

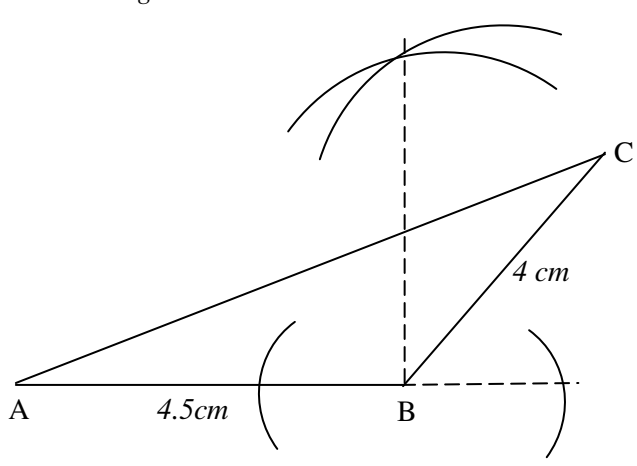
JINJA JOINT EXAMINATIONS BOARD
MOCK EXAMINATIONS 2019
Uganda Advanced Certificate of Education
Marking Guide for Mathematics
456/1 2019

	SOLUTIONS	MARK	COMMENT
Q.1	$(x + 2y)^2 - (2y - x)^2$ $x^2 + 4xy + 4y^2 - (4y^2 - 4xy + x^2)$ $x^2 + 4xy + 4y^2 - 4y^2 + 4xy - x^2$ $= 8xy$	M1M1 M1 A1	M1 for $x^2 + 4xy + 4y^2$ M1 $4y^2 - 4xy + x^2$
		04	
Q.2	$\frac{x+3}{24} = \frac{1}{x-2}$ $(x + 3)(x - 2) = 24$ $x^2 + x - 6 = 24$ $x^2 + x - 30 = 0$ $x^2 + 6x - 5x - 30 = 0$ $x(x + 6) - 5(x + 6) = 0$ $(x + 6)(x - 5) = 0$ <i>Either $x + 6 = 0$ Or $x - 5 = 0$</i> $x = - 6$ Or $x = 5$	M1 M1 M1 A1	M1 for expansion For forming quadratic equation For both values
		04	
Q.3		B1 B1 B2	Label horizontal as marks Label vertical as No of candidates or frequency All 8 bars correct B1 5 – 7 bars correct *
		04	

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Q.4	<p><i>Let</i> $T = \begin{pmatrix} a \\ b \end{pmatrix}$</p> $(a) \therefore \begin{pmatrix} a \\ b \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} -4 \\ 5 \end{pmatrix}$ $\Rightarrow \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} -4 \\ 5 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} -6 \\ 2 \end{pmatrix}$ <p><i>(b)</i> $\begin{pmatrix} -6 \\ 2 \end{pmatrix} + \begin{pmatrix} B \\ 2 \end{pmatrix} = \begin{pmatrix} B' \\ 4 \end{pmatrix}$</p> <p><i>B'</i> (-1, 4)</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	
		04	
Q.5	$\frac{P}{A} = \frac{100}{100 + RT}$ <p>$P(100 + RT) = 100 A$ $100P + PRT = 100A$ $PRT = 100 A - 100P$</p> $T = \frac{100A - 100P}{PR}$	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>Cross multiplication</p> <p>Opening brackets correctly</p> <p>Collecting like terms</p>
		04	
Q.6	<p><i>Let</i> $B = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$</p> $\begin{pmatrix} 3 & 1 \\ 4 & 2 \end{pmatrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ <p>$3a + c = 1$ ----- (i) $4a + 2c = 0$ ----- (ii) $2(i) - (ii)$ $6a + 2c = 2$ $4a + 2c = 0$ - <hr/> $2a = 2$ $a = 1$ $\therefore 3 + c = 1$ <hr/> $c = -2$</p> <p><i>Also</i> $3b + d = 0$ ----- (iii) $4b + 2d = 1$ ---- (iv) $(iv) - 2(iii)$ $4b + 2d = 1$ $6b + 2d = 0$ - <hr/> $-2b = 1$ $b = -1/2$ $\therefore -2 + 2d = 1$ $2d = 3$ $d = 3/2$</p>	<p>M1</p> <p>M1</p>	

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	$B = \begin{pmatrix} 1 & 1/2 \\ -2 & -1/2 \end{pmatrix}$ <p>OR</p> $\det \text{ of } A = (3 \times 2) - (4 \times 1)$ $= 2$ $B = A^{-1} = \frac{1}{2} \begin{pmatrix} 2 & -1 \\ -4 & 3 \end{pmatrix}$ $= \begin{pmatrix} 1 & -1/2 \\ -2 & 3/2 \end{pmatrix}$	<p>A1A1</p> <p>M1</p> <p>A1</p> <p>M1√</p> <p>A1</p>	<p>M1√ for his 2</p>
Q.7	<p>One exterior angle = $180 - 150$ = 30^0</p> <p>No. of sides = n $\therefore 30n = 360$ $n = 12$</p> <p>Polygon is Decagon</p>	<p>04</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>B1</p>	<p>$n = \frac{360}{30}$ $n = 12$</p>
Q.8	<p>$AB = 4.5 \pm 0.1$ $BC = 4.0 \pm 0.1$ $\angle ABC = 135^0$</p> <p>$AC = 7.9 \text{ cm} \pm 0.1$</p> <p>Accurate Drawing</p> 	<p>04</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>(4.4 – 4.6) cm</p> <p>(3.9 – 4.1) cm</p> <p>(7.8 – 8.0) cm</p>
Q.9	<p>Points are (5, 0) (0, 3)</p> <p>Gradient = $\frac{3-0}{0-5} = \frac{-3}{5}$</p> <p>Equation is</p> $\frac{y-3}{x-0} = \frac{-3}{5}$ <p>$5y - 15 = -3x$ $3x + 5y = 15$</p>	<p>04</p> <p>M1</p> <p>A1</p>	<p>Accept</p> $\frac{x}{5} + \frac{y}{3} = 1$ <p>$3x + 5y = 15$</p>


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	Inequality is $3x + 5y \leq 15$	B2	B2 on sight
		04	
Q.10	<p>Let M be married</p> $P(M) = \frac{40}{100}$ $P(M') = \frac{60}{100}$ $P(M \cap M') = P(M).P(M') \text{ or } P(M) \cap P(M')$ $= \left(\frac{40}{100} \times \frac{60}{100}\right) + \left(\frac{60}{100} \times \frac{40}{100}\right)$ $= \frac{24}{100} + \frac{24}{100}$ $= \frac{48}{100} \text{ or } 0.48$	<p>B1</p> <p>M1M1</p> <p>A1</p>	<p>For $P(M') = \frac{60}{100}$</p> <p>Accept 48%</p>
		04	
	SECTION B		
11.	<p>(a) $P + Q = \begin{pmatrix} 3 & 2 \\ 5 & 1 \end{pmatrix} + \begin{pmatrix} 0 & 1 \\ 3 & 4 \end{pmatrix}$</p> $= \begin{pmatrix} 3 & 3 \\ 8 & 5 \end{pmatrix}$ $P - Q = \begin{pmatrix} 3 & 2 \\ 5 & 1 \end{pmatrix} - \begin{pmatrix} 0 & 1 \\ 3 & 4 \end{pmatrix}$ $= \begin{pmatrix} 3 & 1 \\ 2 & -3 \end{pmatrix}$ $(P + Q)(P - Q) = \begin{pmatrix} 3 & 3 \\ 8 & 5 \end{pmatrix} \begin{pmatrix} 3 & 1 \\ 2 & -3 \end{pmatrix}$ $= \begin{pmatrix} 15 & -6 \\ 34 & -7 \end{pmatrix}$ <p>(b) $\frac{x-y}{2x+y} = \frac{1}{3}$</p> $\Rightarrow x - y = 1 \text{ ----- (i)}$ $2x + y = 3 \text{ ----- (ii)}$ <p>(i) + (ii)</p> $3x = 4$ $x = \frac{4}{3}$ <p>Substituting $x = \frac{4}{3}$ into (ii)</p> $2\left(\frac{4}{3}\right) + y = 3$ $\frac{8}{3} + y = 3$ $y = 3 - 2\frac{2}{3}$ $y = \frac{1}{3}$ $\therefore x/y = \frac{4}{3} \div \frac{1}{3}$	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1✓</p> <p>A1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>For his</p> $\begin{pmatrix} 3 & 3 \\ 8 & 5 \end{pmatrix} \text{ or } \begin{pmatrix} 3 & 1 \\ 2 & -3 \end{pmatrix}$ <p>For both $x = \frac{4}{3}$ and $x = \frac{1}{3}$</p>

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	$= \frac{4}{3}x^3/1$ $= 4$	M1 A1																																																			
		12																																																			
12.	<p>(i) $(\overline{AB})^2 = 4^2 + 4^2 - 2 \times 4 \times 4 \times \cos 60^\circ$ $= 32 - 32 \times \cos 60^\circ$ $= 16$ $AB = \sqrt{16}$ $= 4 \text{ cm}$</p> <p>(ii) $4^2 = 10^2 + 10^2 - 2 \times 10 \times 10 \cos AOB$ $16 = 200 - 200 \cos AOB$ $\cos AOB = \frac{184}{200} = 0.92$ $\angle AOB = 23.1^\circ$</p> <p>(iii) Area of segment with 60° angle $= \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 4 \times 4 - \frac{1}{2} \times 4 \times 4 \sin 60^\circ$ $= 8.381 - 6.928$ $= 1.453 \text{ cm}^2$</p> <p>Area of segment with 23° angle $= \frac{23^\circ}{360^\circ} \times \frac{22}{7} \times 10 \times 10 - \frac{1}{2} \times 10 \times 10 \sin 23^\circ$ $= 20.08 - 19.54$ $= 0.54 \text{ cm}^2$</p> <p>Area of shaded region $1.453 + 0.54$ $= 1.993 \text{ cm}$</p>	M1 M1 A1 M1 M1 A1 M1 A1 M1 A1 M1W A1	<p>$AB = 2(4\sin 30^\circ)$ $= 2 \times 4 \times \frac{1}{2}$ 4 cm</p> <p>$\sin AOC = \frac{2}{10}$ or 0.2 $\angle AOC = 11.5^\circ$ $\angle AOB = 2 \times \angle AOC$ $= 2 \times 11.5^\circ$ $= 23^\circ$</p> <p>For his 1.453 or 0.54</p>																																																		
		12																																																			
13.	<table><tr><td>Score</td><td>f</td><td>cf</td><td>x</td><td>fx</td></tr><tr><td>10-19</td><td>6</td><td>6</td><td>14.5</td><td>87.0</td></tr><tr><td>20-29</td><td>7</td><td>13</td><td>24.5</td><td>171.5</td></tr><tr><td>30-39</td><td>8</td><td>21</td><td>34.5</td><td>276.0</td></tr><tr><td>40-49</td><td>10</td><td>31</td><td>44.5</td><td>445.0</td></tr><tr><td>50-59</td><td>9</td><td>40</td><td>54.5</td><td>490.5</td></tr><tr><td>60-69</td><td>6</td><td>46</td><td>64.5</td><td>387.0</td></tr><tr><td>70-79</td><td>3</td><td>49</td><td>74.5</td><td>223.5</td></tr><tr><td>80-89</td><td>1</td><td>50</td><td>84.5</td><td>84.5</td></tr><tr><td></td><td>$\sum f$ = 50</td><td></td><td></td><td>$\sum fx$ = 2165</td></tr></table> <p>(a) Modal Class is 40 – 49</p>	Score	f	cf	x	fx	10-19	6	6	14.5	87.0	20-29	7	13	24.5	171.5	30-39	8	21	34.5	276.0	40-49	10	31	44.5	445.0	50-59	9	40	54.5	490.5	60-69	6	46	64.5	387.0	70-79	3	49	74.5	223.5	80-89	1	50	84.5	84.5		$\sum f$ = 50			$\sum fx$ = 2165	M1 M1 M1 A1 B1 M1✓ A1	<p>M1 for all cf column correct M1 for all x column correct M1 for all fx column correct</p> <p>A1 for $\sum fx = 2165$ Accept (39.5 – 49.5) M1✓ for his 2165</p>
Score	f	cf	x	fx																																																	
10-19	6	6	14.5	87.0																																																	
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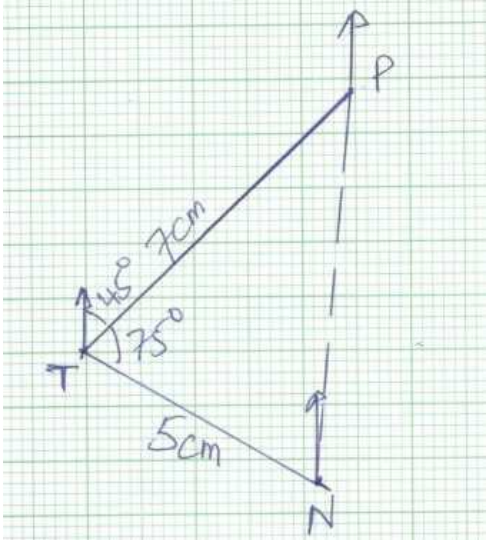
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	<p>(b) $Mean = \frac{\sum fx}{\sum f} = \frac{2165}{50}$ $= 43.3$</p> <p>(c) Labelling horizontal axis as score and vertical axis as cumulative frequency</p> <ul style="list-style-type: none">- Plotting all points correctly- Drawing smooth curve- Locating the median with horizontal and vertical lines- Reading the median score as 43.5 ± 0.5 	B1 M1 M1 M1 A1	Accept class boundary for horizontal axis (43 to 44)																																			
14.	<p>(a)</p> <table border="1"><tr><td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>$2x^2$</td><td>8</td><td>2</td><td>0</td><td>2</td><td>8</td><td>18</td></tr><tr><td>-x</td><td>2</td><td>1</td><td>0</td><td>-1</td><td>-2</td><td>-3</td></tr><tr><td>-6</td><td>-6</td><td>-6</td><td>-6</td><td>-6</td><td>-6</td><td>-6</td></tr><tr><td>y</td><td>2</td><td>-3</td><td>-6</td><td>-5</td><td>0</td><td>9</td></tr></table> <p>-Correct scales used on both axes -Plotting all points correctly -Joining the points using a smooth curve</p> <p>Subtracting $2x^2 - 3x - 5$ from $y = 2x^2 - x - 6$ to obtain $y = 2x - 1$ i.e $y = 2x^2 - x - 6 - 2x^2 + 3x + 5$ $y = 2x - 1$</p> <p>Point for line $y = 2x - 1$ Drawing line $y = 2x - 1$</p> <p>Solution occurs where line $y = 2x - 1$ meets the curve</p>	x	-2	-1	0	1	2	3	$2x^2$	8	2	0	2	8	18	-x	2	1	0	-1	-2	-3	-6	-6	-6	-6	-6	-6	-6	y	2	-3	-6	-5	0	9	12 B1 B1 B1 B1 M1 M1 A1 B1 M1	B1 for all $2x^2$ row correct B1 for all $-x$ row correct (0,-1),(-2,-5),(-1,-3),(2,3),(3,5),(1,1)
x	-2	-1	0	1	2	3																																
$2x^2$	8	2	0	2	8	18																																
-x	2	1	0	-1	-2	-3																																
-6	-6	-6	-6	-6	-6	-6																																
y	2	-3	-6	-5	0	9																																

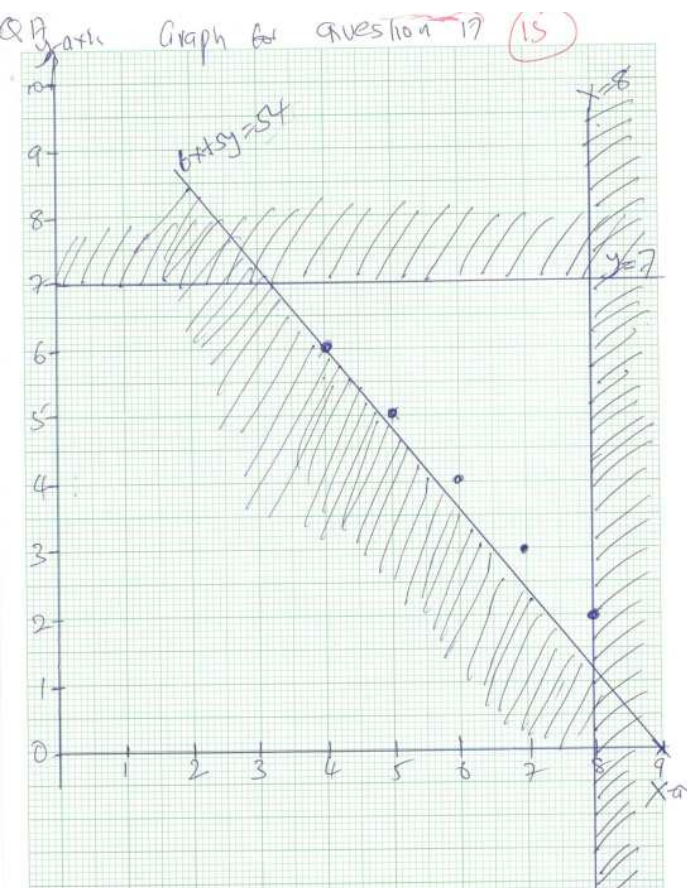
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	<p>i.e $x = -1 \pm 0.1$ or $x = 2.5 \pm 0.1$</p>	A1	(-1, 1 to -0.9)
		A1	(2.4 to 2.6)
		12	
15.	<p>(a) $\begin{matrix} A & B & C \\ \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} & \begin{pmatrix} 1 & 1 \\ -3 & 1 \end{pmatrix} & \begin{pmatrix} -2 \\ 1 \end{pmatrix} \end{matrix} = \begin{matrix} A' & B' & C' \\ \begin{pmatrix} 3 & -1 \\ 1 & 1 \end{pmatrix} & \begin{pmatrix} -1 \\ 2 \end{pmatrix} \end{matrix}$</p> <p>$A'(3, 1) B'(-1, 1) C'(-1, 2)$</p> <p>(ii) $\begin{matrix} A' & B' & C' \\ \begin{pmatrix} 3 & 1 \\ -2 & 0 \end{pmatrix} & \begin{pmatrix} 3 & -1 \\ 1 & 1 \end{pmatrix} & \begin{pmatrix} -1 \\ 2 \end{pmatrix} \end{matrix} = \begin{matrix} A'' & B'' & C'' \\ \begin{pmatrix} 10 & -2 \\ -6 & 2 \end{pmatrix} & \begin{pmatrix} -1 \\ 2 \end{pmatrix} \end{matrix}$</p> <p>$A''(10, -6) B''(-2, 2) C''(-1, 2)$</p> <p>(b) ABC to $A''B''C''$ is</p> $\begin{pmatrix} 3 & 1 \\ -2 & 0 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ $= \begin{pmatrix} 1 & -3 \\ 0 & 2 \end{pmatrix}$ <p>$A''B''C''$ To ABC is</p> <p>Inverse of $\begin{pmatrix} 1 & -3 \\ 0 & 2 \end{pmatrix}$</p> <p>$\det = (1 \times 2) - (0 \times -3)$</p> <p>$= 2$</p> <p>Inverse $= \frac{1}{2} \begin{pmatrix} 2 & 3 \\ 0 & 1 \end{pmatrix}$</p> $= \begin{pmatrix} 1 & 3/2 \\ 0 & 1/2 \end{pmatrix}$	M1A1 A1 M1A1 A1 M1 A1 M1 A1 M1√ A1	For his 2
		12	
16.	<p>(a) Sketch</p>	B1	B1 for correct sketch to include all the given information

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	<p>North line marked and 45° correctly drawn at T</p> <p>$\overline{TP} = 7\text{ cm} \pm 0.2\text{ cm}$</p> <p>$75^\circ$ correctly drawn from north line at T</p> <p>$\overline{TN} = 5\text{ cm} \pm 0.2\text{ cm}$</p> <p>North line correctly drawn at P</p> <p>North line correctly drawn at N</p> <p>(i) $7.5\text{ cm} \pm 0.2\text{ cm} \times 50$ $= 375 \pm 10\text{ km}$</p> <p>(ii) Bearing of P from N is $007^\circ \pm 001^\circ$</p> <p>(b) Time taken to fly directly from N to P is $\frac{375}{100}$ $= 3.75\text{ hours} \pm 0.2$</p> <p>Accurate Drawing</p> 	<p>B1</p> <p>M1</p> <p>B1</p> <p>M1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>(6.8 – 7.2) cm</p> <p>Accept 120°</p> <p>(4.8 to 5.2) cm</p> <p>(365 to 385) km</p> <p>006° to 008°</p> <p>Accept 3 hr 45 min (3.73 – 3.77 Hours)</p>
17.	<p>(a)</p> <p>$x \leq 8$</p> <p>$y \leq 7$</p> <p>$6x + 5y \geq 54$</p> <p>(b) Drawing line $x = 24$ and shading the correct unwanted region</p> <p>Drawing line $y = 7$ and Shading the correct unwanted region</p> <p>Drawing line $6x + 5y = 54$ and shading the correct unwanted region</p> <p>Correct unshaded region</p>	<p>12</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>M1</p>	

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<p>(c) Cost function $C = 300,000x + 100,000y$ Possible pairs (7, 3) (6, 4) (5, 5) (4, 6)</p> <p>(7, 3) gives $2,100,000 + 300,000 = 2,400,000$ (6, 4) gives $1,800,000 + 400,000 = 2,200,000$ (5, 5) gives $1,500,000 + 500,000 = 2,000,000$ (4, 6) gives $1,200,000 + 600,000 = 1,800,000$</p> <p>The least cost occurs at 4 mini buses and 6 Noah vans and it is</p> <p>Shs. 1, 800, 000</p> <p>QA Graph for question 17 (15)</p> 	<p>M1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>(9,0) (4, 6)</p> <p>(4, 6) on sight scores B1M1M1. Testing (4, 6) M1 A1</p>
	12	

END