MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education
PRE-MOCK EXAMINATIONS 2022

121/1 **MATHEMATICS** **Paper 1**

June 2022 – TIME 2 $\frac{1}{2}$ Hours

Name: MARKING SCHEME ..... Adm No: .....

Class: ..... Candidate's Signature: ..... Date: 21/06/2022

Instructions to Candidates

(a) Write your name, admission number and class in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above.
*(c) This paper consists of **two** sections; **Section I** and **Section II**.*
*(d) Answer **all** the questions in **Section I** and only **five** questions from **Section II***
(e) Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question
(f) Marks may be given for correct working even if the answer is wrong.
(g) Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
(h) This paper consists of 16 printed pages.
(i) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing

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

SECTION I (50 Marks)

Answer **ALL** the questions in this section in the spaces provided below each:

1. Evaluate $\dfrac{1\frac{4}{5} \div \frac{2}{3} \text{ of } 2\frac{1}{4} - \frac{3}{10}}{\frac{5}{6} + \frac{22}{39} \times 1\frac{2}{11}}$. (4 marks)

Numerator $\frac{9}{5} \div \frac{2}{3}$ of $\frac{9}{4} - \frac{3}{10}$

$= \frac{9}{5} \times \frac{2}{3} - \frac{3}{10}$

$= \frac{6}{5} - \frac{3}{10}$ $\surd M_1$

$= \frac{9}{10}$

Denominator

$\frac{5}{6} + \frac{22}{39} \times \frac{13}{11}$

$= \frac{5}{6} + \frac{2}{3}$ $\surd M_1$

$= \frac{3}{2}$

Num ÷ Deno $\frac{9}{10} \times \frac{2}{3}$ $\surd M_1$

$= \frac{3}{5}$ $\surd A_1$

2. Jane working as a Sales Executive earns a basic salary of Kshs. 20,000 and a commission of 8% for the sales in excess of Kshs. 100,000. Determine the amount of sales she made in the month of January if she earned a total of Ksh.48,000 in salaries and commissions for that month. (3 marks)

Commission Earned $= 48{,}000 - 20{,}000$ $\surd M_1$

$= 28{,}000$

If $8\% = 28{,}000$

$\therefore 100\% = \dfrac{100\% \times 28\,000}{8\%}$ $\surd M_1$

$= 350{,}000$

Sales $= 100{,}000 + 350{,}000$

$= 450{,}000$ $\surd A_1$

3. Convert $1.065\pi^c$ into degrees. (2 marks)

If $2\pi^c = 360^\circ$

$\therefore 1.065\pi^c = \dfrac{1.065\pi^c \times 360^\circ}{2\pi^c}$ $\surd M_1$

$= 191.7^\circ$ $\surd A_1$

4. After heating his oven to 87°C Masoudi allowed it to cool to 23°C, calculate the number of minutes it took to cool to the final temperature given that it cooled at a rate of 8°C per every 12 seconds. (3 marks)

Change in Temperature = 87°C − 23°C $\surd M_1$

= 64°C

Time taken to cool in seconds = $\frac{64^\circ C}{8^\circ C} \times 12$ $\surd M_1$

= 96 seconds

Time taken in minutes = 96 ÷ 60 = 1·6 minutes $\surd A_1$

5. Peter cast 15 equal wax cubes from one litre of melted wax. Given that the volume of the cubes reduced by 4% on cooling, calculate the dimension of a cube in centimetres. (3 marks)

Volume of each cube = $\frac{1000}{15}$ $\surd M_1$

Volume of each cube after cooling = $\frac{1000}{15} \times \frac{96}{100}$ $\surd M_1$

Dimension of the cube = $\sqrt[3]{64}$

= 4 cm $\surd A_1$

6. Three casual workers: Alice, Benson and Charles working in a Juice Processing Factory earns in a way such that Benson earns twice as much as Alice and Charles earns sh 70 more than Benson. If their total earning is sh1120 per day, express the ratio of their earnings, Alice:Benson:Charles, in its simplest form. (3 marks)

Alice	Benson	Charles
x	$2x$	$2x+70$

$x + 2x + 2x + 70 = 1120$ $\surd M_1$

$x = 210$

Alice : Benson : Charles

210 : 420 : 490 $\surd M_1$

3 : 6 : 7 $\surd A_1$

7. A watch which looses a half-minute every hour was set to read the correct time at 0545h on Monday. Determine the time, in the 12 hour system, the watch will show on the following Friday at 1945h. (3 marks)

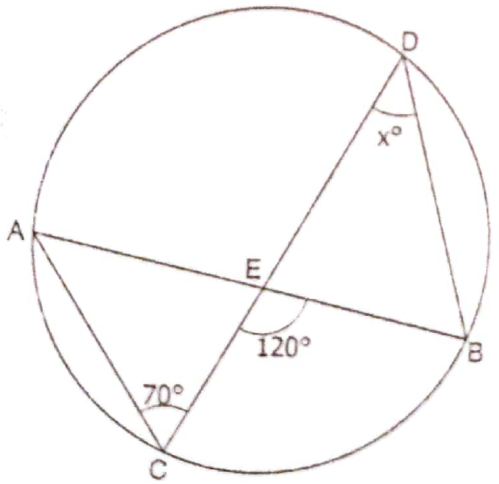
Total time between Monday 0545h to Friday 1945h
$= 4 \times 24 + 14$ $\surd M_1$
$= 110$ hrs
Number of minutes lost $= 110 \div 2 = 55$ minutes
Time $= 1945 - 55$ minutes $\surd M_1$
$= 1850$h

In 12 hr system
6:50 pm $\surd A_1$

8. Given that log Y=1.2534 and the product of X and Y, XY=427.2, calculate X leaving your answer in standard form. (3 marks)

$\log x + \log Y = \log 427.2$
$\log x + 1.2534 = 2.6306$ $\surd M_1$
$\log x = 1.3772$ $\surd M_1$
$x = 2.3834 \times 10^1$ $\surd A_1$

9. The figure is a circle in which AB, AC, DC and DB are chords. Angles ACE and CEB are 70° and 120° respectively.



Calculate the size of angle EDB labelled x°. (3 marks)

$\angle EBD = 70°$ $\surd B_1$
$x° + 70° = 120°$ $\surd M_1$
$x° = 50°$ $\surd A_1$

10. Solve for m in the equation $-54 = 10 - (m-10)^{\frac{3}{2}}$. (3 marks)

$-64 = -(m-10)^{3/2}$

$64 = (m-10)^{3/2}$ $\surd M_1$

$(4^3)^{2/3} = m-10$ $\surd M_1$

$16 = m-10$

$m = 26$ $\surd A_1$

11. The image of P(2, 3) under an enlargement with a scale factor 3 is $P^I(4, 9)$. Determine the centre of enlargement. (3 marks)

Let the centre of enlargement be (x, y)

$\frac{x-4}{x-2} = 3$

$x = 1$ $\surd B_1$

$\frac{y-9}{y-3} = 3$

$y = 0$ $\surd B_1$

Centre of enlargement

$(1, 0)$ $\surd B_1$

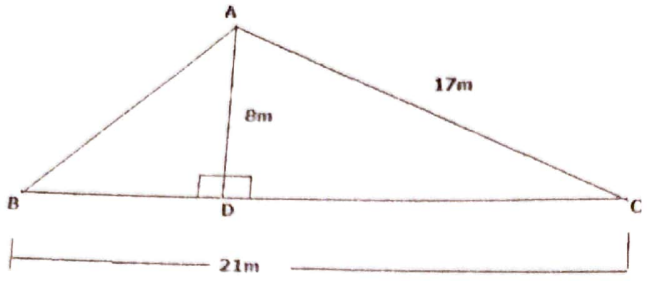
12. Solve for x in the equation $4\sin(x+20^\circ) = 3$ for $0^\circ \leq x \leq 360^\circ$ (3 marks)

$\sin(x+20)^\circ = \frac{3}{4}$ $\surd M_1$

$(x+20)^\circ = 48.59^\circ, 131.41^\circ$ $\surd M_1$

$x = 28.59^\circ, 101.41^\circ$ $\surd A_1$

13. The figure below shows a triangular kitchen garden with lengths AC=17m, AD=8m and BC=21m



Calculate the length of the wire required to fence it round. (3 marks)

$DC = \sqrt{17^2 - 8^2}$ $\surd M_1$

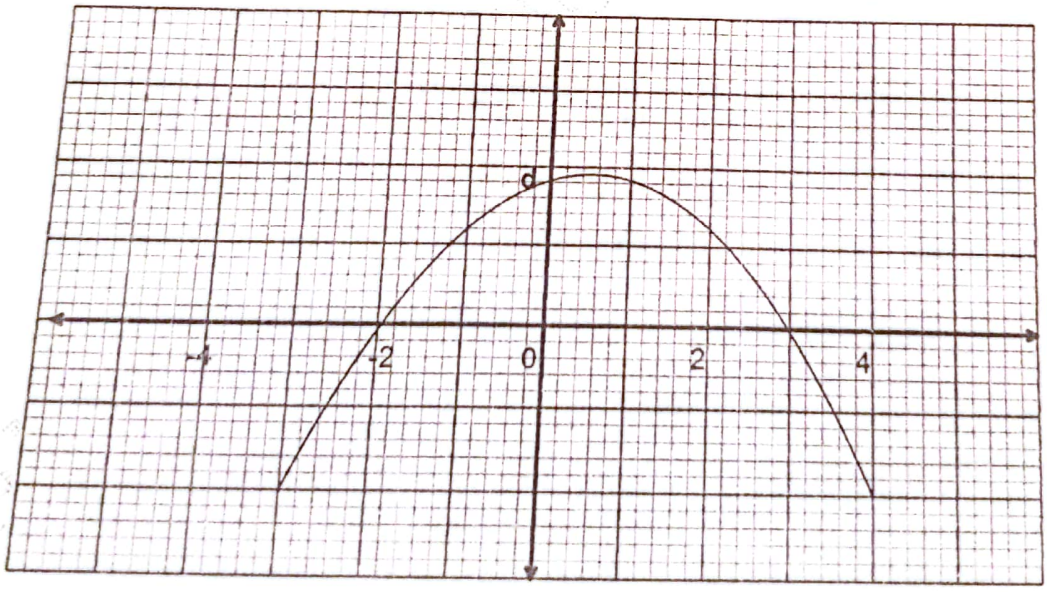
$= 15$

$AB = \sqrt{6^2 + 8^2}$ $\surd M_1$

$= 10$

$L = 10 + 21 + 17$ $\surd = 48m$ $\surd A_1$

14. The graph below is a plot for the function $y = ax^2 + bx + c$ where a, b and c are constants.



Determine the function and its y intercept marked d. (4 marks)

$x = -2$ or 3

$(x+2)(x-3) = 0$ $\surd M_1$

$x^2 - 3x + 2x - 6 = 0$ $\surd M_1$

$x^2 - x - 6 = 0$

$y = x^2 - x - 6$ $\surd A_1$

$d = -6$ $\surd B_1$

15. Find the equation of a line L_1 whose slope is -3 and passes through the intersection of the curves $y = \frac{1}{x}$ and $y = \frac{1}{2x-1}$. (3 marks)

At intersection $\frac{1}{x} = \frac{1}{2x-1}$

$2x - 1 = x$

$x = 1$

$y = 1$

Point of intersection $(1,1)$ $\surd B_1$

$\frac{y-1}{x-1} = -3$ $\surd M_1$

$y - 1 = -3x + 3$

$y = -3x + 4$ $\surd A_1$

16. Evaluate, to 3 decimal places, $\frac{2}{12.56} + (0.12)^{\frac{1}{2}} - (0.25)^3$ using the Tables of Reciprocals, Square roots and Cubes. (4 marks)

$\frac{2}{12.56} = \frac{2}{1.256 \times 10^1}$

$= \frac{2 \text{ recip } 1.256}{10}$

$= 0.2 \times 0.7961$

$= 0.15922$ $\surd M_1$

$(0.12)^{\frac{1}{2}} = (12 \times 10^{-2})^{\frac{1}{2}}$

$= (12)^{\frac{1}{2}} \times (10^{-2})^{\frac{1}{2}}$

$= 3.4641 \times 10^{-1}$

$= 0.34641$ $\surd M_1$

$(0.25)^3 = (2.5 \times 10^{-1})^3$

$= (2.5)^3 \times 10^{-3}$

$= 15.625 \times 10^{-3}$

$= 0.015625$ $\surd M_1$

$0.15922 + 0.34641 - 0.015625$

$= 0.490005$ $\surd A_1$

Deny if truncated or rounded off

SECTION II (50 Marks)

Answer **ONLY FIVE** questions in this section in the spaces provided below each:

17. Given that $A=\begin{pmatrix}3 & 4\\ 2 & 5\end{pmatrix}$ determine:

a) the inverse of matrix A. (2 marks)

Det $A = 3\times5 - 4\times2$ $\surd M_1$

$= 7$

$A^{-1} = \begin{pmatrix}\frac{5}{7} & \frac{-4}{7}\\ \frac{-2}{7} & \frac{3}{7}\end{pmatrix}$ $\surd A_1$ deny if $A^{-1} = \frac{1}{7}\begin{pmatrix}5 & -4\\ -2 & 3\end{pmatrix}$

b) price of a skirt and a blouse using the inverse of matrix A if Jemima bought 3 skirts and 4 blouses and paid Kshs.1150 while Amina paid Kshs. 1000 for two skirts and 5 blouses from the same stall. (4 marks)

$3s+4b=1150$
$2s+5b=1000$ } $\surd M_1$ Correct simultaneous eqns formed

$\begin{pmatrix}3 & 4\\ 2 & 5\end{pmatrix}\begin{pmatrix}s\\ b\end{pmatrix} = \begin{pmatrix}1150\\ 1000\end{pmatrix}$

$\begin{pmatrix}\frac{5}{7} & \frac{-4}{7}\\ \frac{-2}{7} & \frac{3}{7}\end{pmatrix}\begin{pmatrix}3 & 4\\ 2 & 5\end{pmatrix}\begin{pmatrix}s\\ b\end{pmatrix} = \begin{pmatrix}\frac{5}{7} & \frac{-4}{7}\\ \frac{-2}{7} & \frac{3}{7}\end{pmatrix}\begin{pmatrix}1150\\ 1000\end{pmatrix}$ $\surd M_1$ Premultiplication by the inverse

$\begin{pmatrix}s\\ b\end{pmatrix} = \begin{pmatrix}250\\ 100\end{pmatrix}$ $\surd M_1$ $s=250$ & $b=100$ $\surd A_1$

c) how much less Sophie paid for 7 skirts and 3 blouses when she was given a 10% discount on each skirt and 10% increase in price of each blouse. (4 marks)

New price of skirt $= \frac{90}{100}\times250 = 225$
New Price of blouse $= \frac{110}{100}\times100 = 110$ } $\surd B_1$

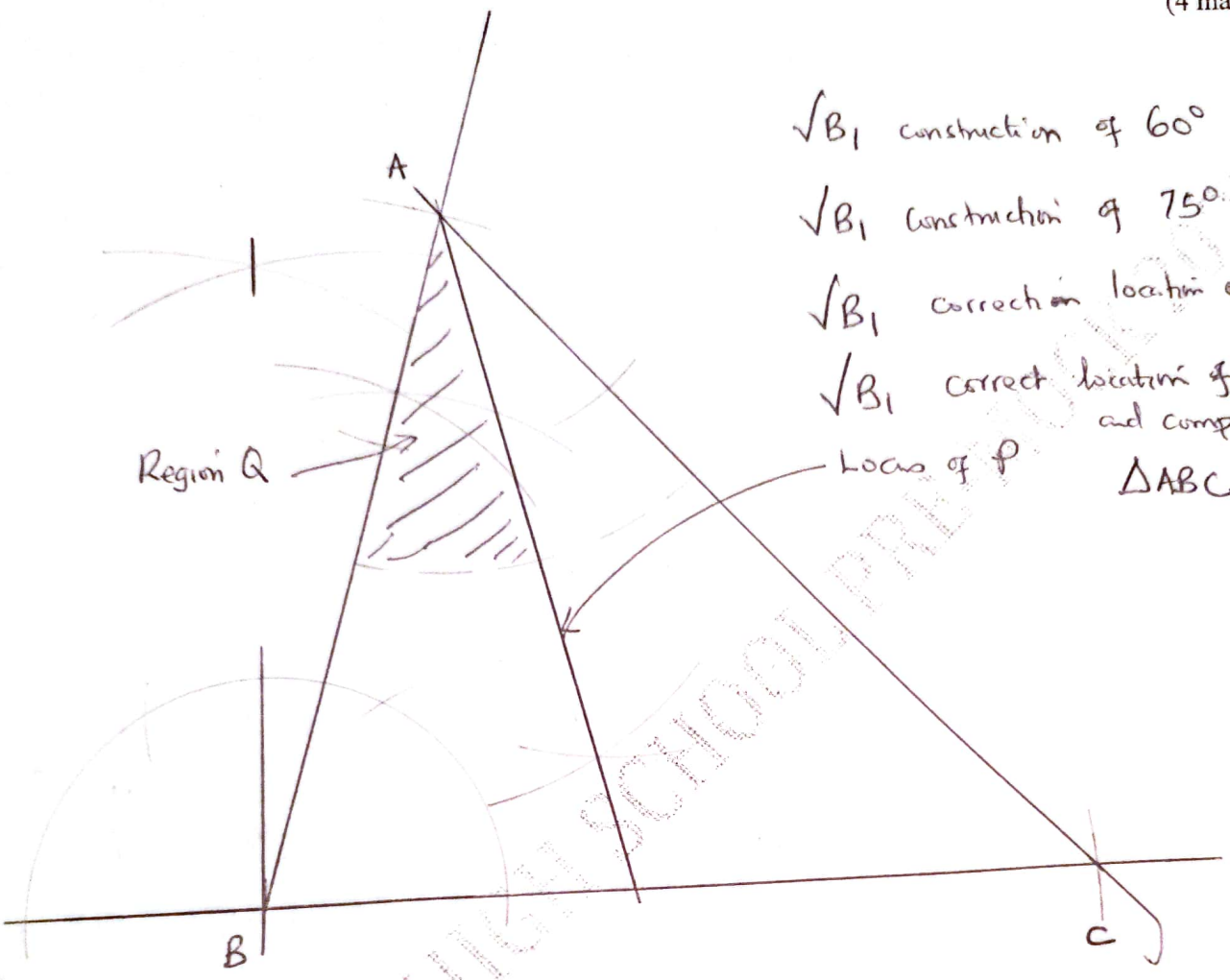
Cost before change in price $= 250\times7 + 3\times100$ $\surd M_1$
$= 2050$

Cost after change in price $= 225\times7 + 3\times110$ $\surd M_1$
$= 1905$

Amount paid less $= 2050 - 1905 = 145/=$ $\surd A_1$

18. a) Construct triangle ABC in which angle ABC is 75°and lengths AB and BC are 10.1cm and 11.2cm respectively.

(4 marks)



√B1 construction of 60°
√B1 Construction of 75°
√B1 correction location of A
√B1 correct location of C and completion of ΔABC

b) Measure length AC and angle ACB. (2 marks)

AC = 13 ± 0.1 cm √B1
∠ACB = 50 ± 1° √B1

c) Construct the locus of a point P equidistant from the sides AB and AC. (2 marks)

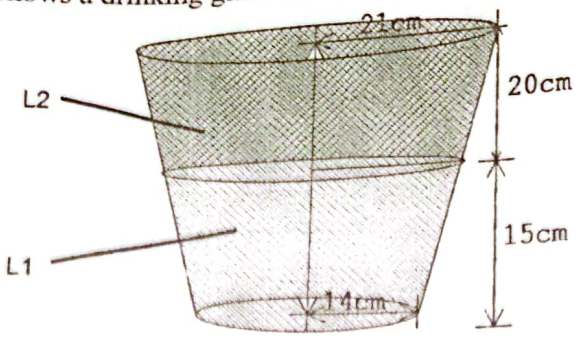
√B1 Angle bisector locus
√B1 Labelling of locus of P

d) Shade the region Q such that Q is closer to AB than AC but not greater than 5.2cm from A. (2 marks)

√B1 Dotted arc (< 5.2cm from A)

√B1 Region Q shaded

19. The figure below shows a drinking glass in the shape of a frustum.



Calculate to one decimal place:

a) the height of the cone from which the glass was cut. (2 marks)

$\frac{21}{14} = \frac{35+h}{h}$ ✓M1

$h = 70$

$H = 70 + 35$

$= 105.0\text{cm}^2$ ✓A1

b) the surface area, in cm^2, of the glass in contact with liquid L_1 occupying the lower 15cm of the height. (4 marks)

$\frac{21}{R_{15}} = \frac{105}{85}$ ✓M1

$R_{15} = 17\text{cm}$

Area of the curved surface

$= \pi \times 17\sqrt{17^2+85^2} - \pi \times 14\sqrt{14^2+70^2}$ ✓M1

$= 1489.770929$

Total surface area

$= 1489.770929 + 615.7521601$ ✓M1

$= 2105.5\text{cm}^2$ ✓A1

c) the surface area, in cm^2, of a spherical ball which can be molded from the molten liquid L_2 occupying the upper 20cm above liquid L_1. (4 marks)

Volume of liquid $L_2 = \frac{1}{3} \times \pi (21^2 \times 105 - 17^2 \times 85)$ ✓M1

$= 22766.07476$

$\frac{4}{3}\pi r_s^3 = 22766.07476$ ✓M1

$r_s^3 = 5435$

$r_s = 17.58192877$

Surface Area $= 4\pi (17.58192877)^2$ ✓M1

$= 3884.6\text{cm}^2$ ✓A1

20. Jenny may either walk to school along a route 5km or take a bus journey of 7km. The average speed of the bus is 24km/h faster than her average speed while walking. Taking the average walking speed to be x km/h:

a) Write down expressions for time of the journey; (2 marks)

(i) when walking

$\frac{5}{x}$ $\surd B_1$

(ii) when using the bus

$\frac{7}{x+24}$ $\surd B_1$

b) The journey by bus takes 36 minutes less than the journey on foot, find her walking speed in km/h. (5 marks)

$\frac{5}{x} - \frac{7}{x+24} = \frac{6}{10}$ $\surd M_1$

$50x + 1200 - 70x = 6x^2 + 144x$

$6x^2 + 164x - 1200 = 0$ $\surd M_1$

$x = \frac{-164 \pm 236}{12}$ $\surd M_1$

$x = 6$ or $-33\frac{1}{3}$ $\surd A_1$

$\therefore x = 6$ km/h $\surd B_1$

c) Hence find total time she took while traveling to school when she walked for two days and boarded the bus for four days. (3 marks)

$2\left(\frac{5}{6}\right) + 4\left(\frac{7}{30}\right)$ $\surd M_1$ $\surd M_1$

$= 2\frac{3}{5}$ hrs $\surd A_1$

21. The position vectors of A and B are $\begin{pmatrix}-4\\6\end{pmatrix}$ and $\begin{pmatrix}-8\\2\end{pmatrix}$ respectively. Point M is the midpoint of **AB** and N the midpoint of **OA**.

a) Find: (2 marks)

(i) the vector **AB**.

$\vec{AB} = \begin{pmatrix}-8\\2\end{pmatrix} + -\begin{pmatrix}-4\\6\end{pmatrix}$ $\surd M_1$

$= \begin{pmatrix}-4\\-4\end{pmatrix}$ $\surd A_1$

(2 marks)

(ii) the coordinates of points M and N.

$M\left(\frac{-4+-8}{2}, \frac{6+2}{2}\right) = M(-6,4)$ $\surd B_1$

$N(-2,3)$ $\surd B_1$

(iii) the modulus of **NM**. (3 marks)

$\vec{NM} = \begin{pmatrix}-6\\4\end{pmatrix} - \begin{pmatrix}-2\\3\end{pmatrix}$ $\surd M_1$

$= \begin{pmatrix}-4\\1\end{pmatrix}$

$|\vec{NM}| = \sqrt{(-4)^2 + (1)^2}$ $\surd M_1$

$= 4.123$ $\surd A_1$

b) The coordinates of a point C is (2,a). Vector **CA** is parallel to vector **OB**. Determine the value of a. (3 marks)

$\vec{CA} = \begin{pmatrix}-4\\6\end{pmatrix} - \begin{pmatrix}2\\a\end{pmatrix} = \begin{pmatrix}-6\\6-a\end{pmatrix}$

$\begin{pmatrix}-6\\6-a\end{pmatrix} = k\begin{pmatrix}-8\\2\end{pmatrix}$ $\surd M_1$

$k = \frac{3}{4}$

$6 - a = \frac{3}{4} \times 2$ $\surd M_1$

$a = 4.5$ $\surd A_1$

22. A water vendor has a tank of capacity 18900 litres. The tank is being filled from two pipes A and B which are closed immediately the tank is full. Water flows at the rate of 150000cm^3 per minute and 120000cm^3 per minute from A and B respectively.

a) Calculate the time it takes to fill the tank if both taps A and B are opened at the same time in hours. (4 marks)

Volume water flowing per minute

$= 150,000 + 120,000$ $\surd M_1$

$= 270,000$

Number of minutes used in filling the tank

$= \frac{18900\,000}{270,000}$ $\surd M_1$

$= 70$

Number of hours taken

$= \frac{70}{60}$ $\surd M_1 = 1\frac{1}{6}$ hrs $\surd A_1$ dem 1.166hrs

b) On a particular day the vendor started refilling the empty tank using taps A and B but was forced to start serving his customers after 25 minutes of filling. Given that the draining tap C supply 20 litres per minute to the customers determine the exact time of the day the tank was filled assuming that the customers supply was continuous from 1115hrs. (6 marks)

Volume of water filled in the tank after 25 minutes

$= \frac{25 \times 270,000}{1000}$ $\surd M_1$

$= 6750$

Volume of the tank be filled while the three taps are running

$= 18900 - 6750$ $\surd M_1$

$= 12150$

Rate of filling the tank per minute

$= 270 - 20$ $\surd M_1$

$= 250$ litres / minute

Time taken $= \frac{12150}{250}$ $\surd M_1$

$= 48$ mins 36s

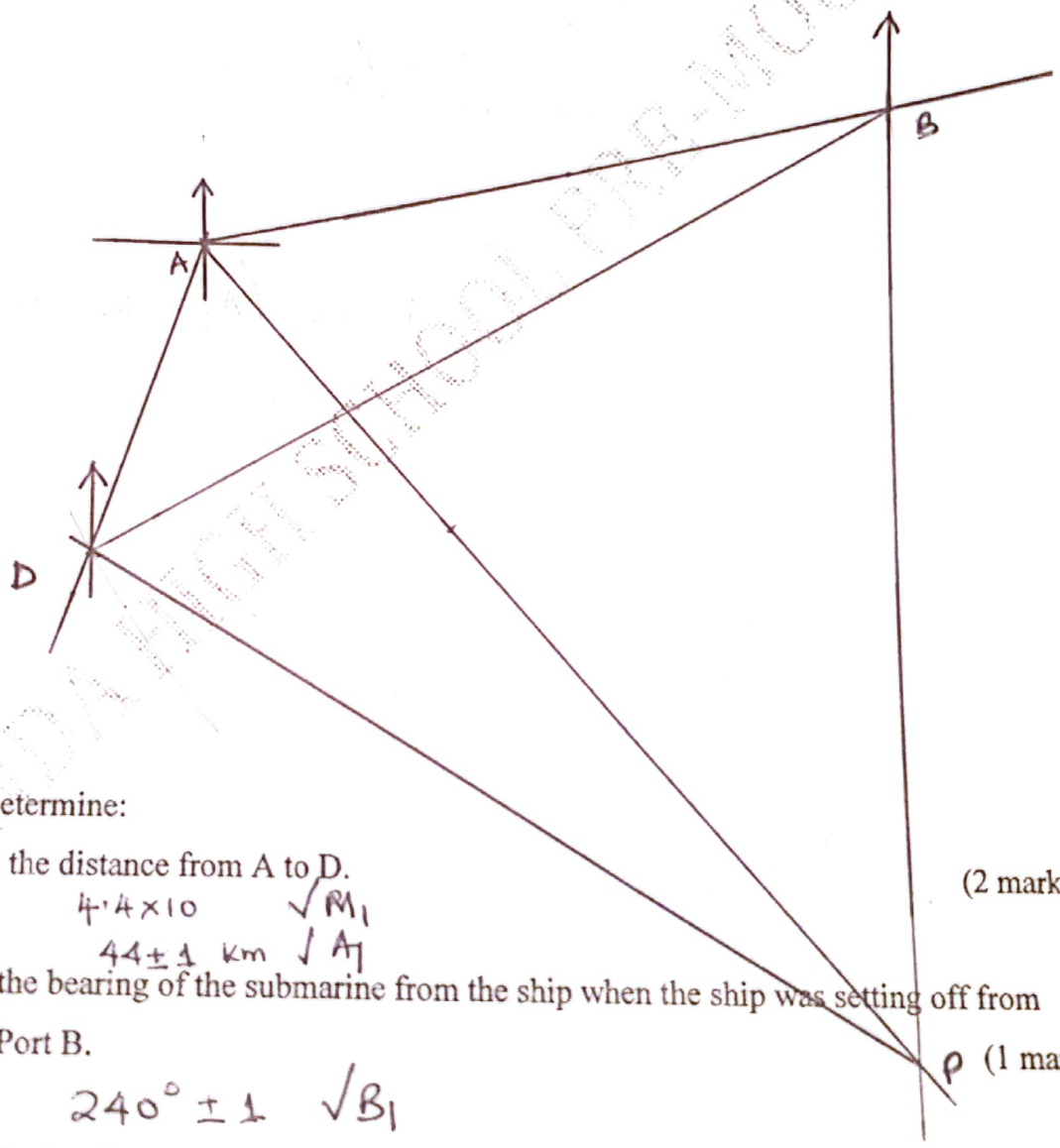
Time when the tank was filled

$= 1115$hrs $+ 48$min 36s $\surd M_1$

$= 1203:36$ pm $\surd A_1$

23. A port B is on a bearings of 080° from a port A and at a distance of 95km. A submarine is stationed at a port D, which is on a bearing of 200° from A, and a distance of 124km from B. A ship leaves B and moves directly southwards to an island P, which is on a bearing of 140° from A. the submarine at D on realizing that the ship was heading for the island P, decides to head straight for the island to intercept the ship.

a) Using a scale of 1cm to represent 10km draw a diagram to show the positions of A, B, D and P. (4 marks)



b) Hence determine:

(i) the distance from A to D. (2 marks)

$4\cdot4\times10$ $\surd M_1$

44 ± 1 km $\surd A_1$

(ii) the bearing of the submarine from the ship when the ship was setting off from Port B. (1 mark)

$240^\circ \pm 1$ $\surd B_1$

(iii) the bearing of the island P from D. (1 mark)

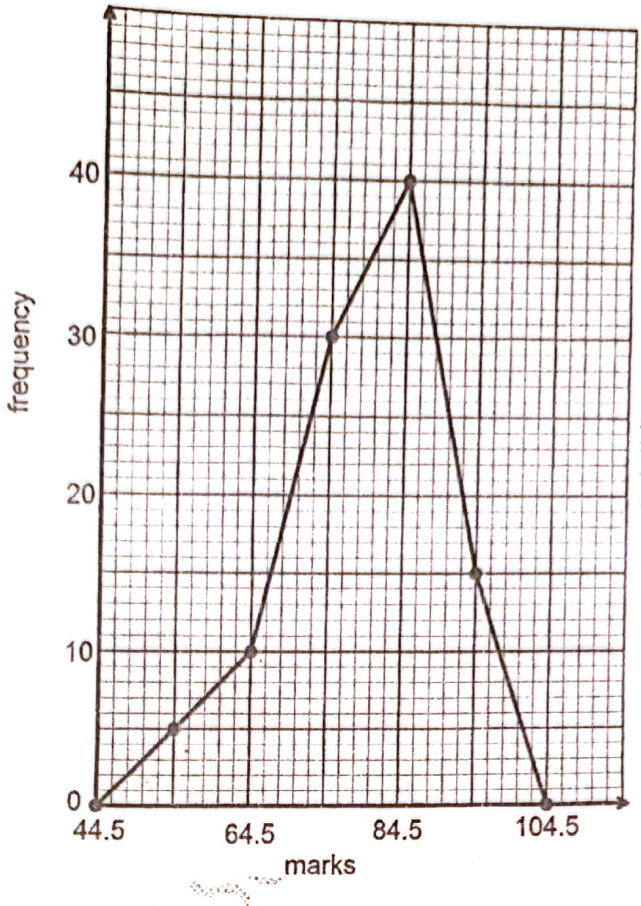
$120^\circ \pm 1^\circ$ $\surd B_1$

(iv) the distance the submarine had to cover to reach the island P. (2 marks)

$12\cdot5\times10$ $\surd M_1$

125 ± 1 km $\surd A_1$

24. The figure below shows a frequency polygon representing the scores of Form 4 Alpha students in a Kiswahili Test.



a) Generate the Frequency Distribution of the data under the columns given below in the table below. (4 marks)

Marks	Frequency (f)	Mid points(x)	fx	cf
49·5-59·5	5	54·5	272·5	5
59·5-69·5	10	64·5	645·0	15
69·5-79·5	30	74·5	2235·0	45
79·5-89·5	40	84·5	3380·0	85
89·5-99·5	15	94·5	1417·5	100
√B1	√B1		√B1	√B1

b) State the modal class. (1 mark)

79·5 - 89·5 √B1

c) Estimate:

(i) The mean score. (2 marks)

$\bar{X} = \frac{7950}{100}$ $\surd_{M1}$

$= 79.5$ $\surd_{A1}$

(ii) The median score. (3 marks)

$\frac{N}{2} = 50$ $\surd_{M1}$

$\text{Median} = 79.5 + \left(\frac{50-45}{40}\right)10$ $\surd_{M1}$

$= 80.75$ $\surd_{A1}$

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