JOHANNESBURG EAST DISTRICT
PLC COMMON PAPER

GRADE 11

MATHEMATICS

PAPER 2

JUNE 2026

DURATION	**: 2 HOURS**
MARKS	**: 100**

This page consists of 8 pages including the cover page + DIAGRAM SHEET.

INSTRUCTIONS

Read the following instructions carefully before answering the questions.

1. This question paper consists of **6** Questions.
2. Answer All the questions.
3. Diagrams are not necessarily drawn to scale.
4. Clearly show ALL steps you have used in determining your answers.
5. Use the DIAGRAM SHEET attached to answer QUESTION 4.1 and submit it with your answer script.
6. Approved non – programmable and non - graphical calculators may be used.
7. Answers only will NOT necessarily be awarded full marks.
8. Round off answers to TWO decimal places, unless otherwise stated.
9. Number your answers correctly according to the numbering system used in this question paper.

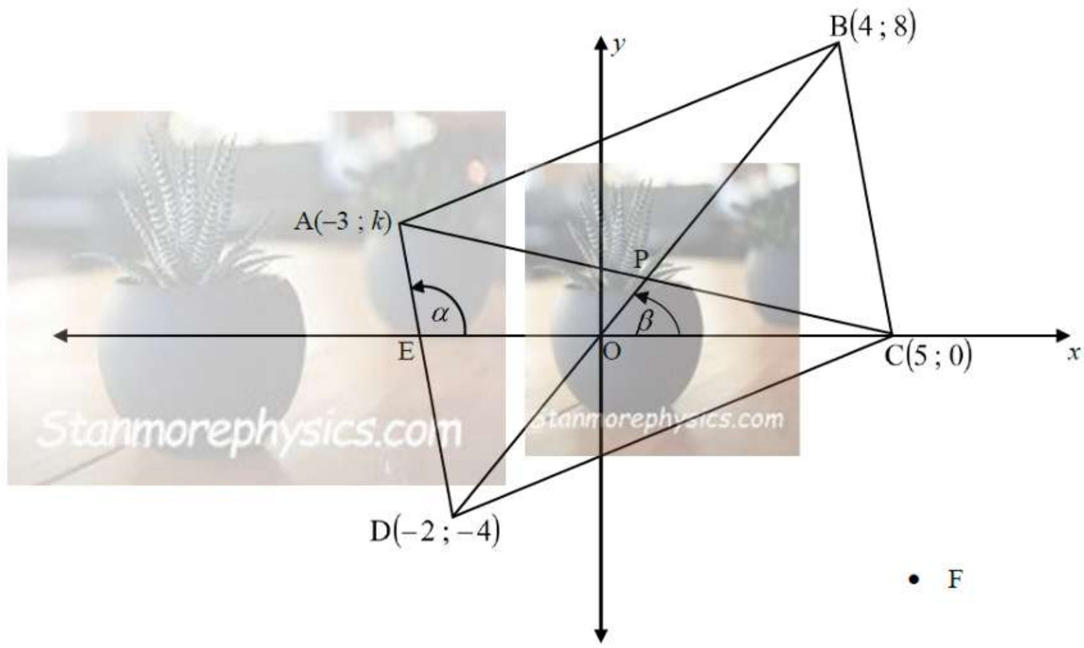
9.Write legibly and present your work neatly

QUESTION 1

In the diagram below, A $(-3; k)$, B $(4; 8)$, C $(5; 0)$ and D $(-2;\ -4)$ are vertices of the parallelogram ABCD. Diagonals AC and BD bisect each other at P.

The angles of inclination of AD and BD are $\alpha\ and\ \beta$ respectively.

AD cuts the $x - axis$ at E. F is a point in the fourth quadrant



1.1	Determine the gradient of BC.	(2)
1.2	If the distance between points AB $= \sqrt{65}$, show that $k = 4$.	(4)
1.3	Prove, using analytical geometry method that $BD \perp AC$.	(3)
1.4	Calculate the area of ΔAPB.	(6)
1.5	Determine the equation of AD in the form $ax + by + c = 0$.	(3)
1.6	Calculate the coordinates of F if it is given that ACFD is a parallelogram.	(2)
1.7	Calculate the size of $E\hat{D}O$ (Correct to one decimal place)	(5)

[25]

QUESTION 2

2.1 If $\sin 31° = p$, determine the following, without using a calculator, in terms of p:

2.1.1 $\sin 149°$ (2)

2.1.2 $\cos(-59°)$ (2)

2.1.3 $\cos 31°$ (3)

2.2 Simplify the following expression to a single trig ratio

$\tan(180° - \theta)\, sin^2(90° + \theta) + \cos(\theta - 180°)\sin\theta$ (5)

[12]

QUESTION 3

3.1 Evaluate without using a calculator:

$\frac{\cos(-225^0)\cdot\sin 135^0 + \sin 330°}{\tan 225^0}$ (6)

3.2 Consider the following identity

3.2.1 Prove the identity

$\frac{cosx}{1+\sin x} + \frac{1+sinx}{\cos x} = \frac{2}{cox\ x}$ (5)

3.2.2 For which value(s) of x in the intervals $0^0 \leq x \leq 360^0$ will the identity in 3.2.1 be undefined? (3)

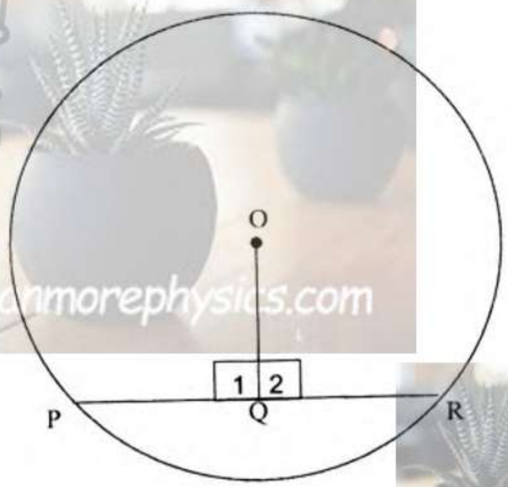
3.3 Determine the general solution of the following equation:

$(\cos x + 2\sin x)(3\sin 2x - 1) = 0$ (6)

[20]

QUESTION 4

4.1 In the diagram, O is the centre of the circle and PR is a chord. Q is a point on PR such that OQ ⊥ PR.

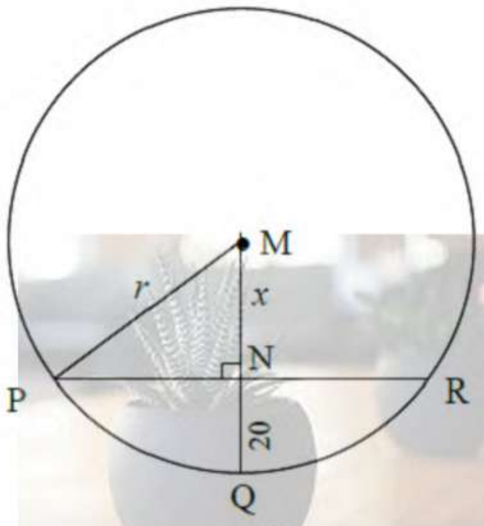


On the DIAGRAM SHEET attached prove the theorem which states that PQ = QR

(6)

4.2 In the diagram PR is a chord of the circle with centre M and radius r. The perpendicular line from M cuts PR at N and the circle at Q.

PR = 160 units; QN = 20 units and MN = x units.



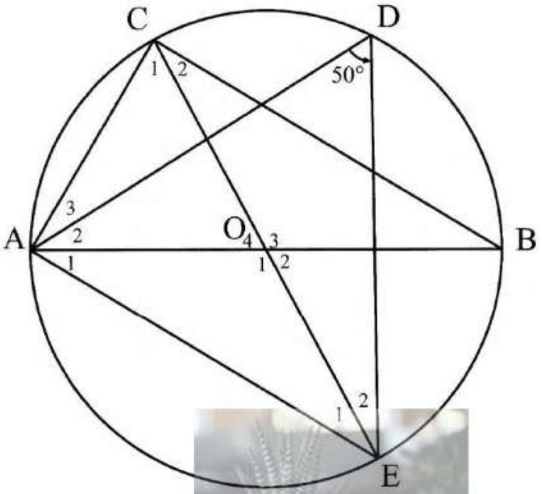
4.2.1 With a reason, determine r in terms of x. (2)

4.2.2 Calculate the numerical value of r. (5)

[13]

QUESTION 5

5.1 AOB and COE are diameters of circle ACDBE with centre O. Chords AC, CB, AE, AD and DE are drawn. $\widehat{D} = 50^0$

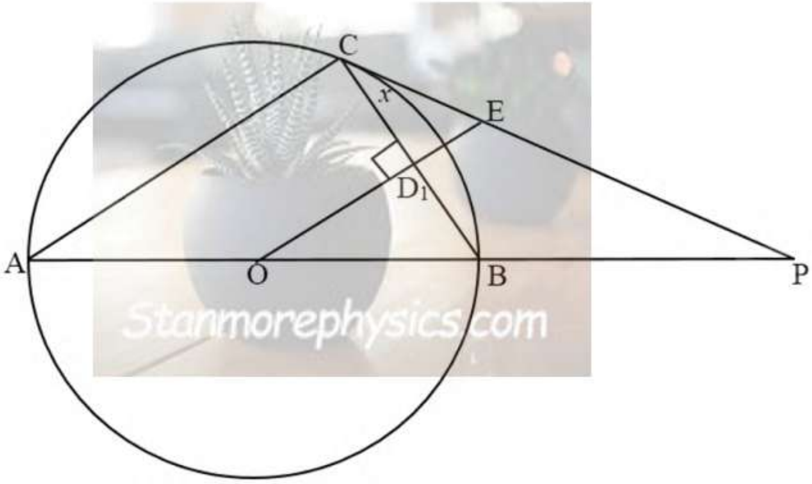


Calculate, with reasons, the size of the following angles:

5.1.1 $\widehat{O}_1$ (2)

5.1. 2 $\widehat{E}_1$ (4)

5.2 In the figure, AB is a diameter of the circle with centre O. AB is produced to P. PC is a tangent to the circle at C and line ODE perpendicular to BC intersects BC at D and PC at E.



5.2.1 Give a reason why $CD = DB$ (1)

5.2.2 Show that AC∥OE (3)

5.2.3 If $B\hat{C}P = x$, name two other angles equal to x (4)

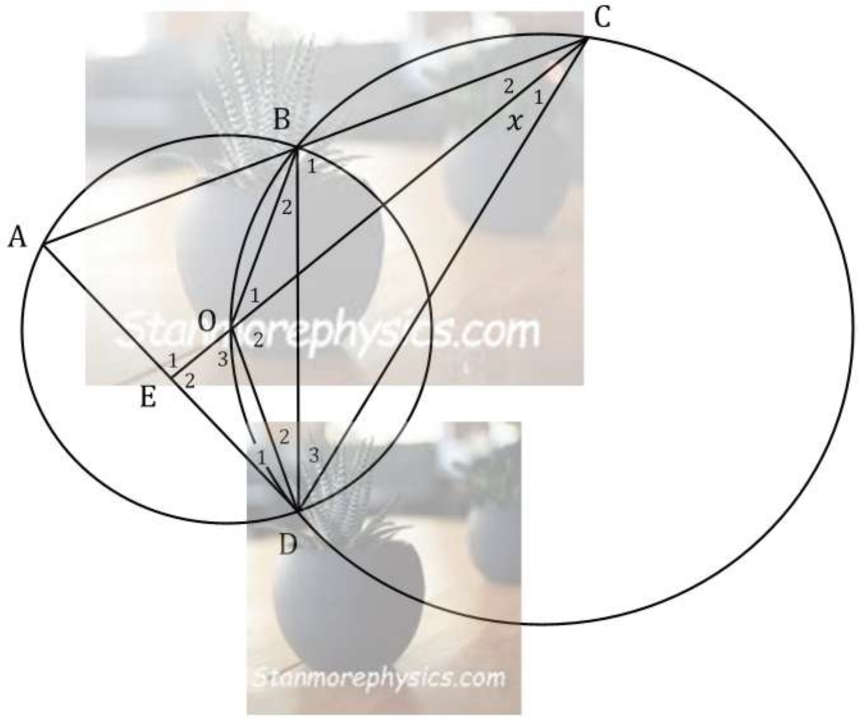
5.2.4 Prove that OBEC is a cyclic quadrilateral (3)

[17]

QUESTION 6

Two intersecting circles are positioned so that the larger circle passes through the centre, O, of the smaller circle.

Let $\hat{C}_1 = x$



6.1. State, with reasons, THREE other angles equal to x . (6)

6.2 Prove that $\hat{A} = 90° - x$. (4)

6.3 Prove that E is the midpoint of AD. (3)

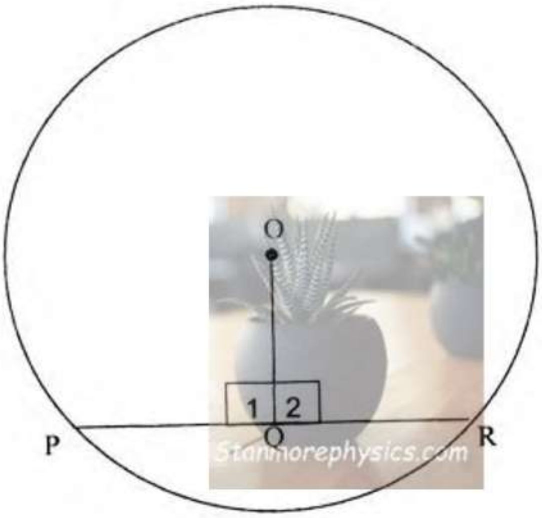
[13]

TOTAL MARKS: 100

DIAGRAM SHEET 1

QUESTION 4.1

Name and Surname	
Class	



JOHANNESBURG EAST DISTRICT
PLC COMMON PAPER

Grade 11

MARKING GUIDELINE

MATHEMATICS

PAPER 2

JUNE 2026

DURATION	**: 2 HOURS**
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This marking guidelines consists of 7 pages including cover page.

NOTE:

- If a canditate answers a quaestion TWICE, mark only the FIRST attempt
- If a candidate has crossed-out an attempt of a question and has not redone the question, mark the crossed-out version.
- Consistent accuracy applied in ALL aspects of the marking guidelines, stop marking at the second calculation error.
- Assuming answer/ value in order to solve a problem is NOT acceptable.

Geometry

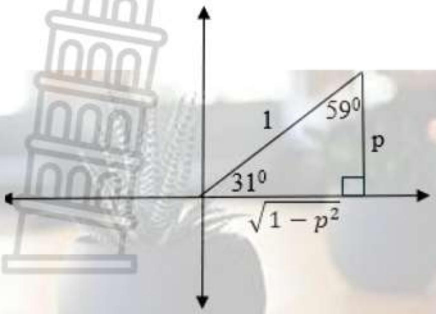
S – Statement

R – Reason

S/R Statement and Reason

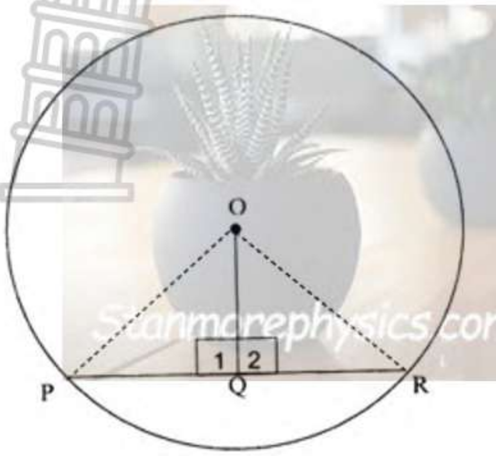
	QUESTION 1	
1.1	$M_{BC} = \dfrac{8-0}{4-5}$ $= -8$	✓Substitution into gradient formula ✓answer (2)
1.2	$AB = \sqrt{65} = \sqrt{(-3-4)^2 + (k-8)^2}$ $65 = 49 + k^2 - 16k + 64$ $k^2 - 16k + 48 = 0$ $(k-4)(k-12) = 0$ $k = 4 \; or \; k \neq 12$ OR $AB = \sqrt{65} = \sqrt{(-3-4)^2 + (k-8)^2}$ $65 = 49 + (k-8)^2$ $(k-8)^2 = 16$ $k - 8 = \pm 4$ $k = 4 \quad k \neq 12$	✓ correct substitution into distance formula ✓ equating with $\sqrt{65}$ ✓ Standard form ✓ factors OR ✓ correct substitution into distance formula ✓ equating with $\sqrt{65}$ ✓ $(k-8)^2 = 16$ ✓ $k - 8 = \pm 4$ (4)
1.3	$M_{BD} = \dfrac{8-(-4)}{4-(-2)}$ $M_{BD} = 2$ $M_{AC} = \dfrac{4-0}{-3-5}$ $= \frac{-1}{2}$ $M_{BD} \times M_{AC} = 2 \times \dfrac{-1}{2}$ $= -1$ $BD \perp AC$	✓ $M_{BD} = 2$ ✓ $M_{AC} = -\frac{1}{2}$ ✓ $M_{BD} \times M_{AC} = -1$ (3)

1.4	$P(1;2)$ $AP=\sqrt{(-3-1)^2+(4-2)^2}$ $=2\sqrt{5}$ $BP=\sqrt{(4-1)^2+(8-2)^2}$ $=3\sqrt{5}$ Area $\Delta APB=\frac{1}{2}\times base\times\perp height$ $=\frac{1}{2}\times 2\sqrt{5}\times 3\sqrt{5}$ $=15$ square units	✓ ✓coordinates of P ✓ length of AP ✓ length of BP ✓ substitution into area formula ✓ answer (6)
1.5	$M_{AD}=M_{BC}=-8$ AB is parallel to BC $y-y_A=M_{AD}(x-x_A)$ $y-4=-8(x+3)$ $y=-8x-20$ $8x+y+20=0$ OR $y=mx+c$ $-4=-8(-2)+c$ $c=-20$ $y=-8x-20$ $8x+y+20=0$	✓ gradient of AD ✓ substitution into straight line formula ✓ standard form of linear line $ax+by+c=0$ (3)
1.6	Midpoint of AF = Midpoint of DC $\frac{x-3}{2}=\frac{-2+5}{2}$ $x=6$ $\frac{y+4}{2}=\frac{-4+0}{2}$ $y=-8$ F$(6;-8)$	✓ $x=6$ ✓ $y=-8$ (2)
1.7	$\tan\alpha=-8$ $\alpha=180°-82.87°$ $\alpha=97.13°$ $\tan\beta=2$ $\beta=63{,}43°$ $E\hat{O}D=\beta=63{,}43°$ vert opp. $\angle s$ = $E\hat{D}O=\alpha-\beta$ ext. $\angle$ of a $\triangle$ $=97{,}13°-63{,}43°$ $=33{,}7°$	✓ $\tan\alpha=-8$ ✓ $\alpha=97{,}13°$ ✓ $\beta=63{,}43°$ ✓ $\alpha-\beta$ ✓ Answer (5)
		[25]

	QUESTION 2	
2.1		
2.1.1	$\sin 149° = \sin(180° - 31°)$ $= \sin 31°$ $= p$	✓ $\sin(180° - 31°)$ ✓ p (2)
2.1.2	$\cos(-59°) = \cos 59°$ $= p$	✓ $\cos 59°$ ✓ Answer (2)
2.1.3	$x^2 = 1^2 - p^2$ $x = \sqrt{1-p^2}$ $\cos 31° = \sqrt{1-p^2}$	✓ correct diagram ✓ Pythagoras ✓ $\cos 31° = \sqrt{1-p^2}$ (3)
2.2	$= -\tan\theta . cos^2\theta - \cos\theta . \sin\theta$ $= -\frac{\sin\theta}{\cos\theta} . cos^2\theta - \cos\theta . \sin\theta$ $= -2\sin\theta . \cos\theta$	✓ $-\tan\theta$ ✓ $cos^2\theta$ ✓ $-\cos\theta$ ✓ $\frac{-\sin\theta}{\cos\theta}$ ✓ $-2sin\theta . \cos\theta$ (5)
		[12]

	QUESTION 3	
3.1	$\frac{\cos 135° . \sin 135° + \sin 330°}{\tan 225°}$ $= \frac{-\cos 45° . \sin 45° - \sin 30°}{\tan 45°}$ $= \frac{-\frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} - \frac{1}{2}}{1}$ $= -1$	✓ $-\cos 45°$ ✓ $\sin 45°$ ✓ $-\sin 30°$ ✓ $\frac{-1}{\sqrt{2}}$ or $\frac{-\sqrt{2}}{2}$ ✓ $-\frac{1}{2}$ ✓ -1 (6)

3.2.1	$LHS = \frac{\cos x \times \cos x + (1+\sin x)(1+\sin x)}{\cos x\,(1+\sin x)}$ $= \frac{cos^2 x + 1 + 2\sin x + sin^2 x}{\cos x(1+\sin x)}$ $= \frac{1 + 1 + 2\sin x}{\cos x\,(1+\sin x)}$ $= \frac{2(1+\sin x)}{\cos x(1+\sin x)}$ $= \frac{2}{\cos x}$	✓denominator ✓$cos^2 x$ ✓ $1 + 2\sin x + sin^2 x$ ✓identity ✓factors (5)
3.2.2	$1 + \sin x = 0$ or $\cos x = 0$ $sinx = -1$ $x = 90°$ or $x = 270°$	✓ Equating the denominator with zero ✓$x = 90°$ ✓$x = 270°$ (3)
3.3	$\tan x = \frac{-1}{2}$ ref $\angle = 26.57°$ $x = 153{,}43° + k.180°$ *or* $x = 333{,}43 + k.180°;\ k \in \mathbb{Z}$ or $\sin 2x = \frac{1}{3}$ ref $\angle = 19.47°$ $2x = 19{,}47° + k.360°$ *or* $2x = 160{,}53° + k.360°$ $x = 9{,}74° + k.180°$ $x = 80{,}27° + k.180°\ ;\ k \in \mathbb{Z}$	✓ $\tan x = \frac{-1}{2}$ ✓ $x = 153.43° + k.180°$ ✓ $x = 333.43 + k.180°$ ✓ $\sin 2x = \frac{1}{3}$ ✓ $x = 9{,}74° + k.180°$ ✓ $x = 80{,}27° + k.180°$ (6)
		[20]

	QUESTION 4	
4.1	 Construction: Join OP and OR In ΔPOQ and ΔROQ $\hat{Q}_1 = \hat{Q}_2$ [Given] $OP = OR$ [Radii] $OQ = OQ$ [Common] $\therefore \Delta POQ \equiv \Delta ROQ$ [RHS] $PQ = QR$	✓ Construction OP and OR ✓ S ✓ R ✓ S/R ✓ S ✓ R (6)
4.2.1	$r = MQ$ Radii $r = x + 20$	✓ S/R ✓ Answer (2)
4.2.2	$(x+20)^2 = (80)^2 + (x)^2$ $x^2 + 40x + 400 = (80)^2 + x^2$ $40x = 6000$ $x = 150$ $r = 150 + 20$ $= 170$	✓ Application of Pyth. Theorem ✓ Substitution ✓ Simplification ✓ x value ✓ Answer (5)
		[13]

	QUESTION 5	
5.1.1	$\hat{O}_1 = 2 \times 50°$ [$\angle$ at centre =2 $\times$ $\angle$ at circumference] $\hat{O}_1 = 100°$	✓ S/R ✓ Answer (2)
5.1.2	$\hat{E}_1 = \hat{A}_2$ $\angle$ opp. = sides $\hat{O}_1 + \hat{E}_1 + \hat{E}_1 = 180°$ sum of $\angle s$ in a $\triangle$ $2\hat{E}_1 = 180° - 100°$ $\hat{E}_1 = 40°$	✓ S ✓ R ✓ S/R ✓ Answer (4)
5.2.1	$CD = DB$ [Line from centre perpendicular to chord]	✓ R (1)
5.2.2	$A\hat{C}B = 90°$[$\angle$ in the semi circle] $\hat{D}_1 = 90°$ [$Given$] $AC \parallel OE$ Corresp. $\angle s$ =	✓ S/R ✓ R ✓ S/R (3)
5.2.3	$\hat{C} = \hat{A} = x$ [$tan - chord\ theorem$] $E\hat{O}B = \hat{A} = x$ [Corresp. $\angle s$; AC $\parallel$ OE]	✓ S ✓R ✓ S ✓R (4)
5.2.4	$\hat{C} = x$ [Given] $E\hat{O}B = x$ proven $\therefore \hat{C} = E\hat{O}B$ OBEC is a cyclic quad [converse $\angle s$ in the same segment]	✓S/R ✓S ✓ R (3)
		[17]

	QUESTION 6	
6.1	$\hat{C}_1 = \hat{B}_2 = x$ [$\angle s$ in the same segment] $\hat{B}_2 = \hat{D}_2 = x$ [$\angle s$ opp = sides $\hat{D}_2 = \hat{C}_2 = x$ [$\angle s$ in same segment]	✓ S ✓ R ✓ S ✓ R ✓ S ✓ R (6)
6.2	$B\hat{O}D = 180° - 2x$ [opp $\angle s$ of cyclic quad] $\hat{A} = 90° - x$ [$\angle$ at centre = 2 $\times$ $\angle$ at circumference]	✓ S ✓R ✓ S ✓R (4)
6.3	$\hat{A} + \hat{E}_1 + \hat{C}_2 = 180°$ [sum of $\angle s$ in a $\triangle$] $\hat{E}_1 = 180° - (90° - x + x)$ $\hat{E}_1 = 90°$ [Line from centre perpendicular to chord]	✓ S ✓ R ✓ S/R (3)
		[13]
		Total: 100