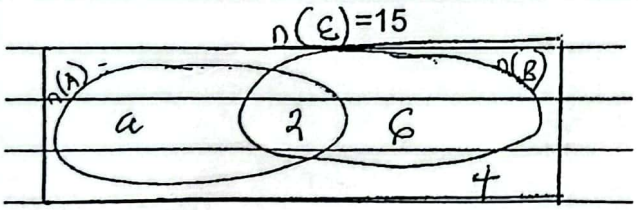
WAKISSHA JOINT MOCK EXAMINATIONS
MARKING GUIDE
Uganda Certificate of Education
MATHEMATICS 456/2
July/August 2023

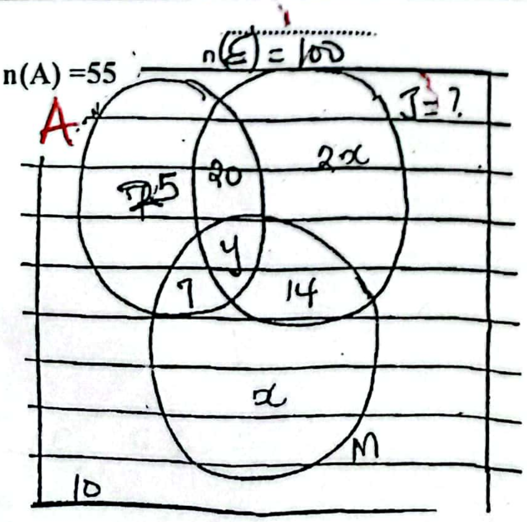
SECTION A (40 MARKS)

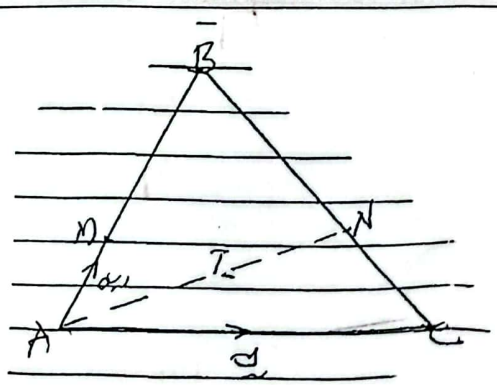
No.	Solution	Marks	Comments
1.	1728 64 27 3^3 $1728 = 2^6 \times 3^3$ $\sqrt[3]{2^6 \times 3^3} = 2^2 \times 3^1$ $= 12$ Alternative 2 | 1728 2 | 864 2 | 432 2 | 216 2 | 108 2 | 54 3 | 27 3 | 9 3 | 3 1	M_1 A_1 M_1 A_1 04	Prime factorizing 1728 or use of ladder method. Taking square root & it's simplification.
		04	
2.	 $a + 2 + 6 + 4 = 15$ $a = 3$ $n(A \cup B) = 15 - 4 = 11$ $n(A) = 3 + 2 = 5$	M_1 A_1 B_1 B_1 04	For equating For C's 3 C's 11 C's 5
3.	$f^{-1}(x) = \frac{4x}{9+x}$ Let $f^{-1}(x)$ be y $y = \frac{4x}{9+x}$ $y(9+x) = 4x$ $9y = 4x - xy$ $9y = x(4 - y)$	M_1	For manuplating

	$x = \frac{9y}{4-y}$ $\therefore f(x) = \frac{9x}{4-x}$ the denominator = 0 for uncle fined $\therefore 4-x=0$ $x=4$	A_1 M_1 A_1	correct f(x) Equaling ~~to 0~~ denominator to 0 Correct x
		04	
4.	Time $\Rightarrow \frac{90}{45} = 2hrs$ Total time = ~~$2+2\frac{1}{2}$~~ $2+1.5$ Average speed = $\frac{\text{Tot. distance}}{\text{Tot. Time}}$ $= \frac{90+150}{3\frac{1}{2}} = \frac{240}{3.5}$ $= 53.3 km/h^{-1}$	B_1 B_1 M_1 A_1	for time 1st journey time added Accept 68.57 or 69.5714 or $68\frac{4}{7}$
		04	
5.	$\overrightarrow{OP} = \begin{pmatrix} a \\ -5 \end{pmatrix}$, $\overrightarrow{OQ} = \begin{pmatrix} 6 \\ c \end{pmatrix}$, $\overrightarrow{PQ} = \begin{pmatrix} -1 \\ 13 \end{pmatrix}$ $\overrightarrow{OP} = \overrightarrow{OQ} - \overrightarrow{OP}$ $\begin{pmatrix} -1 \\ 13 \end{pmatrix} = \begin{pmatrix} 6 \\ c \end{pmatrix} - \begin{pmatrix} a \\ -5 \end{pmatrix}$ $-1 = 6 - a$ $-1-6 = -a$ $a = 7$ $13 = c+5$ $c = 8$ $2\lvert\overrightarrow{OQ}\rvert = 2\sqrt{6^2+8^2}$ $2x10$ $= 20$ units	M_1 A_1 A_1 A_1	equating vectors C's 7 C's 8 C's 20 Accept $2\begin{pmatrix} 6 \\ 8 \end{pmatrix} = \begin{pmatrix} 12 \\ 16 \end{pmatrix}$ B1
		04	
6.	$0.12m = (0.12 \times 100)cm$ $= 12cm$ $v.s.f. = \frac{81}{3} = 27$ $l.s.f. = \sqrt[3]{27} = 3$ $\frac{h}{12} = \frac{1}{3}$ $h = 4cm$	~~B_1~~ M_1 ~~B_1~~ M_1 M_1 A_1	for v.s.f for L.s.f. for equating ratios for 4 Accept 0.04m
		04	

7.	$\frac{6000.000}{12}$ $=500,000$ $tax=\frac{20}{100}\times 500,000$ $=100,000$ $Net=500,000-100,000$ $400,000$	B_1 ~~M_1~~ B1 M_1 A_1	converting simplifying simplifying for net fee
		04	
8.	$\log\frac{6^2}{3}-\log 1.2$ $\log\frac{36}{3}-\log 1.2$ $\log\frac{12}{1.2}$ $\log\left(12\div\frac{12}{10}\right)$ $\log_{10}^{10}=1$	B_1 M_1 M_1 A_1	~~simplifying~~ for 6^2 or 36 ~~Squaring~~ application of law of logs ~~Dividing~~ Simplification C's 1
		04	
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 $x=-5$ $\therefore x=4$km/hr	B_1 ~~M_1~~ M_1 M_1 A_1	for both t_1 & t_2 for time and for equating for equating Solving the quadratic eqn. for cared answer
		04	
10.	$P\propto\frac{1}{q^2}$ $P=\frac{k}{q^2}$ $5=\frac{k}{2^2}$ $5\times 4=k$ $k=20$ $P=\frac{20}{q^2}$ $P=\frac{20}{100}$ $P=\frac{1}{5}$	M_1 A_1 M_1A_1	manipulating correct for C^3 k simplifying C's $^1/_5$ accept $P=0.2$
		04	

SECTION B

11.	(a) $h(x) = x^2 + 3,\ g(x) = x - 1$ $hg(x) = (x-1)^2 + 3$ $\therefore hg(a) = (a-1)^2 + 3$ $= a^2 - 2a + 4$ $gh(x) = x^2 + 3 - 1$ $\therefore gh(a) = a^2 + 2$ $a^2 - 2a + 4 = a^2 + 2$ $-2a = -2$ $a = 1$	M_1 M_1 M_1 A_1	Correct substitution of hg(x) or hg(a) Correct simplification gh(x) or gh(a) Simplification
	(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) $h^{-1}(4.75) = \sqrt{\left(4.75 + \frac{81}{4}\right)} + \frac{5}{2}$ $= \frac{10}{2} + \frac{5}{2}$ $= 7.5$	B_1 M_1 M_1 M_1 A_1	Let k(x) = k Transformation of formular Taking square root on each side. Add $^5/_2$ on each side For $h^{-1}(x)$ Substit. In $h^{-1}(x)$ Accept $^{15}/_2$ or $7\frac{1}{2}$
		12	
12.	n(A) =55 	B_1 B_1 B_1 B_1 B_1	for 2x for 7 Other regions

	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	~~B_1~~ ~~M_1~~ ~~A_1~~ M_1 A_1	for 3 simplifying for 7 addition ~~simplifying~~ for 51
	b(ii) Not visited Arua $= 10 + x + 14 + 2x$ $10 + 21 + 14$ $= 45$ students.	M_1 A_1	simplifying (addition for 45
	(c) P (Almost two towns) = $\frac{10+7+14+25+20+14+7}{100}$ $= \frac{97}{100}$	M_1 A_1	~~Almost region~~ ~~simplifying~~ for 45 accept 0.97
		12	
13.	(a)  		
	(i) $\overrightarrow{AB} = \overrightarrow{AM} + \overrightarrow{MB}$ ~~M_1~~ $= \underline{x} + 2\overrightarrow{AM}$ ~~A_1M_1~~ $x + 2x = 3\underline{x}$ ~~M_1A_1~~		M_1 For correct route/ratio ~~roof~~ A_1 Correct answer
	(ii) $\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AC}$ M_1 $= -3x + y$ A_1		M_1 Correct route A_1 Correct route
	(iii) $\overrightarrow{BN} = \frac{3}{4}\overrightarrow{BC}$		~~Reason~~ M_1 - correct route

	$\frac{3}{4}(y-3x)$ BN: NC=3:1 $\overrightarrow{AN}=\overrightarrow{AB}+\overrightarrow{BN}$ $=3x+\frac{3}{4}(y-3x)$ M_1 $=\frac{12x+3y-9x}{4}=\frac{3}{4}(x+y)$ (b) $\overrightarrow{MT}=\overrightarrow{MA}+\overrightarrow{AT}$ $-x+\frac{2}{3}+\left(\frac{3}{4}x+\frac{3}{4}y\right)=\frac{2}{4}(-x+y)$ $\overrightarrow{TC}=\overrightarrow{TA}+\overrightarrow{AC}=\frac{-2}{3}\left(\frac{2}{4}x+\frac{3}{4}y\right)+y$ $\frac{2}{4}(y-x)$ $\frac{\overrightarrow{MT}}{\overrightarrow{TC}}=\frac{\frac{2}{4}(y-x)}{\frac{2}{4}(y-x)}$ $\frac{\overrightarrow{MT}}{\overrightarrow{TC}}=1$ $\overrightarrow{MT}=\overrightarrow{TC}$ Since T is a common point, M T and C are collinear.	Simplification Correct route A_1 Correct answer M_1 Simplification M_1 for both correct routes MT & TC Correct $\overrightarrow{TC}$ M_1 simplifying A_1 correct answer for the ratio 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 A_1 M_1A_1 M_1 A_1 M_1 A_1 M_1 A_1	Dividing for 320,000/= correctitude simplification for 10,000,000 simplification for C's 5800,000 Correct answer simplifying for C's 46,400,000 Cao Adding for C's 56,400,000 correct answer

		A_1	correct answer
15.	(a) $2(3^t)=162$	B_1	Adding on
	$\frac{2(3^t)}{2}=\frac{162}{2}$	M_1	Dividing
	$3^t=81$	M_1	Prime indices, prove factorizing
	$3^t=3^4$		
	$t=4$	A_1	for t = 4
	(b) $\log(x+y)=1$	B_1	Extracting eqn. for eqn (1)
	$x+y=10$ _____ (i)		
	$\log_2(xy)=4$		
	$xy=16$ _____ (ii)	B_1	Extracting eqn. for eqn (2)
	$(10-y)(y)=16$	M_1	simplifying substitution
	$10y-y^2=16$		
	Gather $y_1=2$ or $y_2=8$	M_1	for values of y, for quadratic eqn
	Finding x;	M_1	substituting for factors of quadratics
	$x=10-y$		
	When y = 2,		
	$\Rightarrow x=10-2=8$	A_1	correct value of x For both value of y $y=2$ or $y=8$
	When y = 8,		
	$x=10-8=2$	M_1 A1	substituting c's 2 for $x=2$ and $x=$
		12	
16.	$6+x=distance$		
	$S=\frac{d}{t}$	B_1	simplifying equations (1)
	$9:45+\frac{\alpha}{60}$ $\quad 10:50+\frac{240-x}{80}$		
	$t_1=9.45+\frac{x}{60}$		
	$t_1=t_2$ $\quad t_2=10:50+\frac{240-x}{80}$	M_1	manipulating equation (2)
	$9:45+\frac{x}{60}=10:50-9.45$ $\quad 9:45+\frac{x}{60}=10:10+\frac{240-x}{80}$		
	$\frac{8x-1440}{480}=\frac{13}{12}$ $\quad \frac{x}{60}-\frac{240-x}{80}=10:50-9:45$	M_1	Equating
	$\frac{12(14x-1440)}{480}=\frac{13}{12}$ $\quad \frac{8x-1440+6x}{480}=\frac{13}{12}$	M_1	Extraction
	$12(14x-1440)=13(480)$ $\quad \frac{14x-1440}{480}=\frac{13}{12}$	A_1	correct value of x
	$168x-17280=6240$		
	$x=140km$		

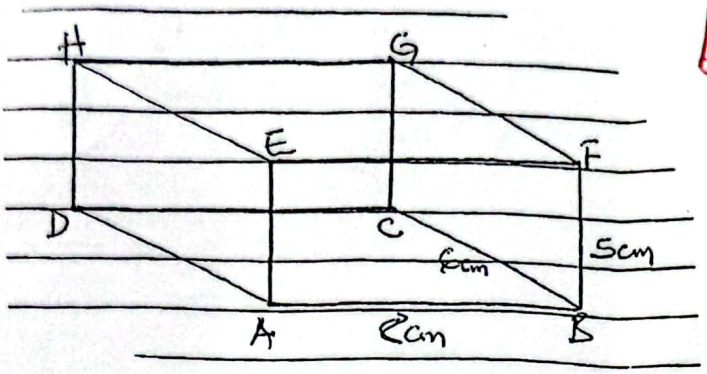
		A_1	correct answer
15.	(a) $2(3^t)=162$	B_1	Adding on
	$\frac{2(3^t)}{2}=\frac{162}{2}$	M_1	Dividing
	$3^t=81$	M_1	Prime indices, prove factorizing
	$3^t=3^4$		
	$t=4$	A_1	for t = 4
	(b) $\log(x+y)=1$	B_1	Extracting eqn. for eqn (1)
	$x+y=10$ _____ (i)		
	$\log_2(xy)=4$		
	$xy=16$ _____ (ii)	B_1	Extracting eqn. for eqn (2)
	$(10-y)(y)=16$	M_1	simplifying substitution
	$10y-y^2=16$		
	Gather $y_1=2$ or $y_2=8$	A_1	for values of y, for quadratic eqn
	Finding x:	M_1	substituting for factors of quadratics
	$x=10-y$		
	When y = 2,		
	$\Rightarrow x=10-2=8$	A_1	correct value of x For both values of y y=2 or y=8
	When y = 8,		
	$x=10-8=2$	M_1 A1	substituting c's 2 for x=2 and x=
		12	
16.	$6+x=distance$		
	$S=\frac{d}{t}$	B_1	simplifying equations (1)
	$9:45+\frac{\alpha}{60}$ $10:50+\frac{240-x}{80}$		
	$t_1=9.45+\frac{x}{60}$		
	$t_1=t_2$ $t_2=10:50+\frac{240-x}{80}$	M_1	manipulating equation (2)
	$9:45+\frac{x}{60}=10:50-9.45$ $9:45+\frac{x}{60}=10:10+\frac{240-x}{80}$		
	$\frac{8x-1440}{480}=\frac{13}{12}$ $\frac{x}{60}-\frac{240-x}{80}=10:50-9:45$	M_1	Equating
	$\frac{12(14x-1440)}{480}=\frac{13}{12}$ $\frac{8x-1440+6x}{480}=\frac{13}{12}$	M_1	Extraction
	$12(14x-1440)=13(480)$ $\frac{14x-1440}{480}=\frac{13}{12}$	A_1	correct value of x
	$168x-17280=6240$		
	$x=140km$		

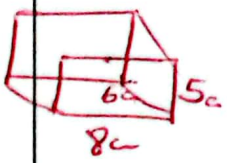
No 16 Cyclist $x = 60(t + 65/60)$

$9:45+\frac{140}{60}$	$x = 60t + 65$ M1	M1	Adding
$9:45+2:20$	Motorist	~~A1~~	Adding
$=12:05$	$240 - x = 80t$		
$S=\frac{d}{t}$	$x = 240 - 80t$ M1	~~M1~~	Equating
$40=\frac{240}{t}$	$60t + 65 = 240 - 80t$		
$t = 6hrs$	$140t = 175$	~~A1~~	correct value of t
	$t = 1.25$ hrs A1		
$9:45+6:00$	$x = 60(1.25) + 65$ M1A1		
$=15:45$	$x = 75 + 65$		
	$x = 140$ km from Kampala A1		
$S=\frac{d}{t}$	b) Time $10:50 + 1.25$		
$80=\frac{240}{t}$	$10:50$ M1		
	$01:25$ A1		
$t=\frac{240}{80}$	$12:05$		
		~~B1~~	~~C's 3~~
$t = 3\ hrs$	c) Cyclist $t = \frac{240}{60} = 4$ hrs ~~B1~~ B1		
So; (c) 10: 50	9: 45	~~M1~~	~~Adding time~~
3: 00	4: 00 Time of arrival 13:45 B1		
13: 50	13: 45		
	Motorist		
13: 50	$t = \frac{240}{80} = 3$ hrs ~~A1~~ B1		~~correct value of t~~
-13: 45			
5minutes	Time of arrival ⇒ 13:50 B1		
		12 marks	

Difference = 13:50
13:45
5minutes B1

17.





Let x be the length CG $2x + 6 = 16$ $2x = 10$ $x = 5$ Or x be length BF EA + AB + BF + FE = 26 $x + 8 + x + 8 = 26$ $2x + 16 = 26$ $\frac{2x}{2} = \frac{26-16}{2} = \frac{10}{2}$ $x = 5$	$B_1\ B_1\ B_1$ M_1 A_1	For base seen. For closed figure ~~Am/sketch~~ for equation for $x = 5$
(b) (i) Volume = L x W x H 8 x 6 x 5 240cm^3	M_1M_1 A_1	M1 & C's H substitution & simplification C's 240.
(b)(ii) Total surface Area = 2 [lw + wh + lh] 2(6 x 6 + 6x 5 + 8 x 5) 2 (48 + 30 + 40) 236cm^2	M_1M_1 M_1 A_1	for C's, H substitution in formula ~~Areas~~ Doubling. Simplification for 236. CAO
	12 marks	

END