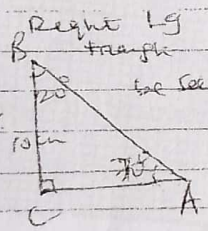
UCE MBARARA DISTRICT MOCK EXAMS, 2022

456/1 MATHEMATICS PAPER ONE
MARKING GUIDE.

QN	SOLUTION	MARKS	COMMENTS
1.	Three consecutive numbers: $x, x+2, x+4$	B1	
	$\Rightarrow x+x+2+x+4=72$	M1	forming equation
	$3x+6=72$		
	$3x=66$	~~H1~~	Simplifying.
	$x=22$	A1	c.a.o
	∴ The three consecutive even numbers are 22, 24 and 26	B1	Stating the numbers
		04	
2.	$3x+y=10$ —(i)		NOTE: Accept Alternative methods and award accordingly.
	$5x-2y=2$ —(ii)		
	$2 \mid 3x+y=10$		
	$\quad 5x-2y=2$		
	$\quad 6x+2y=20$	M1	for both correct equations
	$+ \mid 5x-2y=2$		
	$\quad 11x=22$		
	$\quad x=2$	A1	c.a.o
	Substitute 2 for x in (i):		
	$3(2)+y=10$	M1	Substitution of x Vi
	$6+y=10$		
	$y=4$	A1	c.a.o
		04	
3.	$\frac{\sin 70^\circ}{a}=\frac{\sin 20^\circ}{10\text{cm}}$ 	M1	Sine rule or its equivalent
	$a=\frac{10\text{cm}\sin 70^\circ}{\sin 20^\circ}$ or	M1	Solving for a
	$=27.474774$ cm	~~H~~A1	Simplifying / Evaluation
	$=27.5$cm (1dp)	A1	c.a.o with units
		04	

27.5cm Ao Ao

$y=10-3x$

(To be fastened together with other answers to paper)

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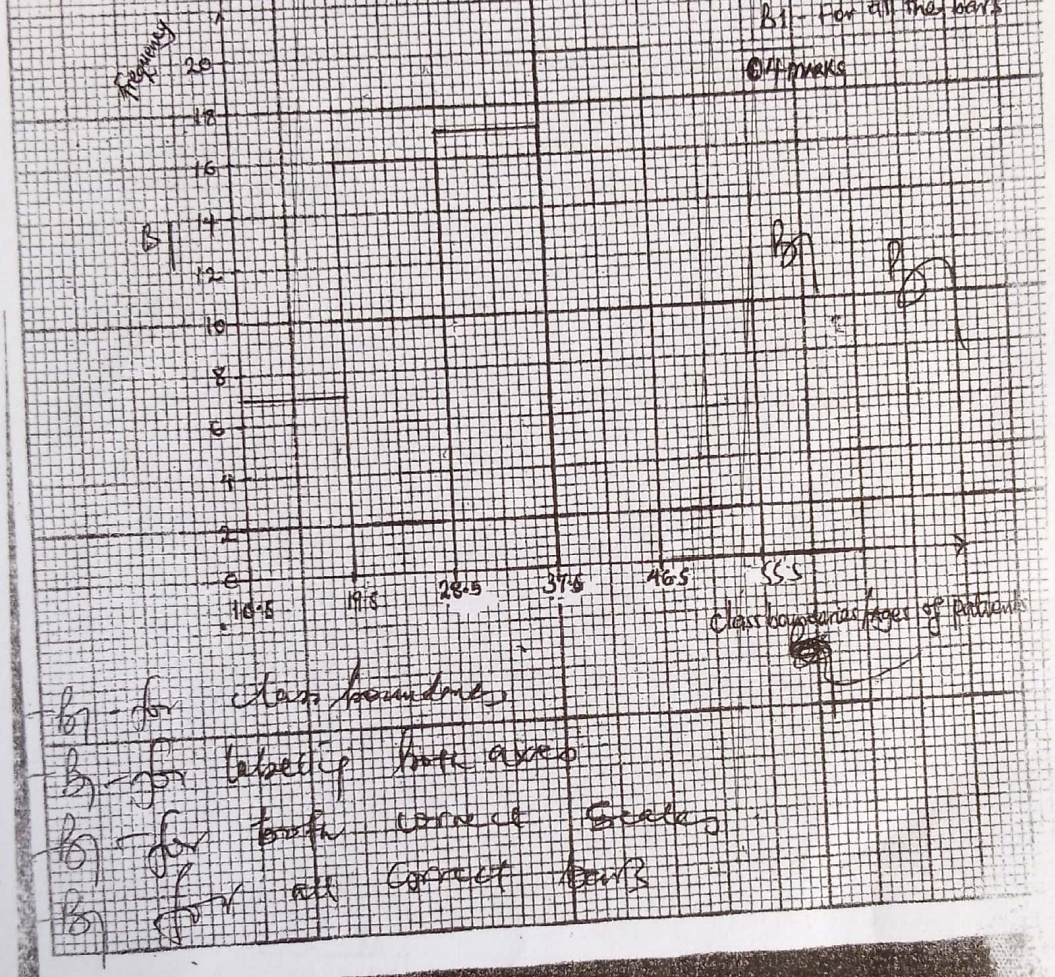
Q.N.4.

Classes	C. boundaries	f
11-19	10.5-19.5	7
20-28	19.5-28.5	6
29-37	28.5-37.5	17
38-46	37.5-46.5	20
47-55	46.5-55.5	10

HISTOGRAM



B1 - For class boundaries

B1 - For Vertical axis well labelled

B1 - For Horizontal axis, labelle correct

B1 - For all the bars

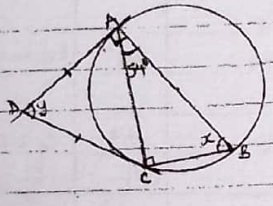
04 marks

B1 - for class boundaries

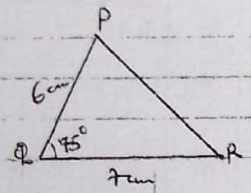
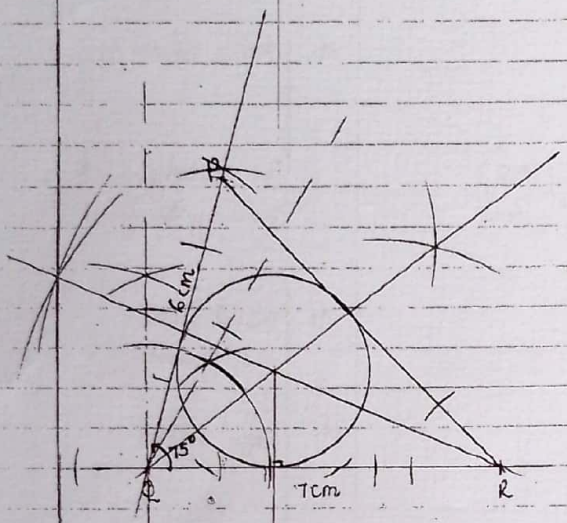
B1 - for labelling both axes

B1 - for both correct Scales

B1 for all Correct bars

QN	SOLUTION	MARKS	COMMENTS
5.	$2^{3y+2} = \left(\frac{1}{16}\right)^{-y}$		
	$2^{3y+2} = (16)^{y}$	M1	Reciprocal law
	$2^{3y+2} = 2^{4y}$	M1	Multiplying the powers
	$3y+2 = 4y$	M1	Equating powers
	$y = 2$	A1	c.a.o
		04	
6.	$\begin{pmatrix} 2a+4b \\ a \end{pmatrix} = \begin{pmatrix} 24 \\ 6 \end{pmatrix}$		Accept alternative method.
		M1	Matrix Multiplication
		A1	c.a.o
	$a = 6$	M1	Substituting 6 for a
	$2(6)+4b = 24$		
	$4b = 12$		
	$b = 3$	A1	c.a.o
		04	
7.	AE		Accept $x + 54^\circ = 90^\circ$
	$A+B+C = 180^\circ$		
	$54^\circ + x + 98^\circ = 180^\circ$	M1	$\angle$ subtended by the diam to the circumference is 9
	$x = 36^\circ$	A1	
			
	$2(36^\circ) + y = 180^\circ$	M1	Δ ADC is Isoceles
	$72^\circ + y = 180^\circ$		
	$y = 108^\circ$	A1	
		04	
8.	$5x^2 - 20 = 5(x^2 - 4)$	M1	Factorising.
	$= 5(x^2 - 2^2)$	~~A1~~	Difference of two Sqs
	$= 5(x+2)(x-2)$	A1	Complete factorization
	$5(x+2)(x-2) = 0$	M1	
	$x = 2$	A1	for both values of x
	or $x = -2$		Accept ± 2
		04	

Qn	SOLUTION	MARKS	COMMENTS
9	$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$		
	$10 = \frac{(11xn)+(12x10)+(8xn)}{n+10+n}$	M1	Formation of Equation.
	$\frac{10}{1} = \frac{11n+120+8n}{2n+10}$	M1	Simplifying
	$20n+100 = 19n+120$	M1	Output of cross multiplication
	$n = 20$	A1	c.a.o
		04	
10.	$\lvert\underset{\sim}{M}\rvert = (3x5)-(6x2)$	M1	Finding $\lvert\underset{\sim}{M}\rvert$
	$= 3$	A1	c.a.o
	$\text{A.S.F} = \frac{\text{Image Area}}{\text{Object Area}} = \lvert\underset{\sim}{M}\rvert$		
	$\Rightarrow \frac{\text{Image Area}}{16\,cm^2} = \frac{3}{1}$	M1	Relating $\lvert\underset{\sim}{M}\rvert$ to A.S.F
	$\therefore$ Ratio of Image Area to Object Area is 3:1	A1	c.a.o
		04	

QN.	SOLUTION	MARKS	COMMENTS
11.	Sketch  	B1	For ~~relatively~~ correct Sketch.
	Accurate drawing.  	B1 B1 B1 ~~B1~~ B1 B1 M1 M1	for $\angle 75^\circ$ for $\overline{QR} = 7cm$ for $\overline{PQ} = 6cm$ ~~for $\triangle PQR$~~ for bisector of $\angle PRQ$ for bisector of $\angle PQR$ ~~for a perpendicular line~~ for the inscribed circle (Note, B1 for the circle is scored when the line from the intersection of $\angle$ bisectors to any side of the $\triangle$ is seen.)
	$PR = 8.0cm \pm 0.1cm$. Radius, $r = 1.9cm \pm 0.1cm$	B1 ~~B1~~	for $\overline{PR}$ 7.9cm - 8.0 - 8.1 for Radius A1
	Area of the circle $= \pi r^2$ $= 3.142 \times (1.9cm)^2$ $= 11.34262cm^2$	M1 A1 12	Substitution c.a.o Accept 2dfs or more $12.108008cm^2$, $11.34262cm^2$ $12.568cm^2$

Q.N.	SOLUTION	MARKS	COMMENTS
12(a)	$A = \begin{pmatrix} 4 & -1 \\ 2 & 3 \end{pmatrix}$		
	$\lvert A \rvert = (4\times3)-(-1\times2)$	M1	Finding the determinant.
	$= 14$	A1	C.a.o
	$A^{-1} = \frac{1}{14}\begin{pmatrix} 3 & 1 \\ -2 & 4 \end{pmatrix}$	M1	
	$= \begin{pmatrix} \frac{3}{14} & \frac{1}{14} \\ -\frac{1}{7} & \frac{2}{7} \end{pmatrix}$	A1	C.a.o Accept only answers in fractional form simplified or not. No dps
12(b)	$2x+3y=1175$ ——— (i) $\quad 4y-x=100$ M	B1	eqn (i)
	$-x+4y=100$ ——— (ii) $\quad 2x+3y=1175$ M	B1	eqn (ii) $4y = 100+x$
	$\begin{pmatrix} 2 & 3 \\ -1 & 4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1175 \\ 100 \end{pmatrix}$	M1	Matrix equation
	$\begin{pmatrix} 4 & -3 \\ 1 & 2 \end{pmatrix}\begin{pmatrix} 2 & 3 \\ -1 & 4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 & -3 \\ 1 & 2 \end{pmatrix}\begin{pmatrix} 1175 \\ 100 \end{pmatrix}$	M1	Pre-multiplying both sides by the adjunct
	$\begin{pmatrix} 11 & 0 \\ 0 & 11 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1175 \\ 100 \end{pmatrix}$	M1	output of Matrix Multiplication.
	$\begin{pmatrix} 11x \\ 11y \end{pmatrix} = \begin{pmatrix} 4400 \\ 1375 \end{pmatrix}$	M1	Equal Matrices
	$11x = 4400$		
	$x = 400$	A1	C.a.o
	$11y = 1375$		
	$y = 125$	A1	C.a.o
		12	
	$x = \frac{\begin{vmatrix} 1175 & 3 \\ 100 & 4 \end{vmatrix}}{\begin{vmatrix} 2 & 3 \\ -1 & 4 \end{vmatrix}} = \frac{4400}{11}$	I	400

b

(To be fastened together with other answers to paper)

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QN 13)

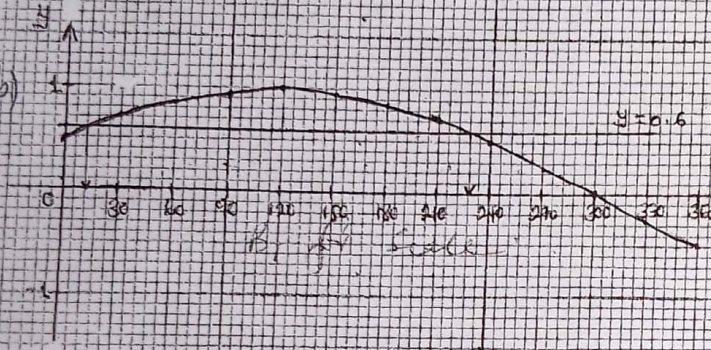
(a)

x°	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$y = \sin(\frac{1}{2}x + 30^\circ)$	0.5	0.707	0.866	0.966	1.0	0.966	0.866	0.707	0.5	0.259	0	-0.259	-0.5
		B1		B1		B1	B1		B1			B1	

B6 - for the table of values

Note: Each correct value is awarded B1

(b)



B1 for scales

B1 for correct labelling of x and y

B1 for correct curve

Correct labelling

B1 - Vertical axis

B1 - Horizontal axis

B1 - Plotting

B1 - for the curve

(c) From the graph, for $\sin(\frac{1}{2}x + 30^\circ) = 0.6$

$x = 12^\circ$ or $x = 218^\circ$

228

B1 for $y = 0.6$

B1 for $x = 12^\circ$

B1 for $x = 218^\circ$

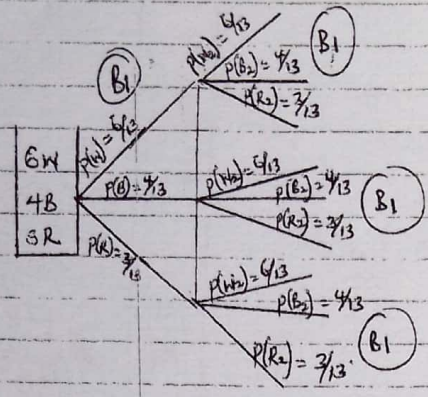
B1 for both values

12 MARKS

Q/N	SOLUTIONS	MARKS	COMMENTS
14(a)	$\begin{pmatrix} 0 & -3 \\ -1 & 2 \end{pmatrix}\begin{pmatrix} A & B & C \\ 2 & 6 & 4 \\ 3 & 3 & 6 \end{pmatrix} = \begin{pmatrix} A' & B' & C' \\ -9 & -9 & -18 \\ 4 & 0 & 8 \end{pmatrix}$	M1	A1
	$\therefore A'(-9,4)$, $B'(-9,0)$ and $C'(-18,8)$	A1 ~~B3~~	B1 for each correct coordinate
	$\begin{pmatrix} 2 & 3 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} A' & B' & C' \\ -9 & -9 & -18 \\ 4 & 0 & 8 \end{pmatrix} = \begin{pmatrix} A'' & B'' & C'' \\ -6 & -18 & -12 \\ -9 & -9 & -18 \end{pmatrix}$	M1	A1
	$\therefore A''(-6,-9)$, $B''(-18,-9)$ and $C''(-12,-18)$	A1 ~~B3~~	B1 for each correct coordinate.
(b)	Combined transformation $\underset{\sim}{T} = \underset{\sim}{N} \times \underset{\sim}{M}$		
	$= \begin{pmatrix} 2 & 3 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 0 & -3 \\ -1 & 2 \end{pmatrix}$	M1	Pre-multiplying $\underset{\sim}{M}$ by $\underset{\sim}{N}$
	$\underset{\sim}{T} = \begin{pmatrix} -3 & 0 \\ 0 & -3 \end{pmatrix}$	A1	
	T is an enlargement scale factor -3 centre (0,0).	B1	For describing the matrix (on right) C(0,0), K = -3
(c)	$\underset{\sim}{M} = \begin{pmatrix} 0 & -3 \\ -1 & 2 \end{pmatrix}$		
	$\lvert\underset{\sim}{M}\rvert = (0\times2) - (-3\times-1)$	M1	Finding determinant.
	$= -3$		
	$\underset{\sim}{M}^{-1} = -\frac{1}{3}\begin{pmatrix} 2 & 3 \\ 1 & 0 \end{pmatrix}$	M1	Finding the inverse
	$\underset{\sim}{M}^{-1} = \begin{pmatrix} -\frac{2}{3} & -1 \\ -\frac{1}{3} & 0 \end{pmatrix}$	A1	Inverse matrix.
	$\therefore = \begin{pmatrix} -\frac{2}{3} & -1 \\ -\frac{1}{3} & 0 \end{pmatrix}$ is a single matrix that would map A'B'C' back onto ABC		Do not accept (dps)
		12	

OR

$$\begin{pmatrix} a & c \\ b & d \end{pmatrix}\begin{pmatrix} P1 & Q1 & R1 \\ -9 & -9 & -18 \\ 4 & 0 & 8 \end{pmatrix} = \begin{pmatrix} P & Q & R \\ 2 & 6 & 4 \\ 3 & 3 & 4 \end{pmatrix}$$

RN	SOLUTION	MARKS	COMMENTS
15		B4	
	P(both balls are same colour) (M1) $= \left(\frac{6}{13} \times \frac{5}{13}\right) + \left(\frac{4}{13} \times \frac{4}{13}\right) + \left(\frac{3}{13} \times \frac{3}{13}\right)$ (M1) (M1)	M1M1M1	
	$= \frac{30}{169} + \frac{16}{169} + \frac{9}{169}$	M1M1	M1 - for products M1 - for summing.
	$= \frac{61}{169}$	A1	
(b)	Let x represent the number of red balls to be added.		
	$3+x = 6+4$	M1	
	$x = 7.$	A1	
	Accept or $\frac{3+x}{13+x} = \frac{1}{2}$ M1 $x = 7.$ A1		
		12	

QN.	SOLUTIONS	MARKS	COMMENTS
16 (a)	Area of $\Delta BCP = \frac{1}{2} \times 4x(x - 3cm)$	M1	
	$= 2x(x - 3cm)$		
	$= 2x^2 - 6x\,cm$		
	Area of $\Delta CDQ = \frac{1}{2}(4x - 3cm) \times x$	M1	
	$= 2x^2 - \frac{3}{2}x\,cm$		
	Sum $= 2x^2 - 6x\,cm + 2x^2 - \frac{3}{2}x\,cm$	M1	
	$= (4x^2 - 7.5x)cm^2$	A1	or $\left(\frac{1}{2}(4x^2 - 15x)\right)$ c
(b)	Area of $\Delta APQ = \frac{1}{2} \times 3cm \times 3cm$	M1	
	$= 4.5cm^2$.		
	Area of $ABCD = 4x \times x$	M1	
	$= 4x^2$		
	$\Rightarrow$ Areas of $\Delta APQ + \Delta PQC + \Delta BCP + \Delta CDQ$ = Area of $\square ABCD$.		
	$4.5cm^2 + 40.5cm^2 + 4x^2 - 7.5x\,cm = 4x^2$	M1	Forming equation to find the value of x.
	$7.5x\,cm = 45cm^2$	M1	Simplifying.
	$x = 6cm$.	A1	
(c)	Area of $PCQ = 40.5cm^2$		
	Area of $ABCD = (4 \times 6cm)^2 = 144cm^2$	M1	
	$\frac{PCQ}{ABCD} = \frac{40.5cm^2}{144cm^2} = \frac{9}{32}$	M1	
	Ratio $PCQ : ABCD = 9 : 32$	A1	
		12.	

10

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Qn. 17 Capacity: $20x+30y \leq 400$ ——— (i)

$2x+3y \leq 40$

Time: $\frac{1}{2}x \leq 6$ ——— (ii)

$\Rightarrow x \leq 12$

$\frac{2y}{3} \leq 6$ ——— (iii)

$\Rightarrow y \leq 9$

B1

B1

B1

For $2x+3y \leq 40$

eqn $2x+3y = 40$

x	2	5	8
y	12	10	8

(2,12), (5,10), (8,8)

For $x \leq 12$

eqn $x = 12$

For $y \leq 9$

$y = 9$

B1 = for both axes.

B1 = for $2x+3y=40$

B1 = for shading

B1 = for $x=12$

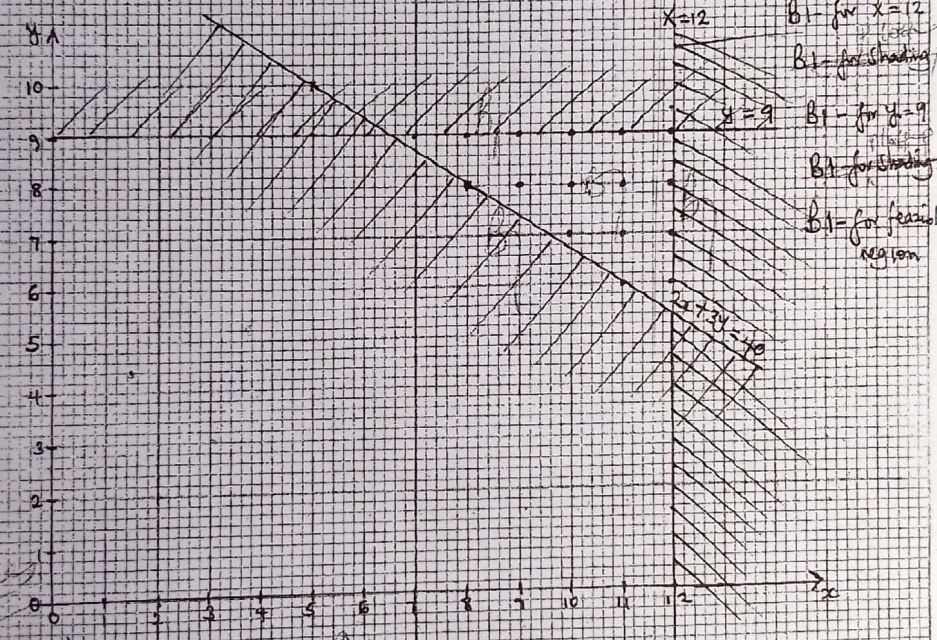
B1 = for shading

B1 = for $y=9$

B1 = for shading

B1 = for feasible region

(b)



(c) (x, y): $20x+30y$

$(8, 8)$: $20(8)+30(8) = 400$

D. Both the pickup and the truck have to make 8 trips each to deliver all the 400 tonnes of maize flour at minimum cost.

B1 for (8,8)

12 marks

11