

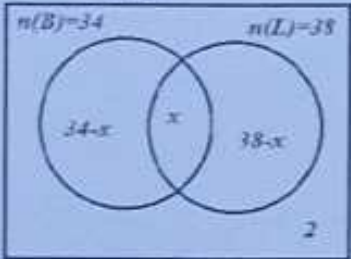


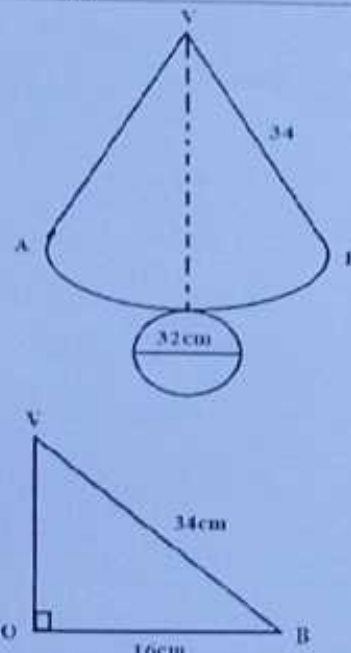
# JINJA JOINT EXAMINATIONS BOARD

## MOCK EXAMINATIONS 2023

### MATHEMATICS – 456/2

### MARKING GUIDE

NO.	SOLUTION	MARK	COMMENT
1.	$x = \frac{2}{3}$ or $x = -4$ $x - \frac{2}{3} = 0, x + 4 = 0$ $3x - 2 = 0, x + 4 = 0$ $(3x - 2)(x + 4) = 0$ $3x(x + 4) - 2(x + 4) = 0$ $3x^2 + 12x - 2x - 8 = 0$ $3x^2 + 10x - 8 = 0$	 M1  M1 M1 A1	For expanding and simplifying
2.	 $34 + 38 - x + 2 = 70$ $74 - x = 70$ $-x = 70 - 74$ $-x = -4$ $x = 4$ $\therefore n(B \cap L) = 4 \text{ farmers}$	 B1  M1  A1 A1	For correct information in the venn diagram
3.	$\begin{pmatrix} 2 \\ 3 \end{pmatrix} m + \begin{pmatrix} 3 \\ 4 \end{pmatrix} n = \begin{pmatrix} 19 \\ 27 \end{pmatrix}$ $2m + 3n = 19$ $3m + 4n = 27$ $3(2m + 3n) = 3(19)$ $2(3m + 4n) = 2(27)$ $6m + 9n = 57$ $6m + 8n = 54$ $n = 3$ $3m + 4(3) = 27$ $3m = 27 - 12$ $3m = 15$ $\frac{3m}{3} = \frac{15}{3}$ $m = 5$ $\therefore m = 5, n = 3$	 M1  A1 M1  A1	
4.	$VSF = \frac{\text{volume of supper}}{\text{volume of min}}$ $= \frac{1800}{1200}$ $VSF = 1.5$ $VSF = (LSF)^3$ $\sqrt[3]{1.5} = \sqrt[3]{(LSF)^3}$	 B1  B1	

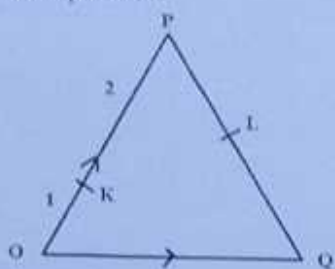
	$1.1447 = LSF$ $LSF = \frac{\text{Height of supper}}{\text{Height of min}}$ $1.1447 = \frac{H_s}{25}$ $H_s = 1.1447 \times 25$ $= 28.6175$ $\approx 28.6 \text{ (3.s.f)}$	M1	
5.	$f(x) = x + 7, g(x) = 3x - 5$ $gf(x) = 3(x + 7) - 5$ $= 3x + 21 - 5$ $gf(x) = 3x + 16$ $3x + 16 = x + 7$ $3x - x = 7 - 16$ $2x = -9$ $\frac{2x}{2} = \frac{-9}{2}$ $x = -4.5$	M1 A1 M1	
6.	 <p>The diagram shows a cone with vertex V and base circle. The radius of the base is 16 cm. The slant height is 34 cm. A right-angled triangle VOB is formed by the height h, the radius 16 cm, and the slant height 34 cm.</p> $h^2 + 16^2 = 34^2$ $h^2 = 34^2 - 16^2$ $\sqrt{h^2} = \sqrt{1156 - 256}$ $h = \sqrt{900}$ $h = 30 \text{ cm}$ $V = \frac{1}{3} \pi r^2 h$ $= \frac{1}{3} \times \frac{22}{7} \times 16^2 \times 30$ $\therefore \text{Volume} = 8045.7 \text{ cm}^3$	M1 A1 M1 A1	
7.	$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{-8 - -4}{4 - -2}$ $= \frac{-8 + 4}{4 + 2}$ $= \frac{-4}{6}$ $= \frac{-2}{3}$ $m \times m_1 = -1$ $\frac{-2}{3} \times m_1 = -1$	B1	For correct gradient

	$m_1 = \frac{3}{2}$ $\text{Mid point } AB = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ $= \left( \frac{-2 + 4}{2}, \frac{-4 - 8}{2} \right)$ $= (1, -6)$ $y = mx + c$ $-6 = \frac{3}{2} \times 1 + c$ $-6 - \frac{3}{2} = c$ $c = -\frac{15}{2}$ $c = -7\frac{1}{2}$ $\therefore y = \frac{3}{2}x - 7\frac{1}{2}$	B1	For correct gradient
		B1	For correct mid point
		B1	For correct equations
8.	$\text{Area} = L \times W$ $= (\sqrt{2} + \sqrt{3})(\sqrt{2} - 2\sqrt{3})$ $= \sqrt{2}(\sqrt{2} - 2\sqrt{3}) + \sqrt{3}(\sqrt{2} - 2\sqrt{3})$ $= 2 - 2\sqrt{6} + \sqrt{6} - 2 \times 3$ $= (-4 - \sqrt{6})\text{cm}^2$ $\therefore \text{Area} = (-4 - \sqrt{6})\text{cm}^2.$	M1 M1M1 A1	For expanding For simplifying
9.	$\text{Hire purchase} = \text{Deposit} + \text{monthly installments}$ $= \frac{60}{100} \times 270,000 + 4 \times 50,000$ $= 162,000 + 200,000$ $\text{Hire purchase price} = \text{shs } 362,000$	M1 M1M1 A1	
10.	$A \propto BC^2$ $A = kBC^2$ $80 = k \times 5 \times 2^2$ $\frac{80}{20} = \frac{20k}{20}$ $k = 4$ $A = kBC^2$ $= 4 \times 7 \times 1^2$ $= 28$ $\therefore A = 28 \text{ when } B = 7 \text{ and } C = 1$	M1 A1 M1 A1	For correct substitution
11.(a)	$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$ $= \begin{pmatrix} 5 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ $= \begin{pmatrix} 3 \\ 5 \end{pmatrix}$ $\overrightarrow{BC} = \overrightarrow{OC} - \overrightarrow{OB}$ $= \begin{pmatrix} 7 \\ 5 \end{pmatrix} - \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ $= \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\overrightarrow{CD} = \overrightarrow{OD} - \overrightarrow{OC}$ $= \begin{pmatrix} -4 \\ 1 \end{pmatrix} - \begin{pmatrix} 7 \\ 5 \end{pmatrix}$ $= \begin{pmatrix} -11 \\ -4 \end{pmatrix}$ $\overrightarrow{DA} = \overrightarrow{OA} - \overrightarrow{OD}$ $= \begin{pmatrix} 2 \\ -3 \end{pmatrix} - \begin{pmatrix} -4 \\ 1 \end{pmatrix}$ $= \begin{pmatrix} 6 \\ -4 \end{pmatrix}$ $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} + \overrightarrow{DA} = 0$	B1 B1 B1 B1	

$$\begin{pmatrix} 3 \\ 5 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} -11 \\ -4 \end{pmatrix} + \begin{pmatrix} 6 \\ -4 \end{pmatrix}$$

$$\begin{pmatrix} 3+2-11+6 \\ 5+3-4-4 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

Hence proved



M1

A1

B1

A1

M1

A1

B1

(i)

$$\vec{PQ} = \vec{OQ} - \vec{OP}$$

$$= \begin{pmatrix} 15 \\ 20 \end{pmatrix} - \begin{pmatrix} 9 \\ 12 \end{pmatrix}$$

$$= \begin{pmatrix} 6 \\ 8 \end{pmatrix}$$

(ii)

$$\vec{OL} = \vec{OP} + \vec{PL}$$

$$= \begin{pmatrix} 9 \\ 12 \end{pmatrix} + \frac{1}{2} \begin{pmatrix} 6 \\ 8 \end{pmatrix}$$

$$= \begin{pmatrix} 9 \\ 12 \end{pmatrix} + \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$$\vec{OL} = \begin{pmatrix} 12 \\ 16 \end{pmatrix}$$

$$\vec{KL} = \vec{KP} + \vec{PL}$$

$$= \frac{2}{3} \begin{pmatrix} 9 \\ 12 \end{pmatrix} + \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{2}{3} \times 9 \\ \frac{2}{3} \times 12 \end{pmatrix} + \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} 6 \\ 8 \end{pmatrix} + \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} 9 \\ 12 \end{pmatrix}$$

$$|\vec{KL}| = \sqrt{9^2 + 12^2}$$

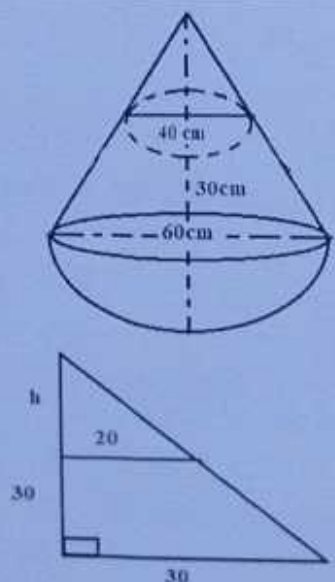
$$= \sqrt{81 + 144}$$

$$= \sqrt{225}$$

$$= 15$$

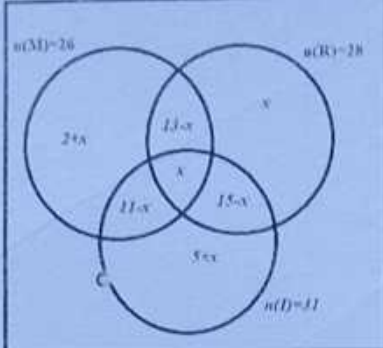
$$\therefore |\vec{KL}| = 15 \text{ units}$$

12.







<p>14.(ii)</p>	 <p> <math>n(M)_{\text{only}} = 26 - (11 - x + x + 13 - x)</math>  <math>= 26 - 24 + x</math>  <math>= 2 + x</math>  <math>n(R)_{\text{only}} = 28 - (13 - x + x + 15 - x)</math>  <math>= 28 - (28 - x)</math>  <math>= 28 - 28 + x</math>  <math>= x</math>  <math>n(I)_{\text{only}} = 31 - (11 - x + x + 15 - x)</math>  <math>= 31 - (26 - x)</math>  <math>= 31 - 26 + x</math>  <math>= 5 + x</math>  <math>26 + x + 15 - x + 5 + x = 52</math>  <math>46 + x = 52</math>  <math>x = 52 - 46</math>  <math>x = 6</math> </p> <p>b(i) 6 students ate all the 3 types of foods.</p> <p>(ii) Atleast 2 types = <math>5 + 7 + 6 + 9</math>  <math>= 27</math> students</p> <p>(c) Atmost one type of foods = <math>8 + 6 + 11</math>  <math>= 25</math> students  Probability = <math>\frac{25}{52}</math></p>	<p>B2</p> <p>B1</p> <p>B1</p> <p>B1 M1</p> <p>A1</p> <p>B1</p> <p>M1 A1</p> <p>M1</p> <p>A1</p>	<p>For all correct entries in the venn diagram</p> <p>o</p>
<p>15.(a)</p> <p>(i)</p> <p>(ii)</p> <p>b(i)</p>	<p><math>f(x)</math> not defined</p> <p> <math>x^2 + x - 6 = 0</math>  <math>x^2 - 2x + 3x - 6 = 0</math>  <math>x(x - 2) + 3(x - 2) = 0</math>  <math>(x - 2)(x + 3) = 0</math>  <math>x - 2 = 0, \quad x + 3 = 0</math>  <math>x = 2, \quad x = -3</math>  <math>\therefore f(x)</math> is not defined when <math>x = 2</math> or <math>x = -3</math> </p> <p> <math display="block">\frac{x-2}{2(x+3)} - \frac{10}{x^2+x-6}</math> <math display="block">\frac{(x+3)(x-2)}{2x+6-10}</math> <math display="block">\frac{(x+3)(x-2)}{2x-4}</math> <math display="block">= \frac{(x+3)(x-2)}{2(x-2)}</math> <math display="block">= \frac{(x+3)(x-2)}{2}</math> <math display="block">= \frac{2}{x+3}</math> </p>	<p>M1</p> <p>A1A1</p> <p>M1</p> <p>A1</p> <p>M1</p>	

$$g(0) = \frac{10}{0^2 + 0 - 6}$$

$$= -1\frac{2}{3}$$

$$f(x) = \frac{2}{x-2}$$

$$y = \frac{z}{x - 2}$$

$$x = \frac{z}{y-2}$$

$$\frac{2}{2x+2} = \frac{xy-2x}{xy}$$

$$y = \frac{2x + 2}{x}$$

$$\therefore f^{-1}(2) = 3$$

16.

Taxi from town M

T(hrs)	7:30	8:00	8:30	9:30	10:30	11:30	12:30	1:30
D(km)	0	50	50	130	210	290	370	450

Remaining distance = 400km

$$T = \frac{400}{80}$$

Subaru from town N

T(hrs)	8:00	9:00	9:30	10:30	11:30	12:30	1:00
D(km)	0	100	100	200	300	400	450

$$T = \frac{350}{100}$$

$$D = (225 + 2.5) = 227.5 \text{ km from M}$$

$$D = (450 - 227.5) \text{ km}$$

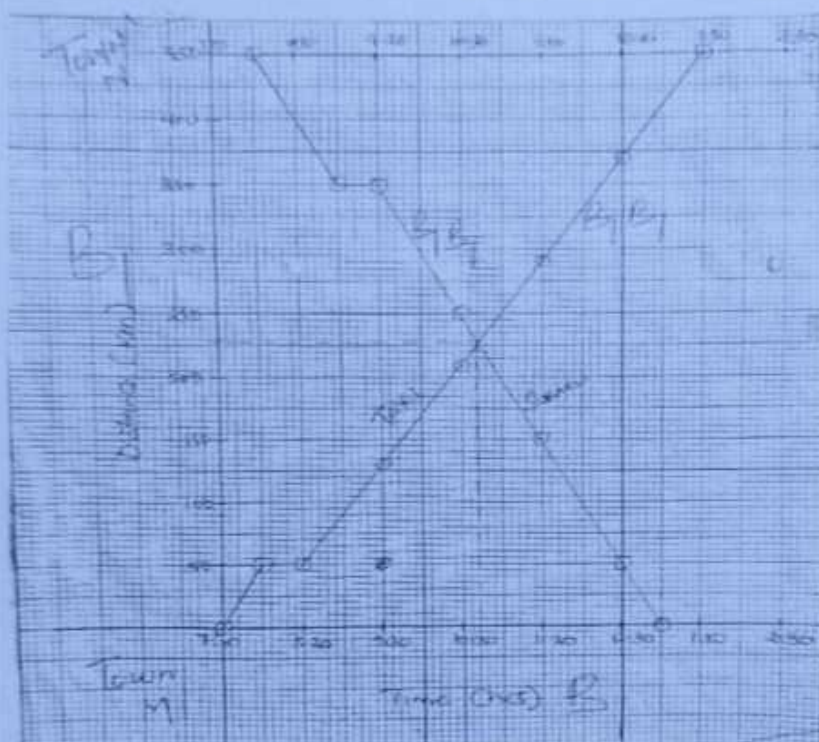
$$= 222.5 \text{ km}$$

$\approx 223\text{km}$  from town N

$$\text{Time} = 10:30 \text{ am} + 12 \text{ min}$$

$= 10:42 \text{ am}$

$\therefore$  They met at 10:42am after travelling 222.5 km from N



17.(a) Allowances

Lunch		28,000
Medical		35,000
Transport	$\frac{720,000}{12}$	60,000
Marriage		25,000
Housing	$\frac{5}{100} \times 720,000$	36,000
Children (6yrs and 10 yrs)	(2x5000)	10,000
14 yrs		3,000

Total allowances = shs197,000

Taxable income = Gross income - Allowances

= 720,000 - 197,000

= shs523,000

Slabs	Rate (%)	Amount to tax	Tax	Balance to be taxed
1 <sup>st</sup>	5	120,000	$\frac{5}{100} \times 120,000$ = shs6000	403,000
2 <sup>nd</sup>	10	120,000	$\frac{10}{100} \times 120,000$ = shs12,000	283,000
3 <sup>rd</sup>	12	160,000	$\frac{12}{100} \times 160,000$ shs19,200	123,000
4 <sup>th</sup>	15	123,000	$\frac{15}{100} \times 123,000$ shs18,450	-
		Total taxable income shs523,000	Total tax = shs55,650	

(b)

Income tax paid = shs 55,650

Net income = Gross income - Taxes



	$= 720,000 - 55650$ $= shs664,350$	M1	
		A1	
(c)	$\frac{664350}{720,000} \times 100 = 92.27\%$	B1	
END			