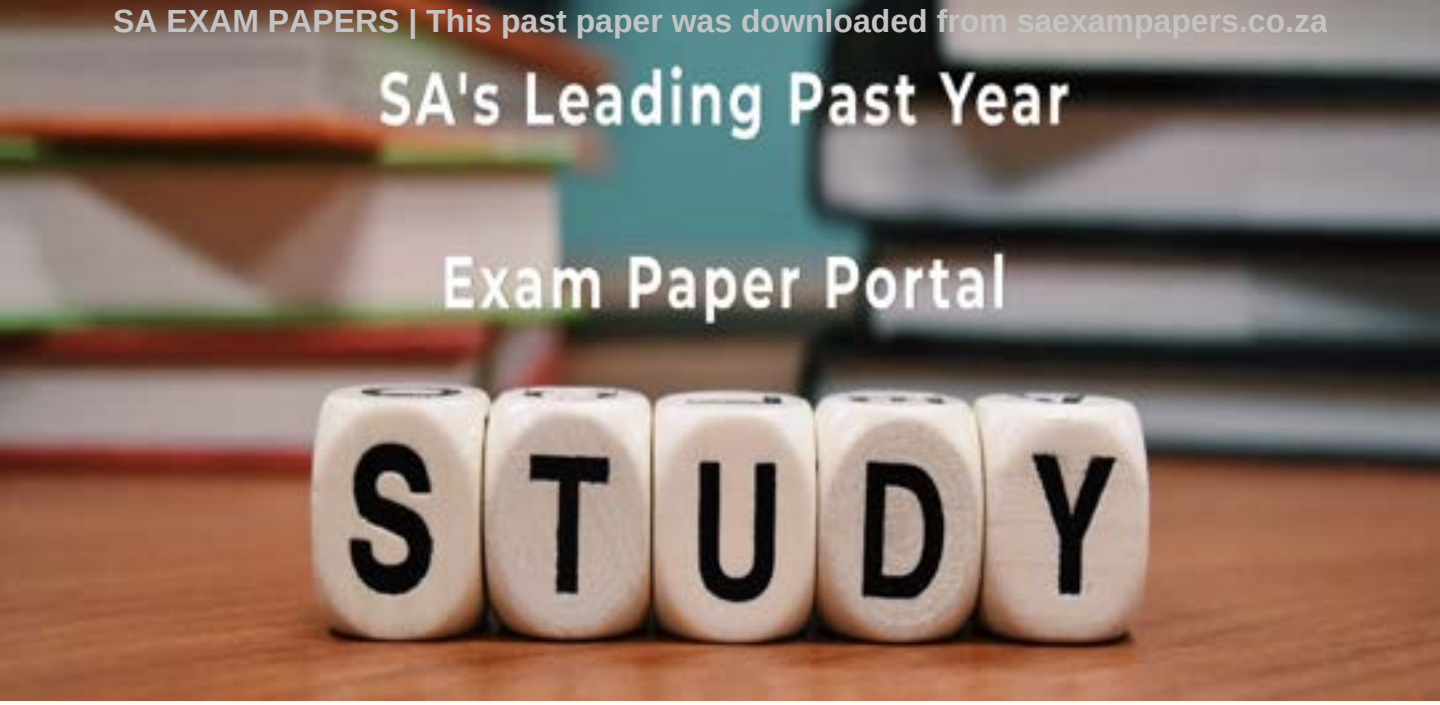


KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

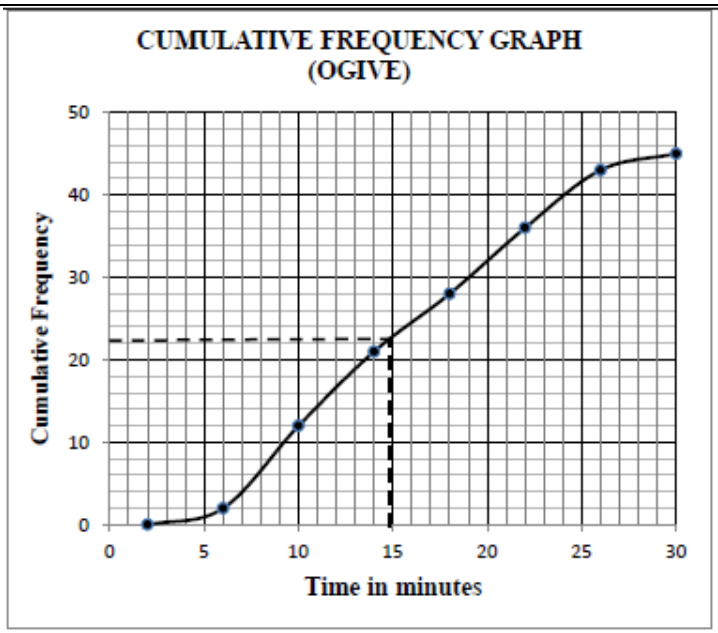
MATHEMATICS AUGUST PRE PREPARATORY PAPER 2

MARKING GUIDELINE

GEOMETRY	
S	A mark for the correct statement. (A statement mark is independent of a reason)
R	A mark for a correct reason. (A reason mark may only be awarded if the statement is correct)
S/R	Award a mark if the statement AND reason are both correct.

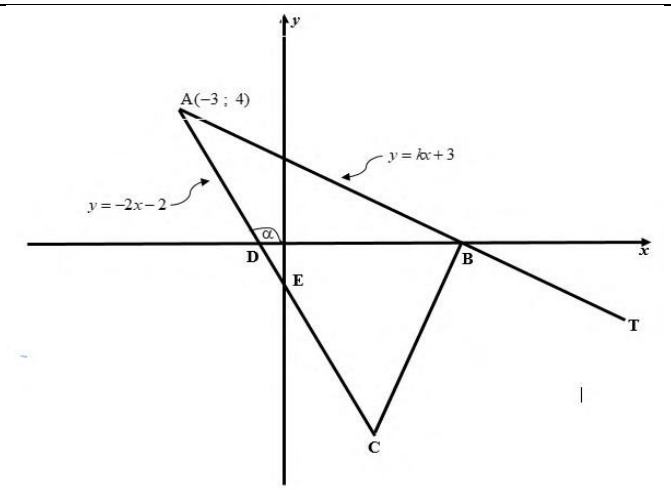
QUESTION 1

<table>
<tr><th>No.</th><th>SOLUTION</th><th>MARK JUSTIFICATION</th><th>MARK</th></tr>
<tr><td>1.1</td><td>45 children</td><td>✓ A answer</td><td>(1)</td></tr>
<tr><td>1.2</td><td>$\bar{X} = \frac{\sum fx}{n}$
$\bar{X} = \frac{(4\times2)+(8\times10)+(12\times9)+(16\times7)+(20\times8)+(24\times7)+(28\times2)}{45}$
$\bar{X} = \frac{692}{45}$
$\bar{X} = 15,38$ minutes
Answer only: full marks</td><td>✓ A 692
✓ CA answer</td><td>(2)</td></tr>
<tr><td>1.3</td><td>
<table>
<tr><th>Time taken (t) (in minutes)</th><th>Number of children</th><th>Cumulative frequency</th></tr>
<tr><td>$2 < t \leq 6$</td><td>2</td><td>2</td></tr>
<tr><td>$6 < t \leq 10$</td><td>10</td><td>12</td></tr>
<tr><td>$10 < t \leq 14$</td><td>9</td><td>21</td></tr>
<tr><td>$14 < t \leq 18$</td><td>7</td><td>28</td></tr>
<tr><td>$18 < t \leq 22$</td><td>8</td><td>36</td></tr>
<tr><td>$22 < t \leq 26$</td><td>7</td><td>43</td></tr>
<tr><td>$26 < t \leq 30$</td><td>2</td><td>45</td></tr>
</table>
</td><td>✓ A first 4 cum freq correct
✓ A last 3 cum freq correct</td><td>(2)</td></tr>
</table>

1.4		✓ CA plotting cum freq at upper limits correctly (all points) ✓ A shape (smooth) ✓ A grounding (2;0)	(3)
1.5	On graph at the y-value of 22,5 or 23 Median = ±15 minutes. Answer only: full marks	✓ CA graph ✓ CA answer	(2)
			[10]
QUESTION 2			
2.1	Answer only: full marks $a = 12,44$ $b = 0,98$ $y = 12,44 + 0,98x$	✓ A value of a ✓ A value of b ✓ CA equation	(3)
2.2.1	$\text{Percentage} = \frac{15}{50} \times 100$ $= 30\%$	✓ A answer	(1)
2.2.2	$y = 12,44 + 0,98x$ $y = 12,44 + 0,98(30)$ $y = 41,84$ $= 42$ Answer only: full marks OR $y = 41,87$(if using calculator) $y = 42$ OR $y = \frac{21}{50}$	✓ A substitution ✓ CA answer as integer ✓ CA value of y ✓ CA answer as integer ✓✓ CA CA answer	(2)

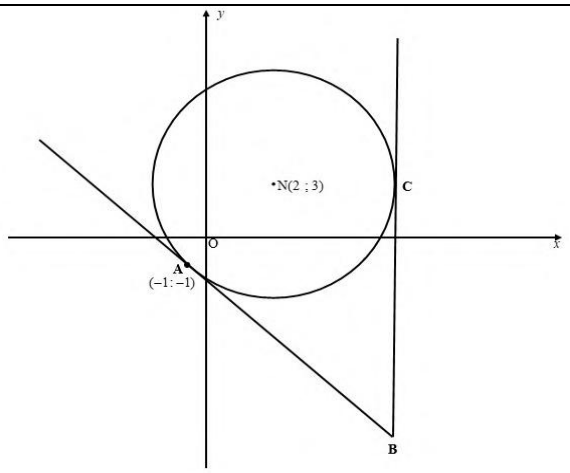
2.3.1	standard deviation $= 13,88$	✓✓ A A answer	(2)
2.3.2	$x = 50,67 - 45,67$ $= 5\%$ Answer only: full marks	✓ A $50,67 - 45,67$ ✓ A answer	(2)
			[10]

QUESTION 3



3.1	$4 = k(-3) + 3$ $k = -\frac{1}{3}$	A✓substitution	(1)
3.2	$-\frac{1}{3}x + 3 = 0$ $-\frac{1}{3}x = -3$ $x = 9$ Answer only: full marks $\therefore B(9\ ;\ 0)$	A✓equating to 0 A✓ $x = 9$	(2)
3.3	E(0 ;−2) $\frac{x + -3}{2} = 0$ and $\frac{y + 4}{2} = -2$ $x = 3$ $y = -8$ C(3 ;−8)	A✓ E(0 ;−2) A✓ $\frac{x + -3}{2} = 0$ CA✓ $\frac{y + 4}{2} = -2$ CA✓ C(3 ;−8)	(4)
3.4	$m_{BC} = \frac{-8 - 0}{3 - 9} = \frac{4}{3}$	CA✓ m_{BC}	(3)

	$m_T = m_{BC}$ (parallel lines) $y = \frac{4}{3}x + c$ $-2 = \frac{4}{3}(15) + c$ $c = -22$ $\therefore y = \frac{4}{3}x - 22$	CA✓ $-2 = \frac{4}{3}(15) + c$ CA✓ $y = \frac{4}{3}x - 22$	
3.5	$\tan\alpha = -2$ $\alpha = 180° - \tan^{-1}(2)$ $\alpha = 116,57°$ $\tan A\hat{B}x = \tan\left(-\frac{1}{3}\right)$ $A\hat{B}x = 180° - \tan\left(\frac{1}{3}\right)$ $A\hat{B}x = 161,57°$ $\therefore B\hat{A}C = 161,57° - 116,57°$ (ext $\angle$ of a Δ) $= 45°$	A✓ $\tan\alpha = -2$ A✓ $\alpha = 116,57°$ A✓ $\tan A\hat{B}x = \tan\left(-\frac{1}{3}\right)$ CA✓ $A\hat{B}x = 161,57°$ CA✓ $B\hat{A}C = 45°$	(5)
3.6	$AD = \sqrt{(3--1)^2 + (4-0)^2} = 2\sqrt{2}$ $AB = \sqrt{(-3-9)^2 + (4-0)^2} = 4\sqrt{10}$ $AT = \sqrt{(-3-15)^2 + (4--2)^2} = 6\sqrt{10}$ $\frac{\text{Area of } \Delta ABD}{\text{Area of } \Delta ATC} = \frac{\frac{1}{2}.AD.AB\sin\hat{A}}{\frac{1}{2}AC.AT\sin\hat{A}}$ $= \frac{AD.AB}{AC.AT}$ $= \frac{(2\sqrt{2})(4\sqrt{10})}{(8\sqrt{10})(6\sqrt{10})}$ $= \frac{\sqrt{5}}{30}$	A✓AD and AB A✓AT A✓ $\frac{\frac{1}{2}.AD.AB\sin\hat{A}}{\frac{1}{2}AC.AT\sin\hat{A}}$ CA✓ $\frac{(2\sqrt{2})(4\sqrt{10})}{(8\sqrt{10})(6\sqrt{10})}$ CA✓ $\frac{\sqrt{5}}{30}$	(5)

			[20]
QUESTION 4			
			
4.1	$(x-2)^2+(y-3)^2=r^2$ $(-1-2)^2+(-1-3)^2=r^2$ $9+16=r^2$ $r^2=25$ $\therefore (x-2)^2+(y-3)^2=25$ OR $AN=\sqrt{(-1-2)^2+(-1-3)^2}$ $AN=\sqrt{9+16}$ $r=5$ $\therefore r^2=25$ $\therefore (x-2)^2+(y-3)^2=25$	A✓subs of N and A into the distance formula A✓ $r^2=25$ CA✓equation A✓subs of N and A into the distance formula A✓ $r^2=25$ CA✓equation	(3) (3)
4.2	C(2+5 ; 3) (by symmetry) C(7 ; 3)	A✓ $x=7$ A✓ $y=3$	(2)
4.3	$m_{AN}=\frac{3-(-1)}{2-(-1)}=\frac{4}{3}$ $m_{AB}=-\frac{3}{4}$ (radius ⊥ tangent) $y-(-1)=-\frac{3}{4}(x-(-1))$ $y=-\frac{3}{4}x-\frac{3}{4}-1$ $y=-\frac{3}{4}x-\frac{7}{4}$	A✓subs A and N into gradient formula A✓ $m_{radius}=\frac{4}{3}$ A✓ $m_{tangent}=-\frac{3}{4}$ A✓subs A and m CA✓equation	(5)

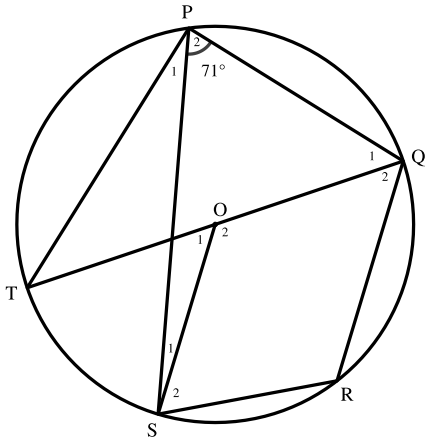
	OR $m_{AN}=\frac{3-(-1)}{2-(-1)}=\frac{4}{3}$ $m_{AB}=-\frac{3}{4}$ (radius $\perp$ tangent) $y=-\frac{3}{4}x+c$ $-1=-\frac{3}{4}(-1)+c$ $c=-\frac{7}{4}$ $\therefore y=-\frac{3}{4}x-\frac{7}{4}$	A✓subs A and N into gradient formula A✓ $m_{radius}=\frac{4}{3}$ A✓ $m_{tangent}=-\frac{3}{4}$ A✓subs A and m CA✓equation	(5)
4.4	B(7 : y_B) $y_B=-\frac{3}{4}(7)-\frac{7}{4}$ $y_B=-7$ B(7 ; −7) BC = 10 units	A✓sub $x=7$ A✓ $y_B=-7$ CA✓ BC = 10	(3)
4.5	$(x+1)^2+(y+1)^2=1$	A✓LHS A✓RHS	(2)
4.6	$d_c=\sqrt{(x_1+x_2)^2+(y_1+y_2)^2}$ N(2 ; 3) M(6 ; −5) $MN=\sqrt{(2+6)^2+(3+-5)^2}$ $=\sqrt{68}$ $=8,25$ $r_1+r_2=5+9=14$ $d_c<r_1+r_2$ ∴ The circles intersect	A✓ $MN=\sqrt{(2+6)^2+(3+-5)^2}$ A✓8,25 A✓14 CA✓ $d_c<r_1+r_2$ CA✓conclusion	(5)
			[20]
QUESTION 5			
5.1.1	$\sin(34°+30°)$ $\cos 34°\cos 30°-\sin 34°\sin 30°$ $\frac{\sqrt{3}}{2}\cos 34°-\frac{1}{2}\sin 34°$ $\frac{\sqrt{3}}{2}p-\frac{1}{2}\sqrt{1-p^2}$	✓ A expansion ✓ A special angles ✓ A simplification	(3)

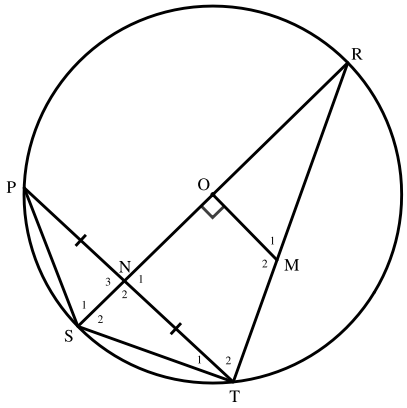
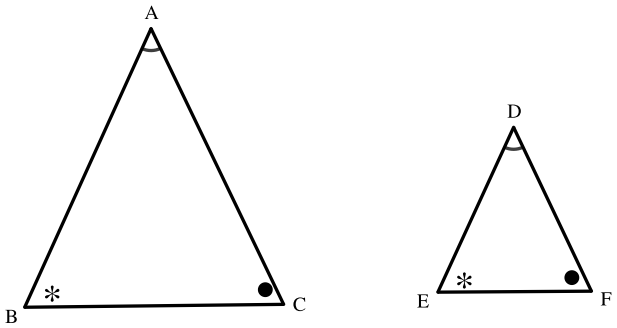
5.1.2	$\cos 68° = 2\cos^2 34° - 1$ $= 2p^2 - 1$	✓ A expansion ✓ A Answer	(2)
5.1.3	$\cos 34° = 1 - 2\sin^2 17°$ $p = 1 - 2\sin^2 17°$ $\sqrt{\frac{1-p}{2}} = \sin 17°$	✓ A half angle ✓ A substitution ✓ A answer	(3)
5.1.4	$2\sin^2 28° - 1 + 1$ $\left(-1 + 2\sin^2 28°\right) + 1$ $-\left(1 - 2\sin^2 28°\right) + 1$ $-\cos 56° + 1$ $-\sqrt{1-p^2} + 1$	✓ A Expansion ✓ A simplification ✓ A Answer	(3)
5.2.1	$\frac{\sin 70°.\tan 60°}{\cos 180° \tan 70° \sin 20°}$ $\frac{\sin 70°\sqrt{3}}{(-1)\frac{\sin 70°}{\cos 70°}.\cos 70°}$ $-\sqrt{3}$	✓ A $\sin 70°$ ✓ A $\cos 180°$ ✓ A $\tan 70°$ ✓ A $\sin 20°$ ✓ A $\frac{\sin 70°}{\cos 70°}$ ✓ A $\sin 20° = \cos 70°$ ✓ CA $-\sqrt{3}$	(7)
5.2.2	$1 - 2\sin^2 22,5°$ $\cos 2(22,5°)$ $\cos 45°$ $\frac{1}{\sqrt{2}}$	✓ A Expansion ✓ A Simplification ✓ CA $\cos 45°$ ✓ CA Answer	(4)
5.3.1	$\sin^2 x = 0$ $\sin x = 0$ $x = 0°$ or $x = 180°$ or $x = 90°$	✓ A $x = 0°$ ✓ A $x = 180°$ ✓ A $x = 90°$	(3)

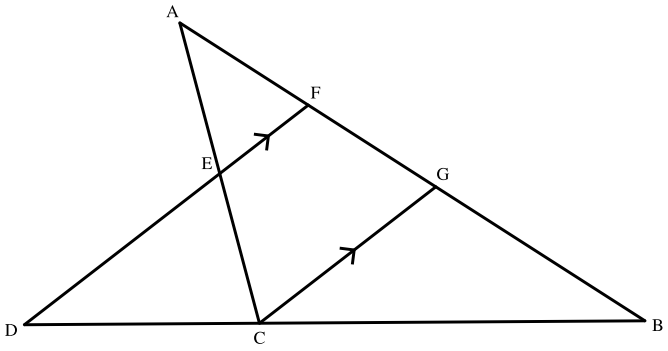
5.3.2	$\frac{\cos 2x.\tan x}{\sin^2 x}$ $\frac{\left(\cos^2 x-\sin^2 x\right)\left(\frac{\sin x}{\cos x}\right)}{\sin^2 x}$ $\frac{\cos^2 x-\sin^2 x}{\sin x\cos x}$ $\frac{\cos^2 x}{\sin x\cos x}-\frac{\sin^2 x}{\sin x\cos x}$ $\frac{\cos x}{\sin x}-\frac{\sin x}{\cos x}$ $\frac{\cos x}{\sin x}-\tan x=\text{RHS}$	✓ A Expansion ✓ A $\frac{\sin x}{\cos x}$ ✓ A Simplification ✓ A simplification ✓ A Answer	(5)
			[30]
QUESTION 6			
6.1	$a=3$ and $b=2$	✓ A $a=3$ ✓ A $b=2$	(2)
6.2	Period $=360°$	✓ A $360°$	(1)
6.3	$y\in[2;4]$	✓ A Values 2 and 4 ✓ A Notation	(2)
6.4	$0°<x<45°$ or $90°<x<135°$	✓ A $0°$ and $45°$ ✓ A $90°$ and $135°$ ✓ A Notation	(3)
6.5	$y=\cos 2x$ $y=\sin(90°+2x)$ $y=\sin 2(x+45°)$ $q=45°$	✓ A $y=\cos 2x$ ✓ A co ratio ✓ A $45°$	(3)
			[11]
QUESTION 7			
7.1	In ΔPMQ: $\tan\theta=\frac{x}{QM}$ $QM=\frac{x}{\tan\theta}$	✓ A Trig ratio ✓ A Answer	(2)

7.2	$\Delta PMQ \equiv \Delta PMS[AAS/RHS]$ $MR = \frac{x}{\tan\theta} = QM$ $Q\hat{M}R = 180° - 2\beta$ $\sin\beta \times \frac{\tan\theta}{x} = \frac{\sin(180° - 2\beta)}{12x}$ $\tan\theta = \frac{\sin 2\beta}{12x} \times \frac{x}{\sin\beta}$ $\tan\theta = \frac{\cos\beta}{6}$	✓ A MR=QM ✓ A Correct substitution ✓ A Reduction ✓ A Double angle	(4)
7.3	$\frac{x}{QM} = \frac{\cos\beta}{6}$ $x = \frac{60\cos 40°}{6}$ $x = 7,66$ The height of the lighthouse is 8 metres	✓ A Equating ✓ A Subst. QM=60 and $\beta = 40°$ ✓ A Answer	(3)
			[09]

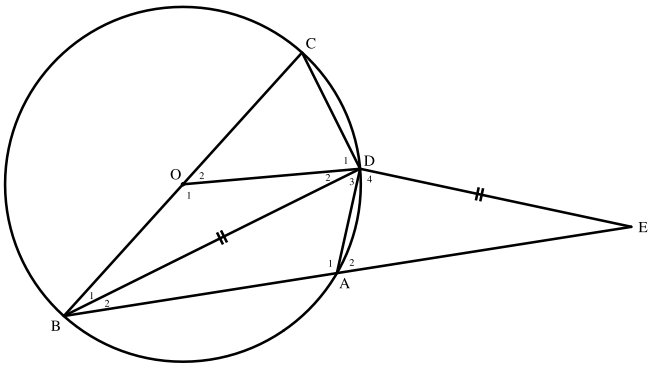
QUESTION 8

			
8.1.1	$\hat{R} = 109°$ [opp ∠s of a cyclic quad]	A✓S A✓R	(2)
8.1.2	$\hat{P}_1 + 71° = 90°$ [∠ in a semicircle] $\hat{P}_1 = 19°$	A✓S/R A✓Answer	(2)
8.1.3	$\hat{O}_1 = 2$ x $19°$ [∠ at centre = 2 x ∠ at circumference] $= 38°$	A✓S A✓R	(2)

			
8.2.1	$S\hat{T}R = 90°$ [$\angle$ in a semicircle] $\therefore$ TSOM is a cyclic quad [converse opp $\angle$s of a cyclic quad]	A✓S/R A✓S/R	(2)
8.2.2	$ON \perp PT$ [line from centre to midpoint of chord] $\therefore PT \parallel OM$ [co-int $\angle$s supplementary/ corresp $\angle$=]	A✓S A✓R A✓R	(3)
8.2.3	$\hat{M}_1 = \hat{T}_2$ [corresp $\angle$s, $PT \parallel OM$] $\hat{T}_2 = \hat{S}_1$ [$\angle$s in the same segment] $\therefore \hat{M}_1 = \hat{S}_1$	A✓S A✓R A✓S A✓R	(4)
			[15]
			
9.1	Constr. Let M and N lie on AB and AC respectively such that $AM = DE$ and $AN = DF$. Draw MN In ΔAMN and ΔDEF $AM = DE$ [constr...] $AN = DF$ [constr...] $\hat{A} = \hat{D}$ [given] $\therefore \Delta AMN = \Delta DEF$ [SAS]	A✓constr. A✓S/R A✓S	(6)

	$\therefore A\hat{M}N = \hat{E} = \hat{B}$ $\quad [\|\|\|\Delta s]$ $\therefore MN \| BC$ [corresp $\angle$s are equal] $\frac{AB}{AM} = \frac{AC}{AN}$ [line $\|\|$ one side of Δ/ prop theorem, $MN \| BC$] but $AM = DE$ and $AN = DF$ $\therefore \frac{AB}{DE} = \frac{AC}{DF}$	A✓S/R A✓S A✓R	
			
9.2	In ΔACG $\frac{AE}{EC} = \frac{AF}{FG}$ [line $\|\|$ one side of Δ/ prop theorem, $EF \| CG$] $\frac{3p}{2p} = \frac{2k}{FG}$ $FG = \frac{4k}{3}$ In ΔBFD $\frac{BG}{GF} = \frac{BC}{CD}$ [line $\|\|$ one side of Δ/ prop theorem, $DF \| CG$] $\frac{\left(\frac{11k}{3}\right)}{\left(\frac{4k}{3}\right)} = \frac{BC}{CD}$ $\frac{BC}{CD} = \frac{11}{4}$	A✓S/R A✓S A✓S/R A✓S A✓Answer	(5)
			[11]

QUESTION 10



10.1	$C\hat{D}B = 90°$ [$\angle$ in a semicircle]	A✓S A ✓R	(2)
10.2	Let $\hat{B}_1 = x$ $\hat{B}_2 = \hat{B}_1$ [given] $\hat{C} = 90° - x$ [sum of $\angle$s of ΔBCD] $\hat{A}_2 = \hat{C} = 90° - x$ [ext $\angle$ of a cyclic quad ABCD] $\hat{E} = \hat{B}_2 = x$ [$\angle$s opp = sides] $\hat{D}_4 = 180° - \hat{A}_2 - \hat{E}$ [sum of $\angle$s of Δ] $= 180° - (90° - x) - x$ $= 90°$	A✓ $\hat{C} = 90° - x$ A✓ $\hat{A}_2 = \hat{C} = 90° - x$ A✓ $\hat{E} = \hat{B}_2 = x$ A✓ $\hat{D}_4 = 180° - \hat{A}_2 - \hat{E}$ A✓Answer	(5)
10.3	In ΔBDO and ΔBED $\hat{B}_1 = \hat{B}_2$ [given] $\hat{D}_2 = \hat{B}_1$ [$\angle$s opp = sides] $\therefore \hat{D}_2 = \hat{E}$ [both =x] $\hat{O}_1 = B\hat{D}E$ [3rd $\angle$] $\therefore \Delta BDO \mid\mid \Delta BED$ [AAA]	A✓ $\hat{D}_2 = \hat{B}_1$ A✓ $\hat{D}_2 = \hat{E}$ A✓R	(3)
10.4	$\frac{BD}{BE} = \frac{OB}{BD}$ [$\mid\mid\mid$s] $BD^2 = OB.BE$ but BD = DE and OB = $\frac{1}{2}$BC $\therefore DE^2 = \frac{1}{2}BC.BE$ $2DE^2 = BC.BE$	A✓S A✓R A✓ $BD^2 = OB.BE$ A✓S	(4)
			[14]