



FORM 4 MATHS PAPER 2 MOCK MARKING SCHEME DECEMBER TERM 2 2021

$\frac{6300}{7217} \% \text{ or } 0.09516\%$   
 $(2x - 1) = 0$   
 $-1) \big] = \log_5 1$   
 (nate segment theorem)  
 )



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5.	$\frac{1}{\tan 15^\circ} = \frac{1}{2 - \sqrt{3}}$ $\frac{1(2 + \sqrt{3})}{(2 - \sqrt{3})(2 + \sqrt{3})}$ $\frac{2 + \sqrt{3}}{4 - 3}$ $2 + \sqrt{3}$	M1 A1	Rationalizing the denominator accuracy
		02	
6.	$5 \cos^2 \theta + 2 = 3(1 - \cos^2 \theta) - 2 \cos \theta$ $8 \cos^2 \theta + 2 \cos \theta - 1 = 0$ $(4 \cos \theta - 1)(2 \cos \theta + 1) = 0$ $\cos \theta = \frac{1}{4} \text{ or } \cos \theta = -\frac{1}{2}$ $\theta = 75.52^\circ, 120^\circ, 240^\circ, 284.48^\circ.$	M1 M1 A1 B1	Expression into Same trigs Attempt to solve the Quadratic equation $\cos \theta$ accurate All $\theta$ values correct
		04	
7.	$x^2 - x(2x - 3) = -4$ $x^2 - 2x^2 + 3x = -4$ $x^2 - 3x - 4 = 0$ $(x + 1)(x - 4) = 0$ $x = -1 \text{ or } x = 4$ $y = -5 \text{ or } y = 5$	M1 M1 A1 B1	Equation in one unknown attempt to solve accuracy (two values) Pairing values
		04	



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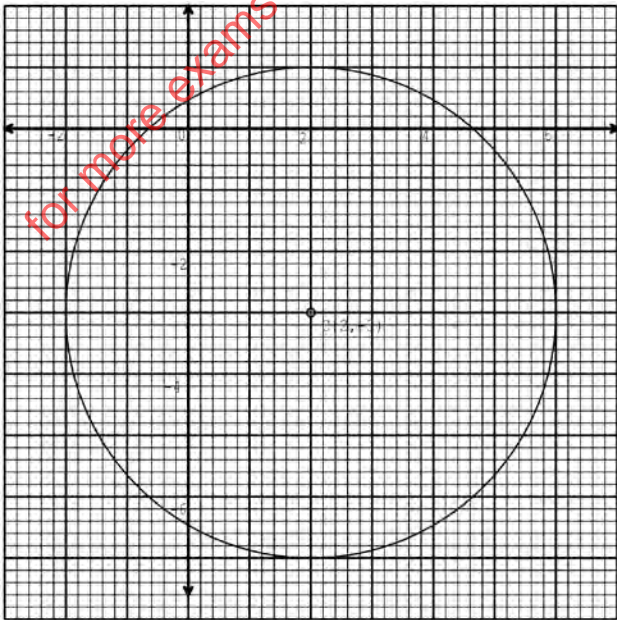
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8.	$(\sqrt{2} + \sqrt{5})^4 - (\sqrt{2} - \sqrt{5})^4$ $(\sqrt{2} + \sqrt{5})^4 = (\sqrt{2})^4 + 4(\sqrt{2})^3(\sqrt{5}) + 6(\sqrt{2})^2(\sqrt{5})^2 + 4(\sqrt{2})(\sqrt{5})^3 + (\sqrt{5})^4$ $= 4 + 8\sqrt{10} + 60 + 20\sqrt{10} + 25 = 89 + 28\sqrt{10}$ $(\sqrt{2} - \sqrt{5})^4 = 4 - 8\sqrt{10} + 60 - 20\sqrt{10} + 25 = 89 - 28\sqrt{10}$ $(\sqrt{2} + \sqrt{5})^4 - (\sqrt{2} - \sqrt{5})^4 = (89 + 28\sqrt{10}) - (89 - 28\sqrt{10})$ $= 56\sqrt{10}$	M1 M1 M1 A1	Correct expansion Of $(\sqrt{2} + \sqrt{5})^4$ Correct expansion of $(\sqrt{2} - \sqrt{5})^4$ subtracting the two expansions Accuracy							
		04								
9.	<table border="1"><tr><td>Cumulative frequency</td><td>3</td><td>13</td><td>25</td><td>34</td><td>38</td><td>40</td></tr></table> $Q_1 = 94.5 + \left(\frac{10-3}{10}\right) \times 5 = 98.0$ $Q_3 = 104.5 + \left(\frac{30-25}{9}\right) \times 5 = 107.28$ $\text{quartile deviation} = \frac{107.28 - 98.0}{2}$ $= 4.639$	Cumulative frequency	3	13	25	34	38	40	B1 B1 M1 A1	Cumulative Frequency Either $Q_1$ or $Q_3$ Finding quartile dev. accuracy
Cumulative frequency	3	13	25	34	38	40				
		04								
10.	$y = \frac{k}{x^n} \Rightarrow 4\frac{1}{2} = \frac{k}{2^n} \text{ and } 1\frac{1}{3} = \frac{k}{3^n}$ $4\frac{1}{2} \times 2^n = 1\frac{1}{3} \times 3^n$ $\left(\frac{2}{3}\right)^n = \left(\frac{2}{3}\right)^3$ $n = 3$ $k = \frac{4}{3} \times 27 = 36$	M1 M1 A1 B1	Correct substitution Equation in one Unknown Accuracy Value of $k$							
		04								



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11.	$P(\text{contracted disease}) = \left( \frac{640}{700} \times \frac{15}{100} \right) + \left( \frac{60}{700} \times \frac{70}{100} \right)$ $= \frac{24}{175} + \frac{3}{50}$ $= \frac{69}{350}$	M1 M1 A1	Probabilities Correct Addition of correct probabilities Accuracy
12.	$60\theta \cos 60^\circ = 1260$  $\theta = 42^\circ$  $U(60^\circ S, 27^\circ E)$	03 M1 A1 B1	Equating to distance Accuracy Position of U
13.	$\frac{1}{3}x^2 + \frac{1}{3}y^2 - 1\frac{1}{3}x + 2y - 1 = 0$ $x^2 - 4x + 4 + y^2 + 6y + 9 = 3 + 4 + 9$ $(x-2)^2 + (y+3)^2 = 4^2$ <i>centre(2, -3) radius = 4 units</i> 	03 M1 M1 A1 B1	Completing the Square. Writing in the form $(x-a)^2 + (y-b)^2 = r^2$ Accuracy centre and radius correct circle drawn.
		04	



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14.	$\text{In } 1h \frac{1}{2} + \frac{1}{3} - \frac{1}{4} = \frac{7}{12} \text{ is filled}$ $\text{time taken to fill } \tan k = \frac{12}{7}$ $= 1\frac{5}{7}h$	M1	Fraction filled in 1 Hr
		A1	Accuracy
		02	
15.	$1^{\text{st}} \text{ slab : } 4200 \times 2 = \text{Ksh } 8,400$ $2^{\text{nd}} \text{ slab : } 4200 \times 3 = \text{Ksh } 12,600$ $3^{\text{rd}} \text{ slab : } y \times 4 = (37000 - 21000)$ $y = 4000$ $\text{annual income} = 4200 + 4200 + 4000$ $= 12,400$	M1	Expression for 1 <sup>st</sup> And 2 <sup>nd</sup> slabs
		M1	Expression for tax In 3 <sup>rd</sup> slab
		A1	Annual income
		03	
16.	$\overrightarrow{OC} = \frac{5}{3}b + \frac{-2}{3}a$ $\overrightarrow{OC} = \frac{5}{3}b - \frac{2}{3}a$	M1	Use of ratio theorem
		A1	Accuracy
		02	



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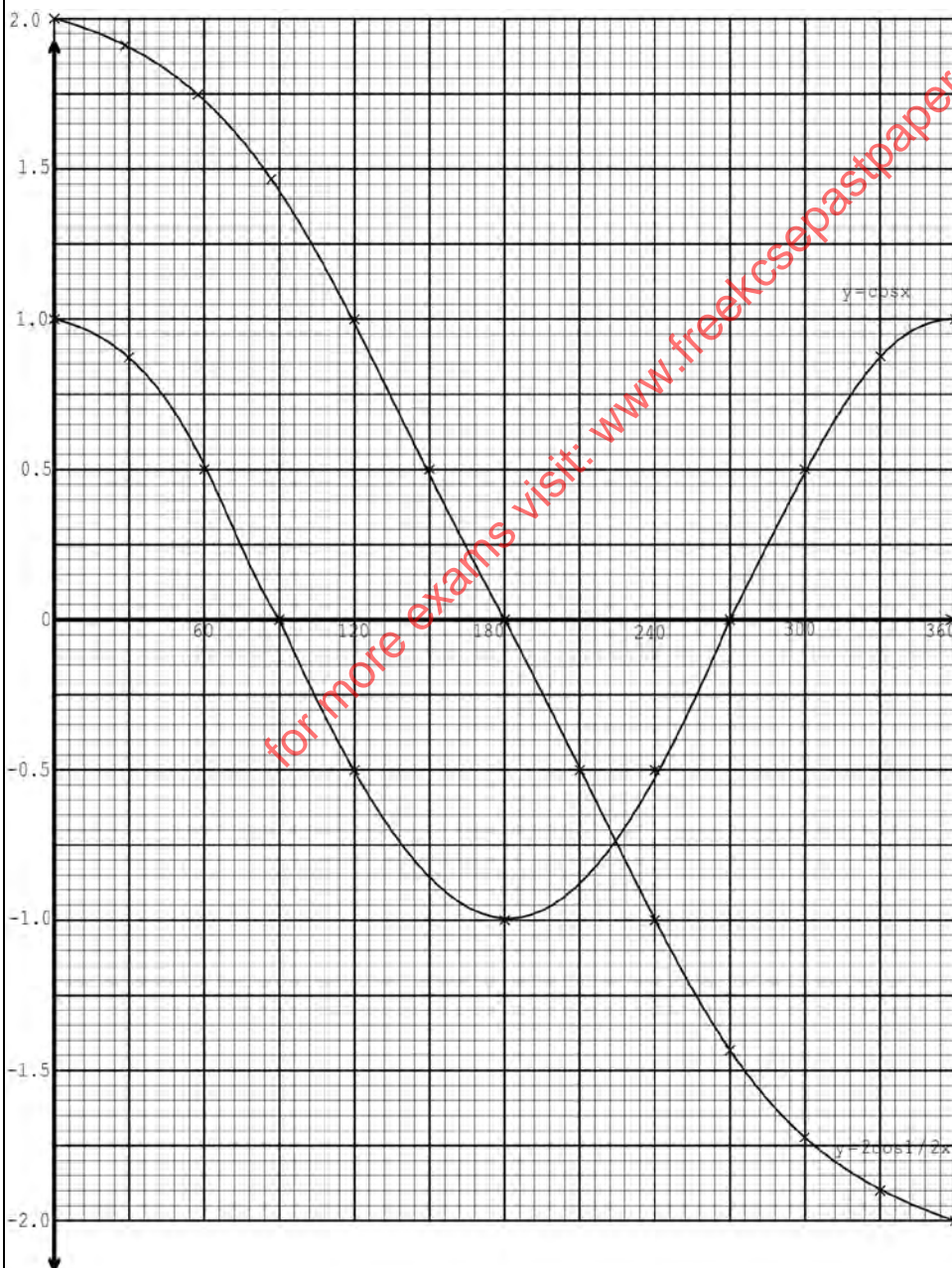
17.	a)			
	(i)	$\frac{448000 - 112000}{24}$	M1	Expression
		Ksh 14,000	A1	Accuracy
	(ii)	$\frac{85}{100} \times 448000$	M1	Expression
		Ksh 380,800	A1	Accuracy
	b)	$\frac{92}{100} \times 380800$	M1	Expression
		$350336 = \left(1 + \frac{4}{100}\right)^{10}$	M1	Expression
		Ksh 518,582.86	A1	Accuracy
	c)	$\frac{518582.86 - 448000}{448000} \times 100\%$	M1	Difference
		$\frac{70582.86}{448000} \times 100\%$	M1	Getting %
		15.76%	A1	Accuracy
			10	



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18. a) .



B2 8-10 values correct

B1 6-7 values correct

B0 Below 6 values

S1 Given scale used

P1 Plotting all points  
For  $\cos \theta$ 

C1 Smooth curve

P1 Plotting all points  
For  $2 \cos \frac{1}{2} \theta$ 

C1 Smooth curve

B1

B1

B1



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b)

$x^0$	60	90	120	210	270	330
$\cos x$	0.5	1	-0.5	-0.87	0	0.87
$2 \cos \frac{1}{2} x^0$	1.73	1.41	1	-0.52	-1.41	-1.93

c) .

(i)  $period = 720^0$ (ii) *stretch along y-axis, stretch factor 2 followed by stretch along x-axis, stretch factor 2*(iii)  $225^0 \pm 2^0$ 

B1

B1

B1

10





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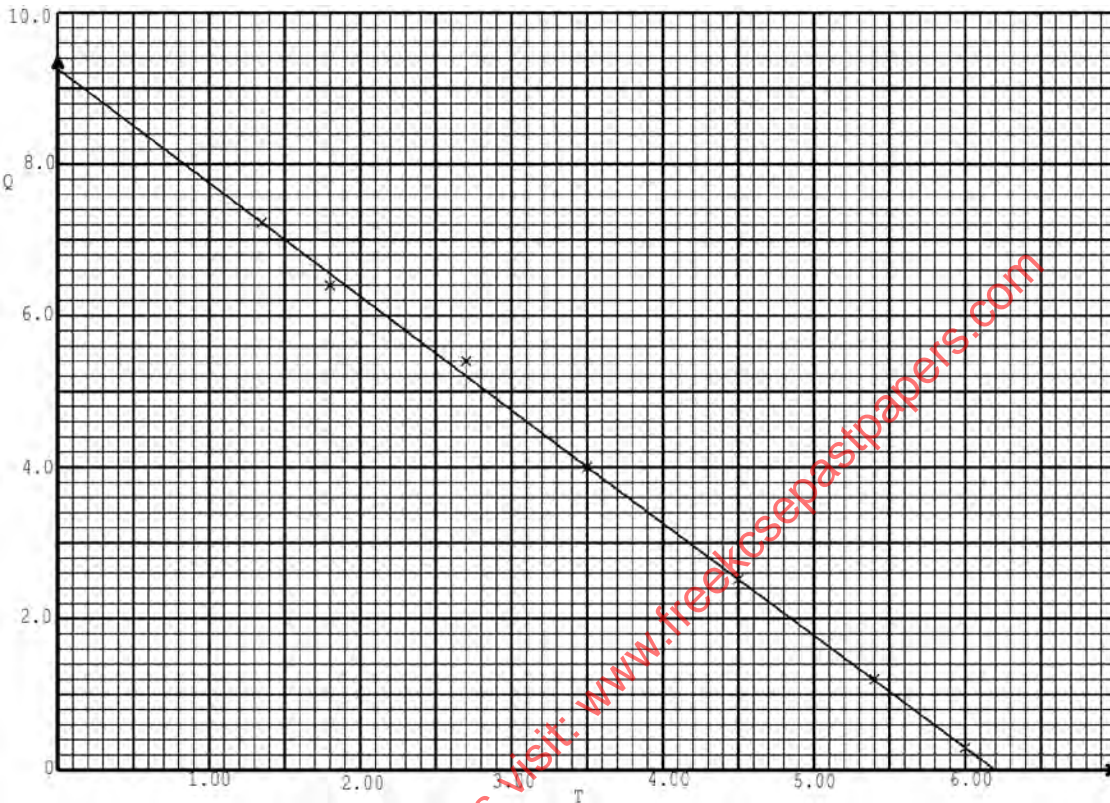
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19.	<p>a)</p> $\text{height of triangle} = \sqrt{7.5^2 - 4.5^2} = 6m$ $\text{vertical height} = \sqrt{6^2 - 2^2}$ $= 5.657m$ <p>b).</p> <p>(i)</p> $\cos \theta = \frac{2}{6}$ $\theta = 70.53^\circ$ <p>(ii)</p> $\sin \alpha = \frac{5.657}{7.5}$ $\alpha = 48.96^\circ$ <p>(iii)</p> $\text{slant length} = \sqrt{7.5^2 - 2^2}$ $= 7.228m$ $\sin \frac{1}{2} \beta = \frac{4.5}{7.228}$ $\beta = 2 \times 38.50$ $\beta = 77.00^\circ$	<p>B1</p> <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>A1</p>	<p>For 6m</p> <p>Expression for Vertical height</p> <p>Accuracy</p> <p>Expression for Finding angle</p> <p>Accuracy</p> <p>Expression for Finding angle</p> <p>Accuracy</p> <p>For the slant length</p> <p>Expression for Finding the angle</p> <p>Accuracy.</p>
		10	



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20.	<p>a)</p>  <p>(b)</p> <p>(i)</p> $a = \text{gradient} = \frac{7.0 - 4.0}{1.5 - 3.5}$ $a = -1.5$ $b = y - \text{intercept} = 9.2 \pm 0.1$ <p>(ii) <math>Q = -1.5T + 9.2</math></p> <p>(iii)</p> $0 = -1.5T + 9.2 \quad \text{or when } Q = 0$ $1.5T = 9.2 \quad T = x - \text{intercept}$ $T = 6.133 \quad T = 6.15 \pm 0.04$	<p>S1</p> <p>P2</p> <p>P1</p> <p>L1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p>	<p>Simple, Linear and Accommodative scale</p> <p>7-8 points correctly Plotted.</p> <p><b>5-6 points</b> <b>Correctly plotted</b> <b>Otherwise P</b></p> <p>Line of best fit</p> <p>Expression for Finding gradient</p> <p>Accuracy</p> <p>y-intercept correctly read</p> <p>Correct substitution Of <i>a</i> and <i>b</i> values</p>
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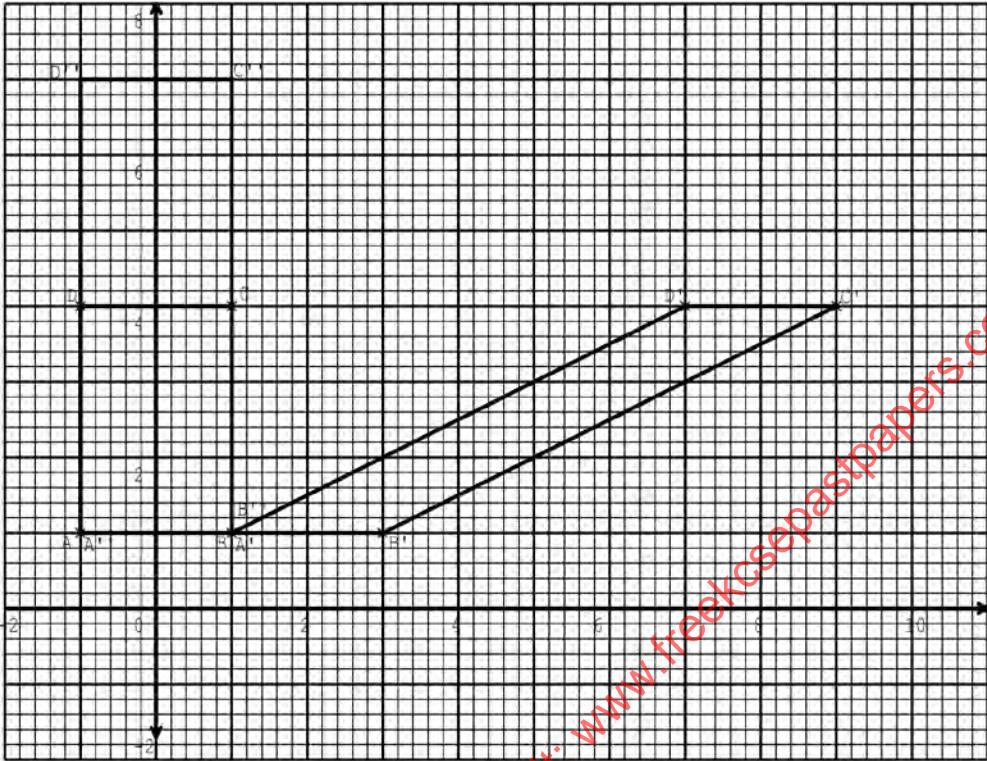
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21.	<p>a) .</p> $8x - x^2 = 3x \qquad 8x - x^2 = x$ $5x - x^2 = 0 \qquad 7x - x^2 = 0$ $x(5 - x) = 0 \qquad x(7 - x) = 0$ $x = 0 \text{ or } x = 5 \qquad x = 0 \text{ or } x = 7$ $P(5,15) \qquad Q(7,7)$ <p>b) .</p> <p>(i) .</p> $\int_0^7 (8x - x^2) dx - \int_0^7 x dx$ $\left[ 4x^2 - \frac{x^3}{3} + c \right]_0^7 - \left[ \frac{x^2}{2} + c \right]_0^7$ $\left[ 4 \times 7^2 - \frac{7^3}{3} \right] - \left[ \frac{7^2}{2} \right]$ $81\frac{2}{3} - 24\frac{1}{2}$ $= 57\frac{1}{6}$ <p>(ii) .</p> $\int_0^5 (8x - x^2) dx - \int_0^5 3x dx$ $\left[ 4x^2 - \frac{x^3}{3} + c \right]_0^5 - \left[ \frac{3x^2}{2} + c \right]_0^5$ $\left[ 4 \times 5^2 - \frac{5^3}{3} \right] - \left[ \frac{3 \times 5^2}{2} \right]$ $58\frac{1}{3} - 37\frac{1}{2}$ $= 20\frac{5}{6}$ <p>(iii).</p> $\text{shaded area} = 57\frac{1}{6} - 20\frac{5}{6}$ $= 36\frac{1}{3} \text{ sq. units}$	<p>B1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>10</p>	<p>Coordinates of P</p> <p>Coordinates of Q</p> <p>Correct integration With limits</p> <p>Correct substitution</p> <p>Accuracy</p> <p>Correct integration With limits</p> <p>Correct substitution</p> <p>Accuracy</p> <p>Subtraction</p> <p>Accuracy</p>
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22.	<p>(a) (i)</p>  <p>(ii) transformation is a shear, line <math>x</math> - axis in variant point <math>B(1,1)</math> mapped onto point <math>B'(3,1)</math></p> <p>(iii)</p> $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ $1 + k = 3$ $k = 2$ $T = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ <p>b) <math>A''(-1,1), B''(1,1), C''(1,7), D''(-1,7)</math></p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>10</p>	<p>Rectangle ABCD Correctly drawn</p> <p>Rectangle A'B'C'D' Correctly drawn</p> <p>Correct transformation</p> <p>invariant line</p> <p>point not on invariant line and its image Correct method of Finding T</p> <p>Accuracy</p> <p>Point C and D Correctly located</p> <p>Rectangle completed Coordinates of A''B''C''D''</p>
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23.	<p>(c)</p> $\theta = 45 \pm 1^\circ$ $\text{area of region } X = \frac{45}{360} \times \frac{22}{7} \times 45^2$ $= 795.54 \text{ m}^2$	B1	Perpendicular Bisector of AB constructed
		B1	Angle bisector of ABC constructed
		B1	N located and Labelled
		B1	Correct shading of Nearer B than A
		B1	Correct shading Of nearer AB than BC
		B1	Arc 3 cm (45m) From N drawn
		B1	X shaded and Labelled correctly
		B1	For $\theta = 45 \pm 1^\circ$
		M1	Correct substitution
		A1	accuracy
		10	



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24.	<p>(a).</p> <p>(i)</p> $\frac{8}{2}[2 \times -11 + (8-1)d] = 52$ $-88 + 28d = 52$ $d = 5$ <p>(ii)</p> $\frac{n}{2}[2 \times -11 + (n-1)5] > 920$ $-22n + 5n^2 - 5n > 1840$ $5n^2 - 27n - 1840 > 0$ $n = \frac{27 \pm \sqrt{(-27)^2 - 4 \times 5 \times -1840}}{2 \times 5}$ $n = \frac{27 \pm \sqrt{37529}}{10}$ $n = \frac{27 \pm 193.72}{10}$ $n = 22.072 \text{ or } -16.672$ <p>Hence least value of <math>n = 23</math> terms</p> <p>(b)</p> <p>(i)</p> $\frac{a+18}{a+6} = \frac{a+48}{a+18}$ $a^2 + 36a + 324 = a^2 + 54a + 288$ $18a = 36$ $a = 2$ $1^{\text{st}} \text{ term of G.P.} = 2 + 2 \times 3 = 8$ <p>(ii)</p> $S_7 = \frac{8(2.5^{7-1})}{2.5-1}$ $S_7 = 1302 \frac{1}{12}$	M1	Correct substitution
		A1	Accuracy
		M1	correct substitution
		M1	correct attempt to solve
		A1	Accuracy
		M1	Correct equation leading 1 <sup>st</sup> term of A.P.
		A1	Accuracy
		B1	1 <sup>st</sup> term of G.P.
		M1	Correct substitution
		A1	Accuracy
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