TABEA LILIAN (HS)

WAKISSHA JOINT MOCK EXAMINATIONS
MARKING GUIDE
Uganda Certificate of Education
MATHEMATICS 456/2
July/August 2023

SECTION A (40 MARKS)

No.	Solution			Marks	Comments
1.					

Factor tree:
1728 → 64 and 27
27 = 3^3

$1728 = 2^6 \times 3^3$

$\sqrt[3]{2^6 \times 3^3} = 2^2 \times 3^1$

$= 12$

Alternative (ladder method):

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

Marks:
M_1 — Prime factorizing 1728 or use of ladder method.
A_1 — product (index form) Taking square root & it's simplification.
M_1 → Cube root
A_1
04

04

2.

$n(\varepsilon) = 15$

$a + 2 + 6 + 4 = 15$

$a = 3$

$n(A \cup B) = 15 - 4 = 11$

$n(A) = 3 + 2 = 5$

Marks:
M_1 — For equating — Correct subst^n
A_1 — For C's 3
A_1 — C's 11
B_1 — C's 5
$M_1 A_1$ — M_1 for correct subst.

04

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3. $f^{-1}(x) = \dfrac{4x}{9+x}$

Let $f^{-1}(x)$ be y

$y = \dfrac{4x}{9+x}$

$y(9 + x) = 4x$

$9y = 4x - xy$

$9y = x(4 - y)$

Marks:
M_1 — For manipulating

	$x = \dfrac{9y}{4-y}$		
	$f(x) = \dfrac{9x}{4-x}$	A₁	correct
	the denominator $= 0$ for undefined	M₁	Equating
	$4 - x = 0$	A₁	
	$x = 4$		
		04	

4.	Time $= \dfrac{90}{15} = 2hrs$	B̶ M₁	Total time for time 1ˢᵗ journey
	Total time $= 2 + 1\frac{1}{2}$	B̶ M₁	time added Total
	Average speed $= \dfrac{\text{Tot. distance}}{\text{Tot. Time}}$		
	$= \dfrac{90 + 150}{3\frac{1}{2}} = \dfrac{240}{3.5}$	M₁	for simplificat.
		A₁	
	$= 53.\overline{3} km/h^{-1}$ $68.5714\ km/hr$ or $68\frac{4}{7} km/hr$	**04**	

5.	$\overline{OP} = \begin{pmatrix} a \\ -5 \end{pmatrix}$ $\overline{OQ} = \begin{pmatrix} 6 \\ c \end{pmatrix}$ $\overline{PQ} = \begin{pmatrix} -1 \\ 13 \end{pmatrix}$		
	$\overline{OP} = \overline{OQ} - \overline{OP}$	M₁	Correct substn. equating vectors
	$\begin{pmatrix} -1 \\ 13 \end{pmatrix} = \begin{pmatrix} 6 \\ c \end{pmatrix} - \begin{pmatrix} a \\ -5 \end{pmatrix}$		
	$-1 = 6 - a$		
	$-1 - 6 = -a$		C's 7
	$a = 7$	A₁	
	$13 = c + 5$		
	$c = 8$		C's 8
	$2|\overline{OQ}| = 2\sqrt{6^2 + 8^2}$	A₁	
	2×10		
	$= 20$ units	A₁	C's 20 Acc $\begin{pmatrix} 12 \\ 16 \end{pmatrix}$
		04	

6.	$0.12m = (0.12 \times 100) cm$		
	$= 12 cm$		
	$v.s.f. = \dfrac{81}{3} = 27$	B̶₁ M₁	for v.s.f
	$l.s.f. = \sqrt[3]{27} = 3$	B₁ M₁	for L.s.f.
	$\dfrac{h}{12} = \dfrac{1}{3}$	A̶₁ M₁	for equating ratios
	$h = 4cm$	A₁	for 4
		04	

No.	Working	Marks	Comment
7.	$\dfrac{6000,000}{12}$		
	$= 500,000$	B_1	converting Gross monthly
	$tax = \dfrac{20}{100} \times 500,000$	M_1	simplifying
	$= 100,000$	B_1	for tax
	$Net = 500,000 - 100,000$	M_1	simplifying Subtraction
	$400,000$	A_1	for net fee
		04	
8.	$\log \dfrac{6^2}{3} - \log 1.2$	B_1	simplifying $6^2/36$
	$\log \dfrac{36}{3} - \log 1.2$	M_1	Squaring law of log
	$\log \dfrac{12}{1.2}$		
	$\log 12 \div \dfrac{12}{10}$	M_1	Dividing simplification
	$\log_{10}^{10} = 1$	A_1	C's 1
		04	
9.	$t = \dfrac{10}{x}$, $t = \dfrac{10}{x+1}$	$B_1\ M_1$	t_1 and t_2 for time and for equating
	$\dfrac{10}{x} + \dfrac{30}{60} = \dfrac{10}{x+1}$	M_1	for equating
	$\dfrac{20-x}{2x} = \dfrac{10}{x+1}$		
	$20x + 20 - x^2 - x = 20x$		Solving
	$x^2 + x - 20 = 0$	M_1	
	$(x-4)(x+5) = 0$		for answer $4km/hr$
	Cult $x = 4$ or $x = -5$	A_1	
	$\therefore x = 4km/hr$		
		04	
10.	$P \propto \dfrac{1}{q^2}$		
	$P = \dfrac{k}{q^2}$	M_1	manipulating for $P = k/q^2$
	$5 = \dfrac{k}{2^2}$		
	$5 \times 4 = k$		
	$k = 20$	A_1	correct value of $k =$
	$P = \dfrac{20}{q^2}$		
	$P = \dfrac{20}{100}$	M_1	cdt k. simplifying
	$P = \dfrac{1}{5}$	A_1	caw C's $1/5$ acc 0.2
		04	

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

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

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

$= a^2 - 2a + 4$

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

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

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

$-2a = 2$

$a = 1$

M_1	for $hg(a)$ Correct substitution of $hg(x)$ or $hg(a)$
M_1	for $gh(a)$ Correct simplification $gh(x)$ or $gh(a)$
M_1	for equating
M_1	Simplification solving
A_1	

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

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

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

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

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

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

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

M_1	Let $k(x) = k$ Transformation a quadratic eqn Transformation of formular
M_1	Taking square root on each side substitute Add $\frac{5}{2}$ on each side
M_1	Simplification For $h^{-1}(x)$
A_1	for $h^{-1}(x)$

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

$= \dfrac{10}{2} + \dfrac{5}{2}$ or $\dfrac{10}{2} - \dfrac{5}{2}$

$= 7.5$ or 2.5 Acc $\frac{15}{2}$ or $\frac{5}{2}$

M_1	Substit. In $h^{-1}(x)$
A_1	Accept $^{15}/_2$ or $7^1/_2$

12 (total)

12.
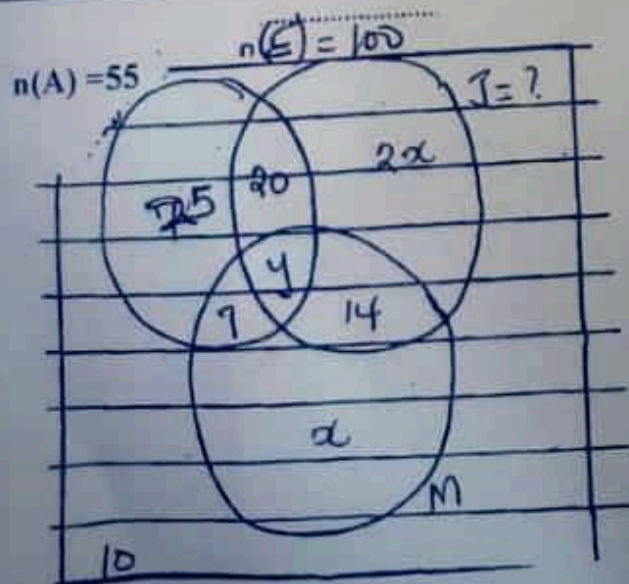
B_1	for $2x$ and x
B_1	for $\cancel{2}$ 5
B_1	for 20
B_1	for Other regions 7
B_1	for 14
B_1	for 10

$\frac{3}{4}(y-3x)$ BN: NC=3:1

$\overline{AN} = \overline{AB} + \overline{BN}$

$= 3x + \frac{3}{4}(y-3x)$ M_1

$= \frac{12x + 3y - 9x}{4} = \frac{3}{4}(x+y)$

(b) $\overline{MT} = \overline{MA} + \overline{AT}$

$-x + \frac{2}{3} + \left(\frac{3}{4}x + \frac{3}{4}y\right) = \frac{2}{4}(-x+y)$

$\overline{TC} = \overline{TA} + \overline{AC} = \frac{-2}{3}\left(\frac{2}{4}x + \frac{3}{4}y\right) + y$ M_T

$\frac{2}{4}(y-x)$

$\frac{\overline{MT}}{\overline{TC}} = \frac{\frac{2}{4}(y-x)}{\frac{2}{4}(y-x)}$

$\frac{\overline{MT}}{\overline{TC}} = 1$

$\overline{MT} = \overline{TC}$

Since T is a common point, M T and C are collinear.

Smplification	
M_1 Correct route	
m_1 Correct route (ds BC.)	
A Correct answer Cao	
M_1 Simplification Correct routes	
m_1 Correct substitn.	
Correct $\overline{TC}$	
M_1 simplifying	
A_1 correct ratio or answer Value of K	
B_1 conclusion	
12	

14. (a) $\frac{4,800,000}{15}$

shs $320,000$

(b) Cash terms

$\frac{1}{5} \times 10 = 2\,pieces$

$2 \times 5000,000 = 10,000,000/=$

Hire purchase,

Initial Deposit $= \frac{25}{100} \times 4000,000$

$= 1000,000$

$1,000,000 + 4,800,000$

$= 5,800,000$

Hire purchase $= 5,800,000 \times 8$

Shs $46,400,000$

Total $= 46,400,000 + 10,000,000$

$56,400,000/=$

Profits $=$ S.P $-$ B.P

$56,400,000 - (10 \times 4000,000)$

Profits $= 16,400,000/=$

M_1 Dividing	
A_1 correctitude	
M_1A_1 simplification	
M_1 simplification	
A_1 for 5800,000	
$M_1 \checkmark$ Correct answer cds 5800,R	
A_1 cao simplifying 46,	
$M_1 \checkmark$ cds 46,400,0	
A_1 Cao	
$M_1 \checkmark$ Adding for cd st	
A_1 correct answer	

Let x represent those who visited Mbale only From

$y + 7 + 20 + 25 = 55$

$y + 52 = 55$

$y = 3$

$20 + y + 14 + 2x + x + 7 + 25 + 10 = 100$

$20 + 3 + 14 + 2x + x + 32 + 10 = 100$

$x = 7$

∴ Those who visited Jinja

$20 + y + 2x + 14$

$= 51 \text{ students}$

	B̶₁	for →̶
	M̶₁	simplifying
	A̶₁	for 7̶
	M₁	addition simplifying
	A₁	for 51

b(ii)

Not visited Arua $= 10 + x + 14 + 2x$

$10 + 21 + 14$

$= 45 \text{ students.}$

M₁	for adding region simplifying
A₁	for 45

(c) P (Almost two towns) =

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

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

M₁	Identifying atmost region simplifying
A₁	for 45 Acc 0.97

12

13. **(a)**
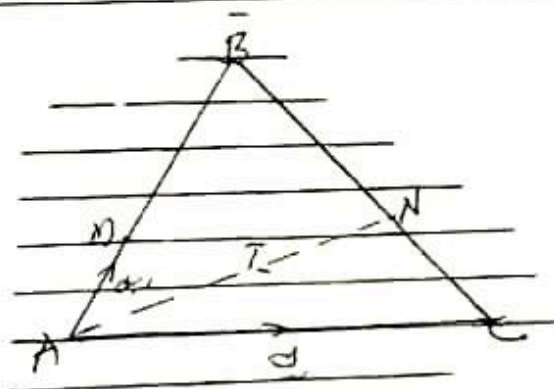
(i) $\overline{AB} = \overline{AM} + \overline{MB}$ M₁

$= \underline{x} + 2\overline{AM}$ A₁M₁

$x + 2x = 3\underline{x}$ M₁A₁

M₁	Correct ratio / route. For correct roof expression
A₁	

(ii) $\overline{BC} = \overline{BA} + \overline{AC}$ M₁

$= -3x + y$ A₁

M₁	Correct answer path / route.
A₁	Correct route expression

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

15. (a) $2(3^t) = 162$

$$\frac{2(3^t)}{2} = \frac{162}{2}$$

$3^t = 81$

$3^t = 3^4$

$t = 4$

A_1	correct answer
M_1	Adding/subtracting
M_1	Dividing
M_1	prime factorizing/indices
A_1	for $t = 4$

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

$x + y = 10$ _____ (i)

$\log_2(xy) = 4$

$xy = 16$ _____ (ii)

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

$10y - y^2 = 16$ $(y - 2)(y - 8) = 0$

Gather $y_1 = 2$ or $y_2 = 8$

Finding x:

$x = 10 - y$

When $y = 2$,

$\Rightarrow x = 10 - 2 = 8$

When $y = 8$,

$x = 10 - 8 = 2$

B_1	Extracting eqn.
B_1	Extracting eqn. substn simplifying for quadratic
M_1	for values of y
M_1	for factors
M_1	substituting
A_1	correct value of y
M_1	substituting $x = 8$
A_1	$x = 2$

12

16. $6 + x = distance$

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

$9:45 + \dfrac{x}{60}$ $10:50 + \dfrac{240 - x}{80}$

$t_1 = 9.45 + \dfrac{x}{60}$

$t_1 = t_2$ $t_2 = 10:50 + \dfrac{240 - x}{80}$

$9:45 + \dfrac{x}{60} = 10:50 - 9.45$ $9:45 + \dfrac{x}{60} = 10:10 + \dfrac{240 - x}{80}$

$\dfrac{8x - 1440}{480} = \dfrac{13}{12}$ $\dfrac{x}{60} - \dfrac{240 - x}{80} = 10:50 - 9:45$

$\dfrac{12(14x - 1440)}{480} = \dfrac{13}{12}$ $\dfrac{8x - 1440 + 6x}{480} = \dfrac{13}{12}$

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

$168x - 17280 = 6240$

$x = 140km$

M_1	equating simplifying
M_1	manipulating
M_1	Equating
M_1	Extraction
A_1	correct value of

$9:45 + \dfrac{140}{60}$

$9:45 + 2:20$

$= 12:05$

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

$40 = \dfrac{240}{t}$

$t = 6hrs$

$9:45 + 6:00$

$= 15:45$

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

$80 = \dfrac{240}{t}$

$t = \dfrac{240}{80}$

$t = 3\ hrs$

So; (c)   10: 50   9: 45
           3: 00   4: 00
         ─────────   ─────────
          13: 50   13: 45

          13: 50
         -13: 45
         ─────────
          5minutes

M_1	Adding	
A_1	Adding	
M_1	Equating	
A_1	correct value of t	
B_1	C's 3	
M_1	Adding time	
A_1	correct value of t	
	12 marks	
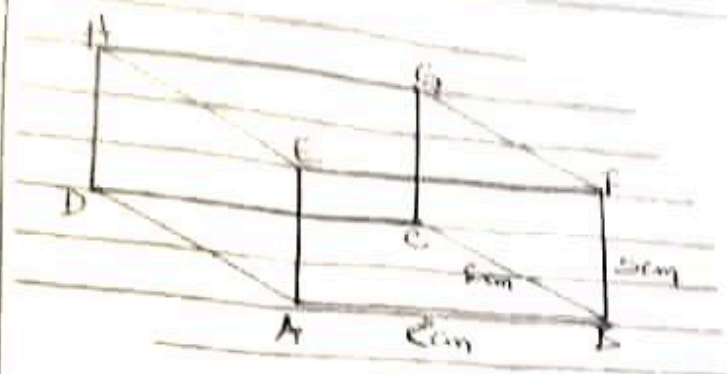
Let x be the length CG	Or	B_1 (a) length AE
		B_1 (b) width BC
$2x + 6 = 16$	x be length BF	B_1 (c) height CG
$2x = 10$	EA + AB + BF + FE = 26	
$x = 5$	$x + 8 + x + 8 = 26$	$D_1 D_1 B_1$ For base seen. For closed figure Arm/sketch
	$2x + 16 = 26$	
	$\dfrac{2x}{2} = \dfrac{26-16}{2} = \dfrac{10}{2}$	M_1 for equation
	$x = 5$	A_1 for $x = 5$
		5 marks

(b) (i) Volume = L x W x H	$M_1 M_1$	substitution &
$\quad 8 \times 6 \times 5$	A_1	simplification
$\quad 240 cm^3$		C's 240. 3 marks

(b)(ii) Total surface Area =	$M_1 M_1$	substitution
$\quad 2 [lw + wh + lh]$	M_1	Areas Doubling.
$2(6 \times 8 + 6 \times 5 + 8 \times 5)$	A_1	for 236.
$2 (48 + 30 + 40)$		
$236 cm^2$		4 marks
	12 marks	

END