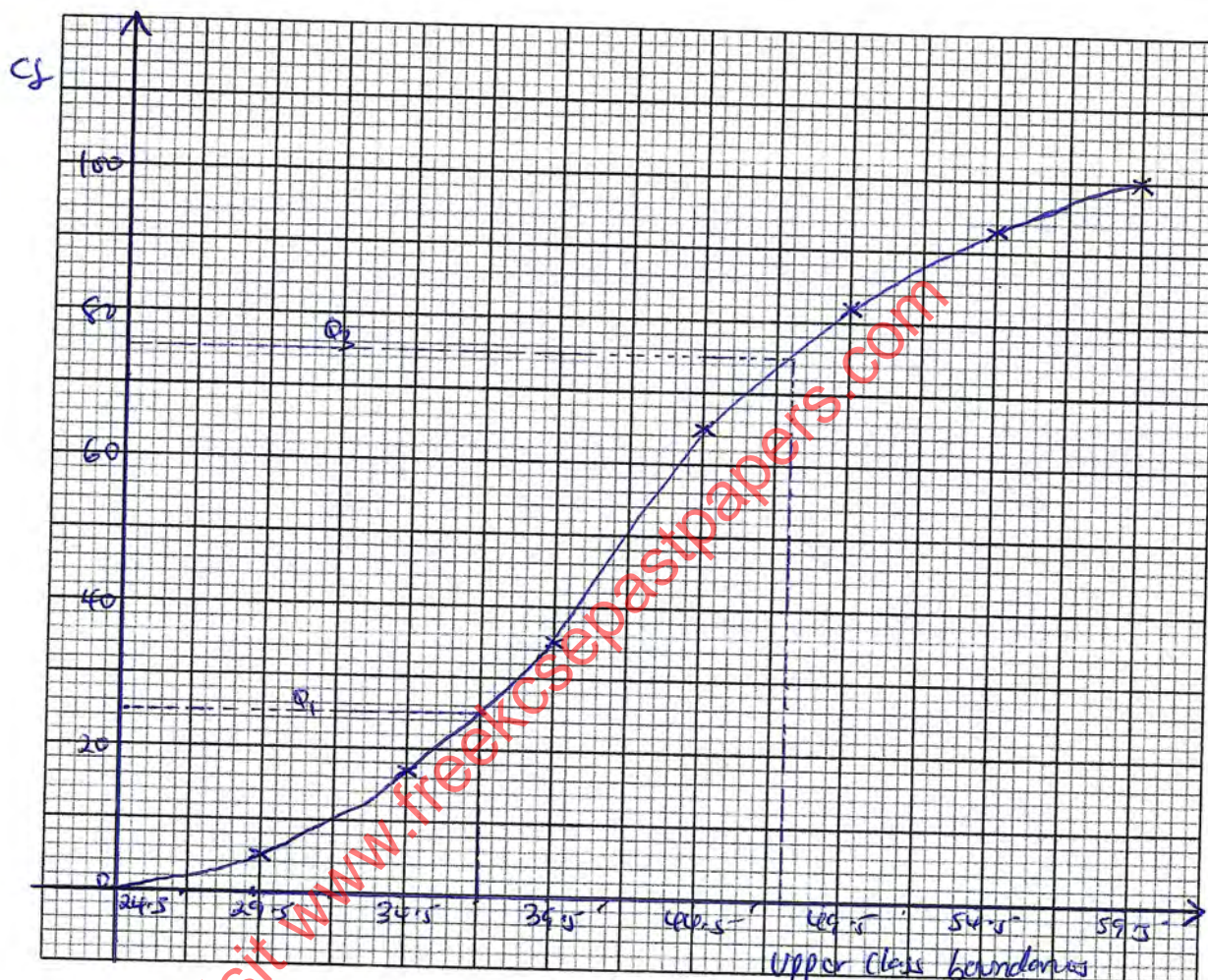
$$\approx 7.66$$

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(b) Draw an ogive to represent above information.
(2 marks)

(3)



(c) Using the graph, estimate the quartile deviation.

(2 marks)

$$Q_1 = \frac{1}{4} \times 100 = 25^{\text{th}} = 37$$

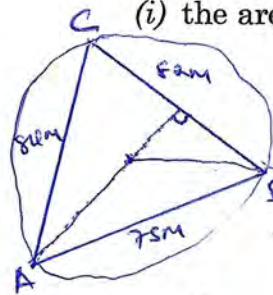
$$Q_3 = \frac{3}{4} \times 100 = 75^{\text{th}} = 47.5$$

$$\frac{47.5 - 37}{2} = \frac{10.5}{2} = 5.25$$

18. A triangular plot ABC is such that $AB = 75 \text{ m}$, $BC = 82 \text{ m}$ and $AC = 84 \text{ m}$.

(a) Calculate the:

(i) the area of the plot in hectares. (3 marks)



$$s = \frac{1}{2} (75 + 82 + 84)$$

$$\sqrt{s(s-a)(s-b)(s-c)}$$

$$\sqrt{120.5(120.5-75)(120.5-82)(120.5-84)}$$

$$\sqrt{120.5 \times 45.5 \times 38.5 \times 36.5}$$

$$= \sqrt{71704634.438}$$

$$= 2775.722324 \text{ m}^2$$

$$\frac{2775.722324}{10000}$$

$$= 0.2775722324$$

$$= 2.7757 \text{ hectares}$$

(ii) acute angle between the edges AB and BC. (3 marks)

$$84^2 = 82^2 + 75^2 - 2 \times 82 \times 75 \cos \theta$$

$$\theta = \cos^{-1}(0.4303)$$

$$7056 - 6724 - 5625 = -12300 \cos \theta$$

$$\theta = 64.51^\circ$$

$$\frac{-5293}{-12300} = \frac{-12300 \cos \theta}{-12300}$$

$$\cos \theta = 0.4303$$

(iii) perpendicular height from A to the side BC. (2 marks)

$$\sin 64.51 = \frac{h}{75}$$

$$h = 75 \times 0.4303$$

$$h = 32.2725 \text{ m}$$

(b) A tree is planted in the plot such that the tree is equidistant from each of the points A, B and C. Calculate the distance of the tree from C giving your answer to 4s.f. (2 marks)

$$\frac{84}{\sin 64.51} = 2R$$

$$2R = \frac{84}{0.4302}$$

$$2R = 195.2126$$

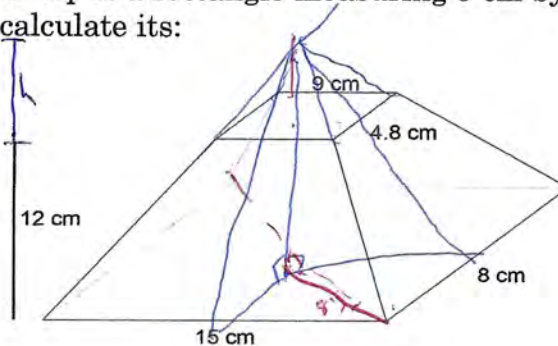
$$R = 97.6063$$

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length

$$97.61 \text{ m}$$

19. The figure below shows a right solid frustum. The base is a rectangle measuring 15 cm by 8 cm while the top is a rectangle measuring 9 cm by 4.8 cm. the height of the frustum is 12 cm. calculate its:



$$\frac{h+12}{h} = \frac{s}{s/3}$$

$$\frac{h+12}{h} = \frac{3}{1}$$

$$3h+36 = 3h$$

$$5h = 3h = 36$$

$$2h = 36$$

$$h = 18 \text{ cm}$$

(a) Volume

(5 marks)

$$\frac{1}{3} \times 15 \times 8 \times 30 - \frac{1}{3} \times 9 \times 4.8 \times 18$$

$$= 1200 - 259.2$$

$$= 940.8 \text{ cm}^3$$

(b) Surface area

(5 marks)

Slant faces.

$$\frac{1}{2} \times 8 \times \sqrt{30^2 + (7.5)^2} \times 2$$

+

$$\frac{1}{2} \times 15 \times \sqrt{30^2 + 4^2} \times 2$$

$$247.3863375 \text{ cm}^2$$

+

$$453.9823785$$

$$= 701.368716 \text{ cm}^2$$

$$\frac{701.368716}{X} = \left(\frac{5}{3}\right)^2$$

$$X = \frac{9 \times 701.368716}{25}$$

$$X = 252.4927378 \text{ cm}^2 \text{ (Small Pyramid)}$$

Slant faces of frustum

$$= 701.368716 - 252.4927378$$

$$= 448.8759782 \text{ cm}^2$$

Total surface area

$$448.8759782 + 1200 + 452$$

$$= 652.0759782 \text{ cm}^2$$

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20. Three business persons John, Felix and Susan contributed a capital of Ksh 80,000, Ksh. 12,000 and Ksh. 90,000 respectively to start a business. They agreed to share their profits as follows; 30% equally, 45% in the ratio of their contributions and the rest was saved for the running of the business. During a certain year, they made a profit of sh. 87 000. Determine:

(a) Amount shared equally

(2 marks)

$$\frac{30}{100} \times 87000$$

$$\text{Ksh } 26,100$$

(b) Amount shared according to ratio of their contribution

(2 marks)

$$\frac{45}{100} \times 87000$$

$$\text{Ksh } 39,150$$

(c) Amount saved

(2 marks)

$$= \frac{25}{100} \times 87000$$

$$\text{Ksh } 21,750$$

(d) The share of Felix and Susan

(4 marks)

J F S
80 12 90
40 : 6 : 45

Amount shared equally
 $\frac{26,100}{3} = @ \text{Ksh } 8700$

Amount shared in ratio

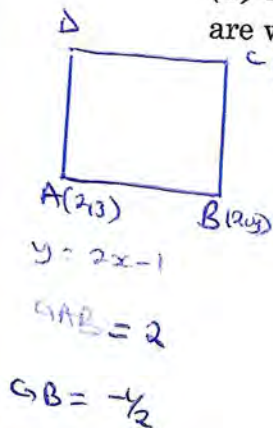
$$\text{Felix} = \frac{6}{91} \times 39,150 = 2581.32 + 8700 = \text{Ksh } 11,281.32$$

$$\text{Susan} = \frac{45}{91} \times 39,150 = 19359.89 + 8700 = \text{Ksh } 28,059.89$$

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21. A square ABCD has two of its vertices at A (2, 3) and C (8, 5). The equation of line AB is $y - 2x + 1 = 0$.

(a) Determine the equation of line BC in the form $ax + by = c$ where a, b and c are whole numbers. (4 marks)



$$(8, 5) (x, y)$$

$$\frac{y - 5}{x - 8} = -\frac{1}{2}$$

$$2y - 10 = -x + 8$$

$$2y = -x + 18$$

$$y = -\frac{1}{2}x + 9$$

$$\boxed{x + 2y = 18}$$

(b) By calculation, determine the co-ordinate of point D (4 marks)

$$\frac{y - 3}{x - 2} = -\frac{1}{2}$$

$$2y - 6 = -x + 2$$

$$2y = -x + 8$$

$$y = -\frac{1}{2}x + 4$$

Eqn DC

$$\frac{y - 5}{x - 8} = \frac{2}{1}$$

$$y - 5 = 2x - 16$$

$$y = 2x - 11$$

Solving (i) and (ii)

$$2x - 11 = -\frac{1}{2}x + 4$$

$$4x - 22 = -x + 8$$

$$5x = 30$$

$$x = 6$$

$$y = 2(6) - 11$$

$$12 - 11$$

$$y = 1$$

$$D(6, 1)$$

(c) Calculate the length of a side of the square ABCD to 3 significant figures. (2 marks)

$$(8, 5) (6, 1)$$

$$\sqrt{(8 - 6)^2 + (5 - 1)^2}$$

$$\sqrt{4 + 16}$$

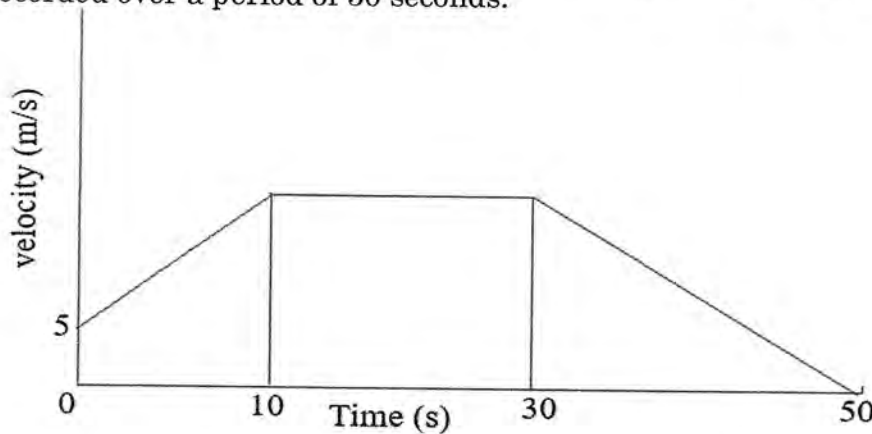
$$\sqrt{20}$$

$$= 4.472135955 \text{ units}$$

$$\approx 4.47 \text{ units}$$

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22. The graph given represents the velocity time graph of a sprinting cheetah recorded over a period of 50 seconds.



(a) Given that the acceleration of the cheetah is 2.5 m/s^2 , calculate the maximum speed attained in km/h . (3 marks)

$$(0, 5) \quad (10, x)$$

$$\frac{x-5}{10-0} = \frac{2.5}{1}$$

$$x-5 = 25$$

$$x = 30$$

$$30 \times \frac{18}{5} = 6 \times 18$$

$$= 108 \text{ km/h}$$

Maximum 30 m/s

(b) The average speed of the cheetah in the first 30 seconds. (3 marks)

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

$$\text{Distance } \frac{1}{2}(5+30) \times 10 + 20 \times 30$$

$$\frac{1}{2} \times 10 \times (35) + 600$$

$$175 + 600 = 775 \text{ m}$$

$$S = \frac{775}{30}$$

$$= 25 \frac{5}{6} \text{ m/s}$$

(c) The time it takes to cover three-fifths of the whole journey. (4 marks)

Total Distance

$$\frac{3}{5} \times 1075 = 645$$

$$775 + \frac{1}{2} \times 20 \times 30$$

$$175 + (k \times 30) = 645$$

$$775 + 300$$

$$30k = 470$$

$$1075 \text{ m}$$

$$k = 15 \frac{2}{3} + 10$$

$$= 25 \frac{2}{3} \text{ seconds}$$

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23. A curve whose equation is $2y = 6 - 12x + 9x^2 - 2x^3$ turns at points A and B.

(a) find the coordinates of A and B.

(4 marks)

$$y = 3 - 6x + 4.5x^2 - x^3$$

$$\frac{dy}{dx} = -6 + 9x - 3x^2$$

$$-3x^2 + 9x - 6 = 0$$

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

$$x^2 - 2x - x + 2 = 0$$

$$x(x-2) - 1(x-2) = 0$$

$$(x-1)(x-2) = 0$$

$$x-1=0$$

$$x=1$$

$$x-2=0$$

$$x=2$$

When $x=1$

$$y = 3 - 6(1) + 4.5(1)^2 - 1^3$$

$$y = 3 - 6 + 4.5 - 1$$

$$y = 7.5 - 7$$

$$y = 0.5$$

$$(1, 0.5)$$

When $x=2$

$$y = 3 - 6(2) + 4.5(2)^2 - 2^3$$

$$y = 3 - 12 + 18 - 8$$

$$y = 21 - 20$$

$$y = 1$$

$$(2, 1)$$

(b) determine the nature of its turning points

(3 marks)

$$(1, 0.5)$$

x	0	1	1.5
$\frac{dy}{dx}$	-6	0	0.5



(1, 0.5) Minimum

$$(2, 1)$$

x	1.5	2	2.5
$\frac{dy}{dx}$	0.5	0	-6



(2, 1) Maximum

(c) A particle moving on a straight line passes a fixed point O at a velocity of 3 m/s. The acceleration of the particle t seconds after passing O is given by the equation $a = 4 + 14t$. Calculate its velocity two seconds later after it passes through O.

(3 marks)

$$\frac{dv}{dt} = 4 + 14t$$

$$\int dv = \int (4 + 14t) dt$$

$$v = 4t + \frac{14t^2}{2} + c$$

$$v = 4t + 7t^2 + c$$

$$v = 3, t = 0$$

$$3 = v(0) + 7(0)^2 + c$$

$$c = 3$$

$$v = 4t + 7t^2 + 3$$

$$v = 4(2) + 7(2)^2 + 3$$

$$8 + 28 + 3 = 39 \text{ m/s}$$

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24. Two vehicles P and Q left town T at the same time. P moved along a straight road on a bearing of 250° at an average speed of 60 km/h. While Q was driven along a straight road on a bearing of $N40^\circ E$ at an average speed of 40 km/h.

(a) Using the scale of 1 : 5000000, determine:

1 cm rep 500000 m

1 cm rep 50 km.

(i) the positions of the two cars 6 hours later from T

(3 marks)

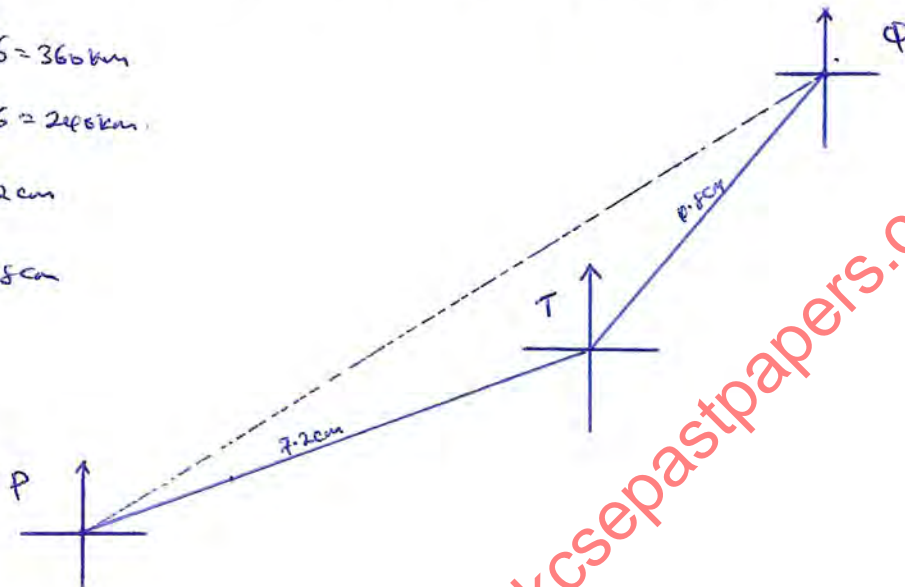
$$D = S \times T$$

$$P = 60 \times 6 = 360 \text{ km}$$

$$Q = 40 \times 6 = 240 \text{ km}$$

$$\frac{360}{50} = 7.2 \text{ cm}$$

$$\frac{240}{50} = 4.8 \text{ cm}$$



(ii) The actual distance between P and Q after 6 hours and the bearing of P from Q.

(3 marks)

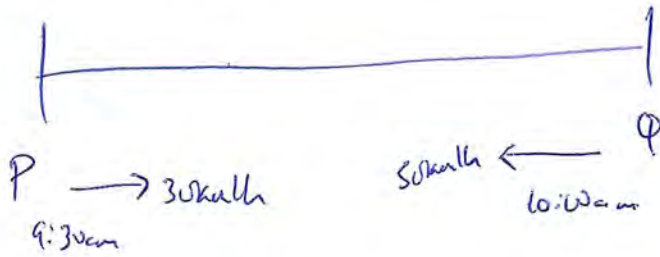
$$11.6 \text{ cm} \times 50 = 580 \text{ km} \pm 5 \text{ km}$$

$$180 \pm 5 = 238^\circ \pm 1^\circ$$

OR

$$S 58^\circ W \pm 1^\circ$$

(b) the two cars were stationary at their new positions in (a) above at 9:00am. At 9:30 am, car P started moving on a straight road towards Q at an average speed of 30km/h. At 10:00 am, car Q started moving towards car P at an average speed of 50km/h. determine the time when the two cars met. (4 marks)



Common speed (Relative speed)

$$50 + 30 = 80 \text{ km/h.}$$

Common distance

Distance moved by P at 10:00am

$$\frac{1}{2} \times 30 = 15 \text{ km}$$

Common distance

$$560 + 15 = 575 \text{ km.}$$

$$t = \frac{575}{80}$$

t = 7hrs 3min 45sec.

$$\begin{array}{r} 10:00:00 \\ 7:03:45 \\ \hline \end{array}$$

$$5:03:45 \text{ pm}$$

$$\text{or } 5:07:30 \text{ pm or } 5:00:00 \text{ pm.}$$