



SECTION A (40 MARKS)

MATHEMATICS 450/2		SECTION A (40 MARKS)																							
July/August 2023																									
No.	Solution	Marks	Comments																						
1.	1728 6427 3³ 1728 = 2⁶ × 3³ $\sqrt[3]{2^6 \times 3^3} = 2^2 \times 3^1$ = 12 <table><tr><th colspan="2">Alternative</th></tr><tr><td>2</td><td>1728</td></tr><tr><td>2</td><td>864</td></tr><tr><td>2</td><td>432</td></tr><tr><td>2</td><td>216</td></tr><tr><td>2</td><td>108</td></tr><tr><td>2</td><td>54</td></tr><tr><td>3</td><td>27</td></tr><tr><td>3</td><td>9</td></tr><tr><td>3</td><td>3</td></tr><tr><td></td><td>1</td></tr></table>	Alternative		2	1728	2	864	2	432	2	216	2	108	2	54	3	27	3	9	3	3		1	M₁ A₁ M₁ A₁ 04	Prime factorizing 1728 or use of ladder method. For p.d.t. Taking square root & it's simplification. for a.w.b.
Alternative																									
2	1728																								
2	864																								
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2.	n(E)=15 a 2 6 4 a + 2 + 6 + 4 = 15 a = 3 n(A ∪ B) = 15 - 4 = 11 n(A) = 3 + 2 = 5 M₁ A₁ M₁ A₁ 04 For equating <i>sub</i> For C's 3 C's 11 C's 5																								
3.	$f^{-1}(x) = \frac{4x}{9+x}$ Let $f^{-1}(x)$ be y $y = \frac{4x}{9+x}$ $y(9+x) = 4x$ $9y = 4x - xy$ $9y = x(4 - y)$ M₁ For manipulating																								

	$x = \frac{9y}{4-y}$ $\therefore f(x) = \frac{9x}{4-x}$ the denominator = 0 for undefined $\therefore 4-x=0$ $x=4$	A₁ M₁ A₁	correct f(x) Equating to 0 Correct x
		04	
4.	Time $\Rightarrow \frac{90}{15} = 2\text{hrs}$ Total time = $2 + \frac{1}{2}$ Average speed = $\frac{\text{Tot. distance}}{\text{Tot. Time}}$ $= \frac{90+150}{3\frac{1}{2}} = \frac{240}{3.5}$ $= 53.3\text{km/h}^{-1}$ 68.5714km/h	B_T M₁ B_T M₁ M₁ A₁	for time 1st journey for total distance time added for total time for simplification
		04	
5.	$\overline{OP} = \begin{pmatrix} a \\ -5 \end{pmatrix}$, $\overline{OQ} = \begin{pmatrix} 6 \\ c \end{pmatrix}$, $\overline{PQ} = \begin{pmatrix} -1 \\ 13 \end{pmatrix}$ $\overline{OP} = \overline{OQ} - \overline{OP}$ $\begin{pmatrix} -1 \\ 13 \end{pmatrix} = \begin{pmatrix} 6 \\ c \end{pmatrix} - \begin{pmatrix} a \\ -5 \end{pmatrix}$ -1 = 6 - a -1 - 6 = -a a = 7 13 = c + 5 c = 8 $2 \overline{OQ} = 2\sqrt{6^2 + 8^2}$ 2×10 = 20 units $\text{or } \begin{pmatrix} 12 \\ 16 \end{pmatrix}$	M₁ A₁ A₁ A₁ A₁	equating vectors C's 7 C's 8 C's 20
		04	
6.	$0.12\text{m} = (0.12 \times 100)\text{cm}$ = 12cm v.s.f. = $\frac{81}{3} = 27$ l.s.f. = $\sqrt[3]{27} = 3$ $\frac{h}{12} = \frac{1}{3}$ h = 4cm 0.04m	M₁ M₁ M₁ A₁	for v.s.f for L.s.f. for equating ratios for 4
		04	

7.	$\frac{6000.000}{12}$ Less monthly $= 500,000$ $\text{tax} = \frac{20}{100} \times 500,000$ $= 100,000$ $\text{Net} = 500,000 - 100,000$ $400,000$	B_1 B_1 M_1 A_1	converting to monthly gross simplifying simplifying for subtracted for net fee
8.	$\log \frac{6^2}{3} - \log 1.2$ $\log \frac{36}{3} - \log 1.2$ $\log \frac{12}{1.2}$ $\log 12 \div \frac{12}{10}$ $\log_{10} 10 = 1$	B_1 M_1 M_1 A_1	simplifying for application of laws Squaring Dividing simplification C's 1
9.	$t_1 = \frac{10}{x}, t_2 = \frac{10}{x+1}$ $\frac{10}{x} + \frac{30}{60} = \frac{10}{x+1}$ $\frac{20-x}{2x} = \frac{10}{x+1}$ $20x + 20 - x^2 - x = 20x$ $x^2 + x - 20 = 0$ $(x-4)(x+5) = 0$ Cult $x = 4$ or $x = -5$ $\therefore x = 4 \text{ km/hr}$ Accept $x = 4$	B_1 M_1 M_1 A_1	for time and for equating t_1 and t_2 for solving equation Solving quadratic eqn for correct answer For correct answer
10.	$P \propto \frac{1}{q^2}$ $P = \frac{k}{q^2}$ $5 = \frac{k}{2^2}$ $5 \times 4 = k$ $k = 20$ $P = \frac{20}{q^2}$ $P = \frac{20}{100}$ $P = \frac{1}{5}$ Accept 0.2	M_1 A_1 M_1 A_1 A_1	manipulating for $P = \frac{k}{q^2}$ correct for value of k simplifying C's $\frac{1}{5}$ C.A.O

SECTION B

11. (a) $h(x) = x^2 + 3$, $g(x) = x - 1$

$$hg(x) = (x-1)^2 + 3$$

$$\therefore hg(a) = (a-1)^2 + 3$$

$$= a^2 - 2a + 4$$

$$gh(x) = x^2 + 3 - 1$$

$$\therefore gh(a) = a^2 + 2$$

$$a^2 - 2a + 4 = a^2 + 2$$

$$-2a = -2$$

$$a = 1$$

$$2a = \frac{x}{x} \quad a = 1$$

M₁

Correct substitution of $hg(x)$ or $gh(a)$

M₁

Correct simplification $gh(x)$ or $gh(a)$

M₁

M₁

A₁

For equating simplification
For solving

(b) (i) Let $k = x^2 - 5x - 14$

$$x^2 - 5x = k + 14$$

$$\left(x - \frac{5}{2}\right)^2 = k + 14 + \frac{25}{4}$$

$$\left(x - \frac{5}{2}\right)^2 = k + \frac{81}{4}$$

$$x - \frac{5}{2} = \sqrt{k + \frac{81}{4}}$$

$$x = \sqrt{k + \frac{81}{4}} + \frac{5}{2}$$

$$h^{-1}(x) = \sqrt{\left(x + \frac{81}{4}\right)} + \frac{5}{2}$$

$$(ii) h^{-1}(4.75) = \sqrt{\left(4.75 + \frac{81}{4}\right)} + \frac{5}{2}$$

$$= \frac{10}{2} + \frac{5}{2}$$

$$= 7.5 \quad \text{or } -2.5$$

M₁

Let $k(x) = k$

M₁

Transformation of formula

For Quadratic

M₁

Taking square root on each side.

Add $\frac{5}{2}$ on each side For substitution

M₁

For simplification

A₁

For $h^{-1}(x)$

For $h^{-1}(x)$

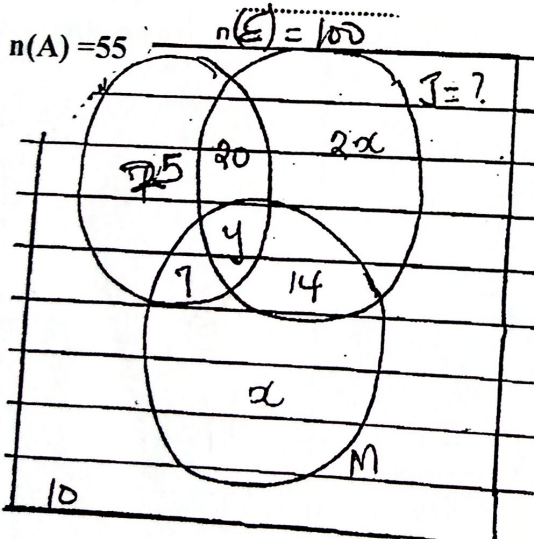
M₁

Substit. In $h^{-1}(x)$

A₁

Accept $15/2$ or $-7 1/2$

12.



B₁

for 25

B₁

for 20

B₁

for 7
Other regions

B₁

for 14

Let x represent those who visited Mbale only From
 $y + 7 + 20 + 25 = 55$
 $y + 52 = 55$
 $y = 3$
 $\therefore 20 + y + 14 + 2x + x + 7 + 25 + 10 = 100$
 $20 + 3 + 14 + 2x + x + 32 + 10 = 100$
 $x = 7$
 $\therefore$ Those who visited Jinja
 $20 + y + 2x + 14$
 $= 51$ students

~~B₁~~
~~B₁~~
~~B₁~~
~~M₁~~
~~A₁~~

for 10
for x add
for 3
simplifying
for 7

~~M₁~~
~~A₁~~

For adding
simplifying
for 51

b(ii)

Not visited Area = $10 + x + 14 + 2x$
 $10 + 21 + 14$
 $= 45$ students.

~~M₁~~
~~A₁~~

For adding the
simplifying regions
for 45

(c) P (Almost two towns) =

$$\frac{10 + 7 + 14 + 25 + 20 + 14 + 7}{100}$$

$$= \frac{97}{100}$$

Accept 0.97

~~M₁~~

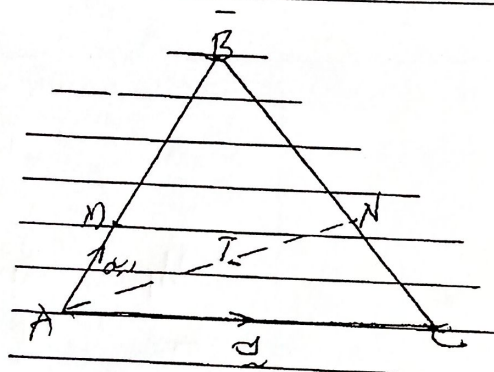
Identify the region
simplifying (at most region)

~~A₁~~

for 45 97%

12

13. (a)



(i) $\overline{AB} = \overline{AM} + \overline{MB}$ M_1
 $= x + 2\overline{AM}$ ~~A₁~~ ~~M₁~~
 $x + 2x = 3x$ ~~M₁~~ ~~A₁~~

(ii) $\overline{BC} = \overline{BA} + \overline{AC}$ M_1
 $= -3x + y$ A_1

(iii) $\overline{BN} = \frac{3}{4} \overline{BC}$

For correct
~~M₁~~
roof

For correct
note

~~A₁~~

Express for AB

Correct answer

~~M₁~~

Correct note

Correct route

~~A₁~~

For BC

$$2(3') = 162$$

$$\frac{2(3')}{2} = \frac{162}{2}$$

$$3' = 81$$

$$3' = 3^4$$

$$t = 4$$

M₁

M₁

A₁

Dividing

Applying of rules
prove factorizing

for t = 4

$$(b) \log(x+y) = 1$$

$$x+y = 10 \quad (i)$$

$$\log_2(xy) = 4$$

$$xy = 16 \quad (ii)$$

$$(10-y)(y) = 16$$

$$10y - y^2 = 16$$

$$\text{Gather } y_1 = 2 \text{ or } y_2 = 8$$

Finding x;

$$x = 10 - y$$

When y = 2,

$$\Rightarrow x = 10 - 2 = 8$$

When y = 8,

$$x = 10 - 8 = 2$$

B₁

B₁

M₁

M₁

M₁

A₁

M₁

A₁

Extracting eqn.
(for Eqn (i))

Extracting eqn.
(for Eqn (ii))

simplifying
substituting

for values of y

for quadratic
substituting for

the factors
correct value of y = 2 or

for both y = 8

for x = 2

substituting
c's 2 for x = 8

12

$$16. 6+x = \text{distance}$$

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

$$9:45 + \frac{x}{60}$$

$$10:50 + \frac{240-x}{80}$$

$$t_1 = 9:45 + \frac{x}{60}$$

(1)

$$t_1 = t_2$$

$$t_2 = 10:50 + \frac{240-x}{80}$$

(1)

M₁

M₁

For simplifying
Eqn (1)

For simplifying
manipulating Eqn (ii)

$$9:45 + \frac{x}{60} = 10:50 - 9:45 \quad 9:45 + \frac{x}{60} = 10:10 + \frac{240-x}{80}$$

$$\frac{8x-1440}{480} = \frac{13}{12}$$

$$\frac{x}{60} - \frac{240-x}{80} = 10:50 - 9:45$$

M₁

M₁

A₁

Equating

Extraction

correct value of x

$$\frac{12(14x-1440)}{480} = \frac{13}{12}$$

$$\frac{8x-1440+6x}{480} = \frac{13}{12}$$

$$12(14x-1440) = 13(480)$$

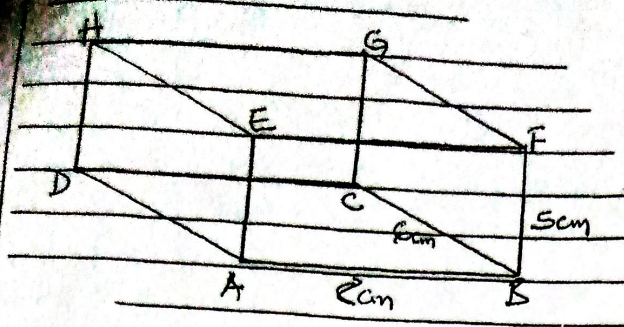
$$\frac{14x-1440}{480} = \frac{13}{12}$$

$$168x - 17280 = 6240$$

$$x = 140 \text{ km}$$

$9:45 + \frac{140}{60}$ $9:45 + 2:20$ $= 12:05$ $S = \frac{d}{t}$ $40 = \frac{240}{t}$ $t = 6\text{hrs}$ $9:45 + 6:00$ $= 15:45$ $S = \frac{d}{t}$ $80 = \frac{240}{t}$ $t = \frac{240}{80}$ $t = 3\text{ hrs}$ So; (c) 10: 50 9: 45 <u>3: 00</u> 13: 50 <u>4: 00</u> 13: 45 13: 50 <u>-13: 45</u> 5minutes	M_1 A_1 M_1 A_1 B_1 M_1 A_1	Adding Adding Equating correct value of t C's 3 Adding time correct value of t
	12 marks	

$$\begin{array}{r} 10:50 \\ - 9:45 \\ \hline 1:05 \end{array} \rightarrow \begin{array}{r} 65 \\ \hline 60 \end{array}$$



Let x be the length CG

$$2x + 6 = 16$$

$$2x = 10$$

$$x = 5$$

Or

x be length BF

$$EA + AB + BF + FE = 26$$

$$x + 8 + x + 8 = 26$$

$$2x + 16 = 26$$

$$\frac{2x}{2} = \frac{26 - 16}{2} = \frac{10}{2}$$

$$x = 5$$

For
AB
BE
EC

For base seen.
For closed figure
Am/sketch

for equation

for $x = 5$

(b) (i) Volume = $L \times W \times H$

$$8 \times 6 \times 5$$

$$240\text{cm}^3$$

M_1M_1
 A_1

substitution &
simplification
C's 240.

(b)(ii) Total surface Area =

$$2 [lw + wh + lh]$$

$$2(6 \times 6 + 6 \times 5 + 8 \times 5)$$

$$2(48 + 30 + 40)$$

$$236\text{cm}^2$$

M_1M_1
 M_1

A_1

substitution into the formula
Areas simplification
Doubling.

for 236.

12 marks

END