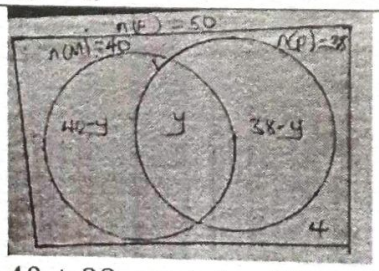
JINJA JOINT EXAMINATION BOARD

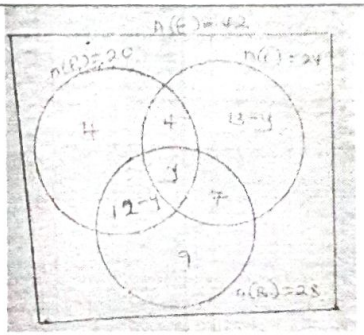
MOCK EXAMINATIONS 2022

MATHEMATICS 456-2

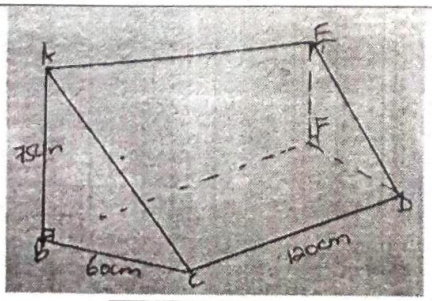
MARKING GUIDE

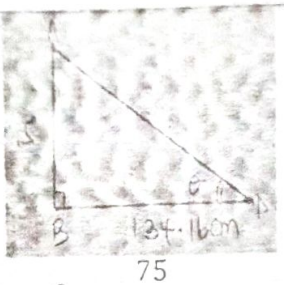
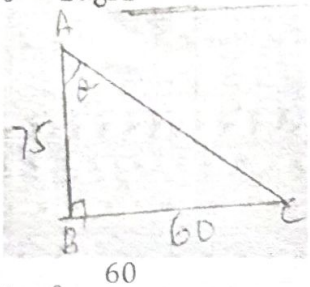
NO.	WORKING	MARKS	COMMENT
1.	$\frac{10^3 \times \sqrt{45}}{10^2 \times \sqrt{180}}$ $= \frac{10^3 \times \sqrt{9 \times 5}}{10^2 \times \sqrt{36 \times 5}}$ $= 10^{3-2} \times \frac{3\sqrt{5}}{6\sqrt{5}}$ $= 10^1 \times \frac{1}{2}$ $= 5.0 \times 10^{-1} \times 10^1$ $= 5.0 \times 10^0$	 M1 M1 M1A1	 For getting the rational and irrational numbers. For simplifying
2.	$Gradient = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{-3-5}{-2-3}$ $= \frac{-8}{-5}$ $= \frac{8}{5}$ $Gradient = \frac{d+3}{13+2}$ $\frac{8}{5} = \frac{d+3}{15}$ $8 \times 15 = 5(d+3)$ $120 = 5d + 15$ $\frac{105}{5} = \frac{5d}{5}$ $21 = d$	 M1 A1 M1 A1	 Right substitution of the coordinates in the formula of gradient. For the gradient.
3.	 $40 + 38 - y + 4 = 50$ $82 - y = 50$ $-y = -32$ $y = 32$ (a) Both subjects = 32 *students* (b) At most one subject = $8 + 6 + 4$ $= 18$ *students*	B1 B1 B1	For correct method and value of the unknown.
4.	*Angle sum* $= (n-2)180^0$ $= (4-2)180^0$	 M1	

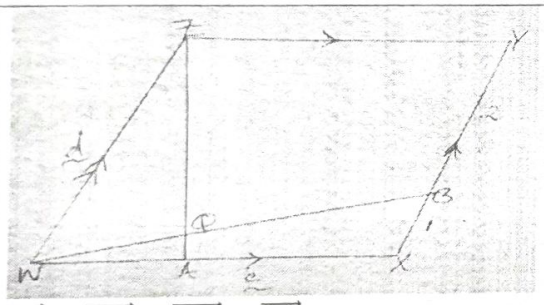
	$= 360^0$ $60^0 + 180^0 - 2t + 360^0 - 3t + 180^0 - t = 360^0$ $780^0 - 6t = 360^0$ $\frac{-6t}{-6} = \frac{-420^0}{-6}$ $t = 70^0$	M1 M1 A1	
5.	$5\log_{10} y + \log_{10} 5 = 1 + 2\log_{10} 4$ $\log_{10} y^5 + \log_{10} 5 = \log_{10} 10 + \log_{10} 4^2$ $\log_{10}(5y^5) = \log_{10}(10 \times 16)$ $\frac{5y^5}{5} = \frac{160}{5}$ $y^5 = 32$ $\sqrt[5]{y^5} = \sqrt[5]{32}$ $y = 2$	M1 M1 M1 A1	
6.	$f(x) = 2x + 3, g(x) = 5x - 2$ $gf(x) = g(x)$ $gf(x) = 5(2x + 3) - 2$ $= 10x + 15 - 2$ $= 10x + 13$ $10x + 13 = 5x - 2$ $10x - 5x = -2 - 13$ $\frac{5x}{5} = \frac{-15}{5}$ $x = -3$	M1 M1 M1 A1	
7.	$S.I = \frac{PRT}{100}$ $360{,}000 = \frac{P \times 4 \times 6}{100}$ $\frac{36{,}000{,}000}{24} = \frac{24P}{24}$ $1{,}500{,}000 = P$ $Principal = shs\ 1{,}500{,}000$	M1 M1M1 A1	
8.	$V = \pi r^2 h$ $= \pi \times 5^2 \times 4$ $= 100\pi\ m^3$ $V = \pi \times 7.5^2 \times 4$ $V = 225\pi\ m^2$ $Ratio = \frac{100\pi}{225\pi}$ $= 4:9$ $\therefore$ *The ratio capacity of the first tank to the second* $= 4:9$	B1 B1 B1 B1	For correct capacity For correct capacity For expressing as a ratio
9.	$9x^2 - (x-3)^2$ $a^2 = 9x^2,\ b^2 = (x-3)^2$ $a = 3x,\ \ b = x - 3$ $a^2 - b^2 = (a+b)(a-b)$ $9x^2 - (x-3)^2 = (3x + x - 3)(3x - (x-3))$ $= (4x - 3)(2x + 3)$	M1 M1 M1 A1	
10.	$Distance = 5.4km \quad T = 36\ minutes$ $36min = \left(\frac{36}{60}\right) hrs$ $= 0.6hrs$ a) Average speed$= \frac{5.4}{0.6}$ $= 9kmhr^{-1}$	M1 A1	

	b) $5.4km = (5.4 \times 1000)m$ $= 5400m$ Average speed $= \frac{5400}{36}$ $= 150m/minute$	M1 A1	
	SECTION:B		
11a)	$12^{2}/_{3} \times 6^{2}/_{3} \times 8^{1}/_{3} \times 3^{2}/_{3}$ $= (3 \times 4)^{2}/_{3} \times (2 \times 3)^{2}/_{3} \times (2 \times 4)^{1}/_{3} \times 3^{2}/_{3}$ $= 3^{2}/_{3} \times 2^{4}/_{3} \times 2^{2}/_{3} \times 3^{2}/_{3} \times 2^{1}/_{3} \times 2^{2}/_{3} \times 3^{2}/_{3}$ $= 3^{2}/_{3} \times 3^{2}/_{3} \times 3^{2}/_{3} \times 2^{4}/_{3} \times 2^{2}/_{3} \times 2^{1}/_{3} \times 2^{2}/_{3}$ $= 3^{6}/_{3} \times 2^{9}/_{3}$ $= 3^{2} \times 2^{3}$ $= 9 \times 8$ $= 72$	M1 M1 M1 M1 M1 A1	For expressing as a product of its factors Simplifying Collecting like terms and applying the laws of indices.
11b)(i)	$H \propto \frac{V}{R^2}$ $H = \frac{KV}{R^2}$ $10 = \frac{K \times 540}{7^2}$ $490 = 540K$ $\frac{490}{540} = K$ $\therefore K = \frac{49}{54}$	M1 M1 A1	
11b(ii)	$H = \frac{\frac{49}{54} \times 308}{3.5^2}$ $= \frac{279.481}{12.25}$ $= 22.815\ cm\ (3d.p)\ or\ 22.82\ cm(2d.p)\ or\ 22.8\ cm(1d.p)$	M1 M1 A1	If a student has written any of the 3 solutions, award the answer mark.
12(i).	 Let $n(P \cap C \cap B) = y$ $n(P)_{only} = 20 - (4 + 12 - y + y)$ $= 20 - 16$ $= 4$ $n(C)_{only} = 24 - (4 + y + 7)$ $= 24 - 11 - y$ $= 13 - y$	B1B1B1 B1 B1	-3marks for correct information in the venn diagram - 2marks for any five correct information put in the venn diagram. -1 mark for any 3 correct information put in the venn diagram.

12(ii) 12(iii) 12(iv)	$n(B)_{only} = 28 - (12 - y + y + 7)$ $= 28 - 19$ $= 9$ $20 + 13 - y + 7 + 9 = 42$ $49 - y = 42$ $-y = -7$ $y = 7$ $\therefore 7$ *students study all subjects.* $12 - y = 12 - 7 = 5$ *students* $\therefore n(P \cap B \cap C^{l}) = 5$ *students* $n(chemistry)_{only} = 13 - y$ $= 13 - 7$ $= 6$ *students* At least 2 subjects$= 4 + 9 + 7 + 6$ $= 26$ *students*	B1 M1 A1 B1 B1 M1 A1	Answer mark to be given to only those who have drawn a conclusion
13a) (i) (ii) 13b C)	*Market price is shs* 780,000 *Discout is* 5% $Cash\ price = 780{,}000 - \frac{5}{100} \times 780{,}000$ $= 780{,}000 - 39{,}000$ $= shs741{,}000$ $Hire\ purchase = Deposit + monthly\ installments$ $= 100{,}000 + 50{,}800 \times 8$ $= 100{,}000 + 914{,}400$ $= shs1{,}014{,}400$ $Extra\ amount = 1{,}014{,}400 - 741{,}000$ $= shs\ 273{,}400$ *Depreciation rates* $1^{st} year = (100 - 10)\% = 90\%$ $2^{nd}\ \&\ 3^{rd} years = (100 - 20)\% = 80\%$ $Amount = 650{,}000 \times \frac{90}{100} \times \left(\frac{80}{100}\right)^2$ $= 650{,}000 \times 0.9 \times (0.8)^2$ $= shs\ 374{,}400$ Men Days Height(Length) 150 80 2400 180 ? 3600 Since men increased, the number of days taken would reduce i.e $\frac{150}{180}$. Since the height of the trench has increased then the number of days also increase i.e $\frac{3600}{2400}$ $Number\ of\ days = 80 \times \frac{150}{180} \times \frac{3600}{2400}$ $= 100$	M1 A1 M1 A1 M1 A1 B1 M1 A1 B1 M1 A1	If a student has clearly indicated how he/she has come up with the solution, then the marks must be awarded
14. (i)	$f(x) = \frac{6x - 30}{2x^2 - 50}, \quad g(x) = \frac{21}{x^2 + 3x - 10}$ $f(4) = \frac{6 \times 4 - 30}{2 \times 4^2 - 50}$ $= \frac{24 - 30}{2 \times 16 - 50}$ $= \frac{-6}{-18}$ $= \frac{1}{3}$	 M1 A1	

(ii)	$\frac{6x-30}{2x^2-50}+\frac{21}{x^2+3x-10}$		
	$=\frac{6(x-5)}{2(x^2-25)}+\frac{21}{x^2+3x-10}$	M1	
	$=\frac{3(x-5)}{(x+5)(x-5)}+\frac{21}{(x+5)(x-2)}$	M1	
	$=\frac{3}{x+5}+\frac{21}{(x+5)(x-2)}$		
	$=\frac{3(x-2)+21}{(x+5)(x-2)}$	M1	
	$=\frac{3x-6+21}{(x+5)(x-2)}$		
	$=\frac{3x+15}{(x+5)(x-2)}$		
	$=\frac{3(x+5)}{(x+5)(x-2)}=\frac{3}{x-2}$	M1	Simplifying
	$\therefore f(x)+g(x)=\frac{3}{x-2}$	A1	
b) (i)	$f(x)$ *not defined* $2x^2-50=0$ $\frac{2x^2}{2}=\frac{50}{2}$ $x^2=25$ $\sqrt{x^2}=\sqrt{25}$ $x=\pm 5$	M1	
	$\therefore f(x)$*is not defined when* $x=\pm 5$	A1	For both solutions.
(ii)	$g(x)$ *not defined* $x^2+3x-10=0$ *sum* $=3$ *product* $=-10$ *using* $(5,-2)$ $x^2+5x-2x-10=0$ $x(x+5)-2(x+5)=0$ $(x-2)(x+5)=0$ $x=2 \quad or\ x=-5$	M1	For factorizing
	$\therefore g(x)$*is not defined when* $x=2$ *or* $x=-5$	A1A1	For both solutions
15.			
(i)	$CF=\sqrt{120^2+60^2}$ $=134.16\ cm$	M1 A1	
	$AC=\sqrt{75^2+60^2}$ $=96.05\ cm$	B1	
	$CE=\sqrt{120^2+96.05^2}$ $=153.71\ cm$	M1 A1	
(ii)		B1	

(iii)	 $tan\theta = \frac{75}{134.16}$ $\theta = 29_o21^0$	M1 A1 B1	
	 $tan\theta = \frac{60}{75}$ $\theta = tan^{-1}\left(\frac{60}{75}\right)$ $\theta = 38.66^0$	M1M1 A1	
16a)	$2y + 3x - 4 = 0$ $y = \frac{-3}{2}x + 2$ $m = \frac{-3}{2}$ *using* (4,1)	B1	For correct gradient
(i)	$y = mx + c$ $1 = \frac{-3}{2} \times 4 + c$ $1 + 6 = c$ $c = 7$ $\therefore y = \frac{-3}{2}x + 7$	M1 A1	
(ii)	$m \times m_1 = -1$ $\frac{-3}{2}m_1 = -1$ $m_1 = \frac{2}{3}$ *using* (6,2) $y = mx + c$ $2 = \frac{2}{3} \times 6 + c$ $2 - 4 = c$ $-2 = c$ $\therefore y = \frac{2}{3}x - 2$	B1 M1 A1	For correct gradient For correct substitution and simplifying
b) (i)	$+\begin{vmatrix} 3x + y = 11 \\ x - y = 1 \end{vmatrix}$ $4x = 12$ $x = 3$ *from* $x - y = 1$ $3 - y = 1$ $-y = -2$ $y = 2$ $\therefore$ *point* $R(3,2)$	B1 B1 B1	For the solution of x For the solution of y

(ii)	$(3,2)$ and $(1,8)$ $mid\ point = \left(\frac{3+1}{2}, \frac{2+8}{2}\right)$ $= (2,5)$ $Gradient(m) = \frac{8-2}{1-3}$ $= \frac{6}{-2}$ $= -3$ $m \times m_1 = -1$ $-3m_1 = -1$ $m_1 = \frac{1}{3}$ $y = mx + c$ $5 = \frac{1}{3} \times 2 + c$ $5 - \frac{2}{3} = c$ $\frac{15-2}{3} = c$ $\frac{13}{3} = c$ $\therefore y = \frac{1}{3}x + \frac{13}{3}$	B1 B1 B1	For the point R indicated. For the mid-point For the gradient For the correct equation
17(a)			
(i)	$\overrightarrow{ZB} = \overrightarrow{ZW} + \overrightarrow{WX} + \overrightarrow{XB}$ $= -\underset{\sim}{d} + \underset{\sim}{c} + \frac{1}{3}\underset{\sim}{d}$ $= \frac{-3\underset{\sim}{d} + 3\underset{\sim}{c} + \underset{\sim}{d}}{3}$ $= \frac{1}{3}(3\underset{\sim}{c} - 2\underset{\sim}{d})$	M1 A1	Without the tilde symbol or arrows to indicate that these are vectors, award M0 and A0
(ii)	$\overrightarrow{WB} = \overrightarrow{WX} + \overrightarrow{XB}$ $= \underset{\sim}{c} + \frac{1}{3}\underset{\sim}{d}$ $= \frac{1}{3}(3\underset{\sim}{c} + \underset{\sim}{d})$	B1	
(iii)	$\overrightarrow{ZA} = \overrightarrow{ZW} + \overrightarrow{WA}$ $= -\underset{\sim}{d} + \frac{1}{2}\underset{\sim}{c}$ $= \frac{1}{2}(-2\underset{\sim}{d} + \underset{\sim}{c})$	M1 A1	
(b)	$\overrightarrow{ZQ} = n(\overrightarrow{ZW} + \overrightarrow{WA})$ $= n(-\underset{\sim}{d} + \frac{1}{2}\underset{\sim}{c})$ $= -n\underset{\sim}{d} + \frac{1}{2}n\underset{\sim}{c}$ $\overrightarrow{ZQ} = \overrightarrow{ZA} + \overrightarrow{WQ}$ $= -\underset{\sim}{d} + m(\underset{\sim}{c} + \frac{1}{3}\underset{\sim}{d})$	B1	

$= -\underset{\sim}{d} + \frac{1}{3}\underset{\sim}{d} + m\underset{\sim}{c}$ B1

$= \left(-1 + \frac{1}{3}m\right)\underset{\sim}{d} + m\underset{\sim}{c}$

comparing vectors

$-nd = (\frac{1}{3}m - 1)\underset{\sim}{d}$

$-n = \frac{1}{3}m - 1$ M1

$\frac{1}{3}m + n = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots *$

$\frac{1}{2}n\underset{\sim}{c} = m\underset{\sim}{c}$

$\frac{1}{2}n = m \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots **$

*solving eqn * and ** simultaneously*

$\frac{1}{3} \times \frac{1}{2}n + n = 1$

$\frac{1}{6}n + n = 1$

$\frac{n + 6n}{6} = 1$

$7n = 6$

$n = \frac{6}{7}$

$m = \frac{1}{2}n$

$= \frac{1}{2} \times \frac{6}{7}$

$= \frac{3}{7}$

$\therefore n = \frac{6}{7}, \quad m = \frac{3}{7}$ A1A1

$\overrightarrow{ZA} = \frac{1}{2}(\underset{\sim}{c} - 2\underset{\sim}{d})$

$\overrightarrow{ZQ} = \frac{6}{7}(\frac{1}{2}\underset{\sim}{c} - \underset{\sim}{d})$

$\overrightarrow{ZQ} = \frac{3}{7}(\underset{\sim}{c} - 2\underset{\sim}{d})$

$\overrightarrow{ZQ} : \overrightarrow{ZA}$

$\frac{3}{7}\left(\underset{\sim}{c} - 2\underset{\sim}{d}\right) : \frac{1}{2}\left(\underset{\sim}{c} - 2\underset{\sim}{d}\right)$ B1

$14 \times \frac{3}{7} \ : \ \frac{1}{2} \times 14$

$6 : 7$

$\therefore \ \overrightarrow{ZQ} : \overrightarrow{ZA} = 6 : 7$ B1

END