

FORM FOUR TERM 1 JOINT EVALUATION TEST 2017

Kenya Certificate of Secondary Education (K.C.S.E)

221/2

MATHEMATICS

PAPER 2

MARKING SCHEME

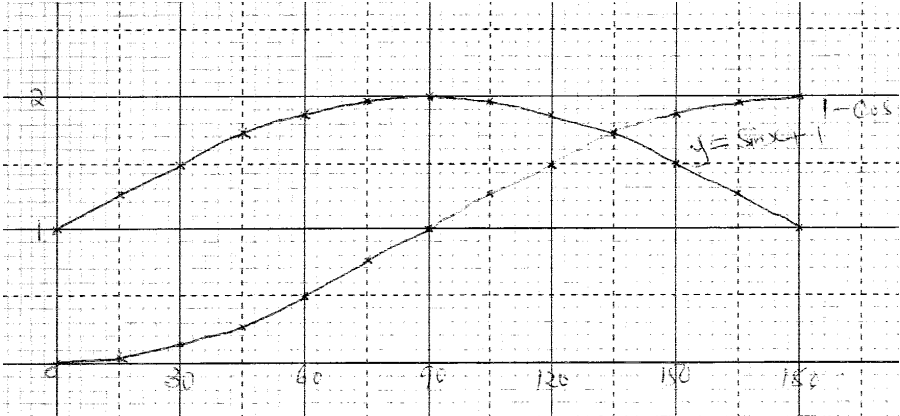
	MAIN SCHEME	MARKS	COMMENTS																								
1	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:30%;">No</th> <th style="width:30%;">Log</th> <th style="width:40%;">Others</th> </tr> </thead> <tbody> <tr> <td>9.631</td> <td>1.9836</td> <td></td> </tr> <tr> <td>0.003425</td> <td><u>3.5346</u></td> <td></td> </tr> <tr> <td></td> <td><u>1.5182</u></td> <td><u>1.5182</u></td> </tr> <tr> <td>$\log 3.428 (0.5350)$</td> <td><u>1.7284</u></td> <td><u>1.7284</u></td> </tr> <tr> <td></td> <td></td> <td><u>1.7898</u></td> </tr> <tr> <td></td> <td></td> <td>$\frac{2 + 1.7898}{2}$</td> </tr> <tr> <td>0.7850</td> <td></td> <td><u>1.8949</u></td> </tr> </tbody> </table>	No	Log	Others	9.631	1.9836		0.003425	<u>3.5346</u>			<u>1.5182</u>	<u>1.5182</u>	$\log 3.428 (0.5350)$	<u>1.7284</u>	<u>1.7284</u>			<u>1.7898</u>			$\frac{2 + 1.7898}{2}$	0.7850		<u>1.8949</u>	M1 M1 M1 A1	For logs For addition and subtraction.
No	Log	Others																									
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2	<p>Square both sides</p> $tv^2 = \frac{tv^2 - w}{m}$ $m tv^2 - tv^2 = - w$ $t(mv^2 - v^2) = - w$ $t = \frac{- w}{mv^2 - v^2}$	M1 M1 A1	Collecting terms with t on one side																								
		03																									
3	$4x + 2 \geq 2x + 3$ $2x \geq 1$ $x \geq \frac{1}{2}$ $2x + 3 \geq 5x - 6.$ $9 \leq 3x$ $3 \leq x$ 1,2,3	B1 B1 B1																									
		03																									
4	$\begin{pmatrix} -5 & 4 \\ 4 & -3 \end{pmatrix} \begin{pmatrix} 3 & 4 \\ 4 & 5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -5 & 4 \\ 4 & -3 \end{pmatrix} \begin{pmatrix} 5 \\ 2 \end{pmatrix}$	B1 M1																									

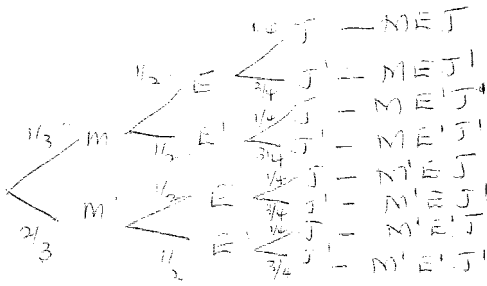
	$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -17 \\ 14 \end{pmatrix}$ $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -17 \\ 14 \end{pmatrix}$ $(x, y) = (-17, 14)$	A1 B1	
		04	
5	$4x^2 + 4y^2 - 16x + 40y - 80 = 0$ $x^2 + y^2 - 4x + 10y - 20 = 0$ $x^2 - 4x + 4 + y^2 + 10y + 25 = 20 + 4 + 25$ $(x - 2)^2 + (y + 5)^2 = 49 = 7^2$ $\text{centre} = (2, -5) \text{ radius} = 7 \text{ units}$	B1 B1 B1	
		03	
6	<p>By pascals triangle</p> $x^3 - 3x^2 \times \left(\frac{y}{2}\right)^1 + 3x^1 \times \left(\frac{y}{2}\right)^2 - \left(\frac{y}{2}\right)^3$ $x^3 - \frac{3x^2y}{2} + \frac{3xy^2}{4} - \frac{y^3}{8}$ $x - \frac{1}{2}y = 10 - \frac{1}{2} \times 0.1 \text{ hence } x = 10 \text{ and } y = 0.1$ $10^3 - \frac{3 \times 10^2 \times 0.1}{2} + \frac{3 \times 10 \times 0.1^2}{4}$ $1000.075 - 15$ 985.075	M1 A1 M1 A1	
		04	
7	$2\log_2 x + \log_3 27 = \log_2 5x + 5$ $\log_2 x^2 + 3 = \log_2 5x + 5$ $\log_2 x^2 + \log_2 8 = \log_2 5x + \log_2 32$ $\log_2 (8 \times x^2) = \log_2 (5x \times 32)$ $8x^2 = 160x$ $x = 20$	M1 M1 A1	
		03	
8	$\frac{4.4}{r} = 1.1$ $\frac{4.4}{1.1} = r$ $r = 4 \text{ cm}$	M1 A1	
		02	

9	$\frac{\sqrt{2}(\sqrt{2} + \sqrt{3}) - \sqrt{3}(\sqrt{2} - \sqrt{3})}{(\sqrt{2} - \sqrt{3})(\sqrt{2} + \sqrt{3})}$ $\frac{2 + \sqrt{6} - \sqrt{6} + 3}{2 - 3}$ $\frac{5}{-1} = -5$	M1 M1 A1	
		03	
10	<p><i>money borrowed</i> = 5,000 – 2000 = 3000</p> $6 \times 1000 = 3000 \times \left(\frac{100 + r}{100}\right)^6$ $\frac{6000}{3000} = \left(\frac{100 + r}{100}\right)^6$ $\log 2 = 6 \log \left(\frac{100 + r}{100}\right)$ $\frac{0.3010}{6} = \log \left(\frac{100 + r}{100}\right)$ $0.0502 = \log \left(\frac{100 + r}{100}\right)$ $1.123 = \frac{100 + r}{100}$ $112.3 = 100 + r$ $12.3\% = r$	B1 M1 M1 A1	
		04	
11	$OT = \frac{-2}{3-2}OA + \frac{3}{3-2}OB$ $OT = \frac{-2}{1} \begin{pmatrix} -1 \\ 3 \end{pmatrix} + \frac{3}{1} \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ $OT = \begin{pmatrix} 2 \\ -6 \end{pmatrix} + \begin{pmatrix} 12 \\ 15 \end{pmatrix} = \begin{pmatrix} 14 \\ 9 \end{pmatrix}$ <p>T(14,9)</p>	M1 M1 A1 B1	
		04	
12	$\frac{155 \times 100}{125} = 124$ $\frac{100x + 160y}{x + y} = 124$ $100x + 160y = 124x + 124y$ $160y - 124y = 124x - 100x$ $36y = 24x$	M1 M1	

	$\frac{36}{24} = \frac{x}{y} = \frac{3}{2}$ $x:y = 3:2$	A1 B1																																					
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13	$\theta + 2\theta = 90$ $3\theta = 90$ $\theta = 30^\circ$ $\tan \theta = \frac{1}{\sqrt{3}}$	M1 A1 B1																																					
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14	<p>a)</p> <table border="1" style="margin-left: 20px;"> <tbody> <tr><td></td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>2</td><td>22</td><td>32</td><td>42</td><td>52</td><td>62</td></tr> <tr><td>3</td><td>23</td><td>33</td><td>43</td><td>53</td><td>63</td></tr> <tr><td>4</td><td>24</td><td>34</td><td>44</td><td>54</td><td>64</td></tr> <tr><td>5</td><td>25</td><td>35</td><td>45</td><td>55</td><td>65</td></tr> <tr><td>6</td><td>26</td><td>36</td><td>46</td><td>56</td><td>66</td></tr> </tbody> </table> <p>b) $P(\text{Composite number}) = \frac{22}{25}$</p>		2	3	4	5	6	2	22	32	42	52	62	3	23	33	43	53	63	4	24	34	44	54	64	5	25	35	45	55	65	6	26	36	46	56	66	B2	For all values B2 otherwise 0
	2	3	4	5	6																																		
2	22	32	42	52	62																																		
3	23	33	43	53	63																																		
4	24	34	44	54	64																																		
5	25	35	45	55	65																																		
6	26	36	46	56	66																																		
		03																																					
15	$10 \times 4 = x(18 + x)$ $x^2 + 18x - 40 = 0$ $x^2 + 20x - 2x - 40 = 0$ $x(x + 10) - 2(x + 10) = 0$ $(x + 10)(x - 2) = 0$ $x = 2\text{cm}$	M1 M1 A1																																					
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16	$t = \text{Time taken} = \frac{80 \times 2.5}{120 - 80} = \frac{200}{40}$ $\text{Distance from Nairobi} = 650 - 7.5 \times 80$ $= 650 - 600$ $= 50 \text{ Km.}$	M1 M1 A1																																					
		03																																					
17	<p>a) $\text{PAYE} = (16,816 - (920 + 580 + 1400 + 4500))$ $= \text{Ksh. } 9,416$</p> <p>b) Monthly Taxable Income $\frac{9416 + 1064}{20} = \frac{10480}{20} = 524$</p>	M1 A1 M1 M1																																					

	$236 \times \frac{10}{100} = 23.6$ $236 \times \frac{15}{100} = 35.4$ $236 \times \frac{20}{100} = 47.2$ $236 \times \frac{25}{100} = 59$ $(23.6 + 35.4 + 47.2 + 59) = 165.2$ $(x - 944) \times \frac{30}{100} = 524 - 165.2$ $x - 944 = 358.8 \times \frac{100}{30}$ $x - 944 = 1196$ $x = \text{K}\text{E } 2140 = \text{Ksh. } 42,800$ <p>c)</p> $42800 - 5200$ $= 37,600$	M1 M1 M1 A1 M1 A1	
		10	
18	<p>i) The length of led CD</p> $= \sqrt{17.5^2 - (14 - 3.5)^2} = \sqrt{196} = 14\text{cm}$ <p><i>Actual Length</i> = $14 \times \frac{500,000}{100,000}$</p> $= 90 \text{ Km}$ <p>ii) the length of the DEG</p> $\text{Angle DEG} = 2 \times \text{Cos}^{-1} \frac{10.5}{17.5}$ $= 2 \times \text{Cos}^{-1} 0.6 = 2 \times 53.13 = 106.26$ <p><i>length of the DEG</i></p> $= \frac{106.26}{360} \times \frac{22}{7} \times 2 \times 3.5 \times \frac{500,000}{100,000}$ $= 6.4937 \times \frac{500,000}{100,000}$ 32.4685 Km. <p>iii) the length of the HFC</p> $\text{Angle HFC} = 360 - 106.26$ $= 253.74$ <p><i>length of the HFC</i></p>	M1 A1 M1 M1 A1 M1 M1	

	$= \frac{253.74}{360} \times \frac{22}{7} \times 2 \times 14 \times \frac{500,000}{100,000}$ $= 62.025 \times \frac{500,000}{100,000}$ <p style="text-align: center;">310.125 Km.</p> <p>iv) The Amount per day</p> <p>No of race officials</p> $= \frac{2(90) + 32.4685 + 310.125}{500} \times \frac{1000}{500} \Rightarrow 1045$ $= \frac{522.5935}{500} \times \frac{1000}{500} \Rightarrow 1045$ <p>Amount per day = 1045 x 250.00 = Ksh 261, 250</p>	<p>A1</p> <p>M1</p> <p>A1</p>																												
		10																												
19.	<p>a)</p> <table border="1"> <tr> <td>x</td> <td>15</td> <td>45</td> <td>75</td> <td>105</td> <td>120</td> <td>135</td> <td>150</td> <td>165</td> </tr> <tr> <td>sin x + 1</td> <td>1.26</td> <td>1.71</td> <td></td> <td></td> <td>1.87</td> <td></td> <td>1.50</td> <td></td> </tr> <tr> <td>1-Cos x</td> <td></td> <td></td> <td>0.74</td> <td>1.26</td> <td></td> <td>1.71</td> <td></td> <td>1.97</td> </tr> </table> <p>b)</p>  <p>c)</p> <p>i)</p> $\sin x + 1 = 1 - \cos x$ $= 135^\circ$ <p>ii) $\sin x + 1 = 1 \equiv y = 1$</p> $= 0^\circ$ $= 180^\circ$	x	15	45	75	105	120	135	150	165	sin x + 1	1.26	1.71			1.87		1.50		1-Cos x			0.74	1.26		1.71		1.97	<p>B2</p> <p>S1</p> <p>P1</p> <p>C1</p> <p>P1</p> <p>C1</p> <p>B1</p> <p>B1</p> <p>B1</p>	
x	15	45	75	105	120	135	150	165																						
sin x + 1	1.26	1.71			1.87		1.50																							
1-Cos x			0.74	1.26		1.71		1.97																						
		10																												
20	a)	B2																												



M1
A1

b) i)
$$P(\text{MEJ}) = \frac{1}{3} \times \frac{1}{2} \times \frac{1}{4}$$

$$= \frac{1}{24}$$

M1
A1

ii)
$$P(\text{ME}^1\text{J}) = \frac{1}{3} \times \frac{1}{2} \times \frac{1}{4}$$

$$= \frac{1}{24}$$

M1

iii)
$$P(\text{At least one scored}) = 1 - P(\text{None scored})$$

$$= 1 - \left(\frac{2}{3} \times \frac{1}{2} \times \frac{3}{4}\right)$$

$$= 1 - \frac{1}{4}$$

$$= \frac{3}{4}$$

A1

M1
A1

iv)
$$P(\text{at most two players scored a goal}) = 1 - P(\text{all scored})$$

$$= 1 - \frac{1}{24}$$

$$= \frac{23}{24}$$

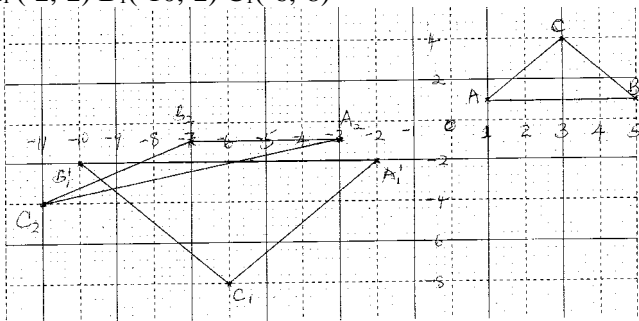
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21

a)

$$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} A & B & C & D \\ 1 & 5 & 3 \\ 1 & 1 & 4 \end{pmatrix} = \begin{pmatrix} A_1 & B_1 & C_1 \\ -2 & -10 & -6 \\ -2 & -2 & -8 \end{pmatrix}$$

$A_1(-2,-2)$ $B_1(-10,-2)$ $C_1(-6,-8)$



M1
A1
B1
B1

A B C D
drawn

A₁ B₁ C₁ D₁
drawn

b)

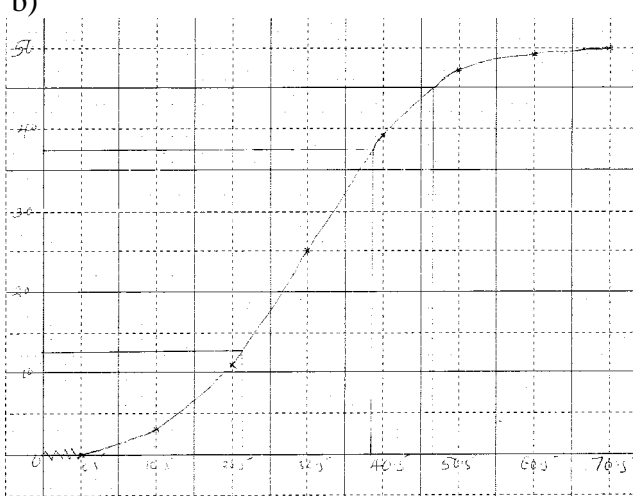
(i)

$$\begin{pmatrix} 1/2 & 1 \\ 0 & 1/2 \end{pmatrix} \begin{pmatrix} A_1 & B_1 & C_1 \\ -2 & -10 & -6 \\ -2 & -2 & -8 \end{pmatrix} = \begin{pmatrix} A_2 & B_2 & C_2 \\ -3 & -7 & -11 \\ -1 & -1 & -4 \end{pmatrix}$$

$A_2(-3,-1)$ $B_2(-7,-1)$ $C_2(-11,-4)$

M1
A1
B1
B1

	c) $The\ area = \frac{1}{2} \times 4 \times 3$ $= 6\ Square\ units.$	M1 A1	Coordinates A ₂ B ₂ C ₂ D ₂ A ₂ B ₂ C ₂ D ₂ Drawn
		10	

22	<p>a) 14 b)</p>  <p>c) From the graph (ii) $Median = \frac{1}{2} \times 50 = 25th\ entry$ $= 30.5$ (iii) $Q_1 = \frac{1}{4} \times 50 = 12.5th\ entry$ $= 22$ $Q_3 = \frac{3}{4} \times 50 = 37.5th\ entry$ $= 39$ $Quartile\ Deviation = \frac{39 - 22}{2} = \frac{17}{2} = 8.5$ (iv) $9th\ Decile = \frac{9}{10} \times 50 = 45th\ entry$</p>	<p>B1 B1 S1 P1 C1</p> <p>B1 B1 B1 B1 B1</p>	<p>For the CF</p> <p>AC = bisector</p> <p>Location of point O</p> <p>Completion of circle</p>
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	$= 47$		
		10	
23	<p>a) $2nd = 4 + d, 5th = 4 + 4d, 14th = 4 + 13d$</p> <p>b) $\frac{4+13d}{4+4d} = \frac{4+4d}{4+d}$</p> $(4 + d)(4 + 13d) = (4 + 4d)(4 + 4d)$ $16 + 52d + 4d + 13d^2 = 16 + 32d + 16d^2$ $56d + 13d^2 = 32d + 16d^2$ $24d - 3d^2 = 0$ $3d(8 - d) = 0$ <p>$d = 8$ hence</p> $a = 4 + 8 = 12,$ $r = \frac{4 + 4 \times 8}{4 + 8}$ $= \frac{36}{12}$ $= 3$ <p>c) $s_6 = \frac{12(3^6 - 1)}{3 - 1}$</p> $= \frac{12(729 - 1)}{2}$ $= \frac{8736}{2}$ $= 4368$	<p>B1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>A1 for both distances</p> <p>A1 for both speeds</p>
		10	
24	<p>a) i) $\angle ADC = 47^\circ$ $\angle ACS = 47^\circ$</p> <p>ii) $\angle CBA = 133^\circ$ $\angle BCA = \frac{47}{2} = 23.5^\circ$</p> <p>iii) $\angle BAS$ $180 - (47 + 43 + 23.5)$ $180 - 113.5$ $= 66.5^\circ$</p> <p>iv) $\angle SCE$</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p>	<p>Alternate angle segment theorem</p>

	$\angle CAE = 43^\circ + 47^\circ = 90^\circ$ hence CE is a diameter $\angle SCE = 90^\circ$ b) i) $AC = 2 \times 10 \cos 43^\circ$ $= 10 \times 0.7314 \times 2$ $= 14.628 \text{cm}$	B1 B1 M1 A1	
		10	