education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS

COMMON TEST

MARCH 2020

MARKS: 75

TIME: 1½ hours

This question paper consists of 5 pages and 2 Diagram Sheets.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 5 questions.

2. Answer ALL the questions.

3. Number the answers correctly according to the numbering system used in this question paper.

4. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.

5. Answers only will NOT necessarily be awarded full marks.

6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

7. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.

8. Diagrams are NOT necessarily drawn to scale.

9. TWO DIAGRAM SHEETS for QUESTION 4.1, QUESTION 4.2, QUESTION 5.1 and QUESTION 5.2 are attached at the end of this question paper. Detach the DIAGRAM SHEETS and hand in together with your ANSWER BOOK.

10. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $2x\left(x-\frac{1}{2}\right)=0$ (2)

1.1.2 $4x^2+11x=2$ (answer correct to TWO decimal places) (4)

1.1.3 $x-\sqrt{8-2x}=0$ (5)

1.1.4 $x(x-7)+12<0$ (4)

1.2 Solve simultaneously for x and y:

$x=3y-5$ and $(2x-y-2)(x+y)=0$ (4)

[19]

QUESTION 2

2.1 Simplify WITHOUT the use of a calculator: $\sqrt{18}+2\sqrt{2}+\frac{1}{\sqrt{2}}$

Write your answer with a rational denominator. (3)

2.2 Solve for x without the use of a calculator:

2.2.1 $\sqrt[x]{16}=128$ (4)

2.2.2 $\frac{3^{2x+1}-3^{2x-1}}{3^x}=24$ (4)

[11]

QUESTION 3

3.1 If $\cos\theta=-\frac{2}{5}$ and $\theta\in[180°;360°]$, determine the value of $\tan\theta$ by using a diagram, and **without the use of a calculator**. (3)

3.2 Evaluate, **without using of a calculator**: $\frac{\cos 115°.\cos 214°}{\cos 65°.\sin 236°}$ (5)

3.3 Simplify to a single term, without the use of a calculator:

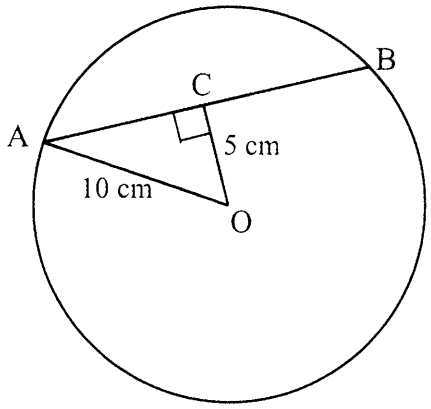
$\cos(90°+x).\tan(540°+x).\cos(180°-x)+\sin(-90°)$ (7)

[15]

GIVE REASONS FOR YOUR STATEMENTS AND CALCULATIONS IN QUESTIONS 4 AND 5.

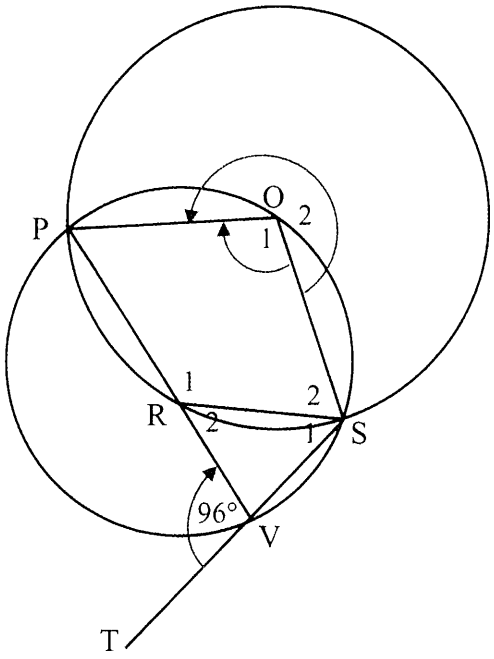
QUESTION 4

4.1 In the diagram, AB is a chord of the circle having centre O. C is a point on AB such that $A\hat{C}O = 90°$. OC = 5 cm and AO = 10 cm.



Calculate, with reasons, the length of AB. (4)

4.2 In the diagram, O is the centre of the larger circle, which passes through P, R and S. R is a point on chord PV of the smaller circle PVSO. SV is produced to T. $R\hat{V}T = 96°$.



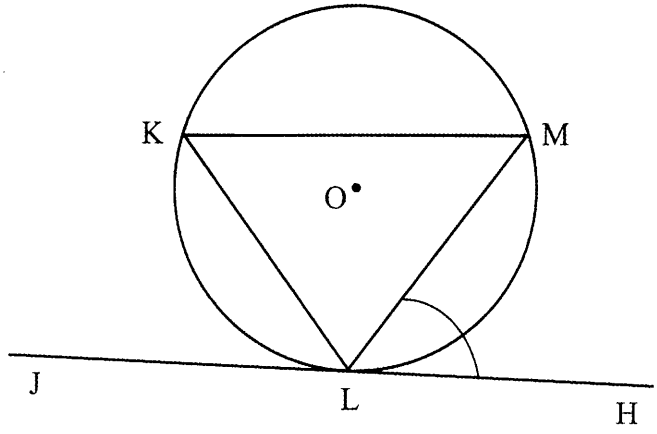
4.2.1 Calculate, with reasons, the size of $\hat{R}_2$. (7)

4.2.2 Prove that ΔRVS is isosceles. (3)

[14]

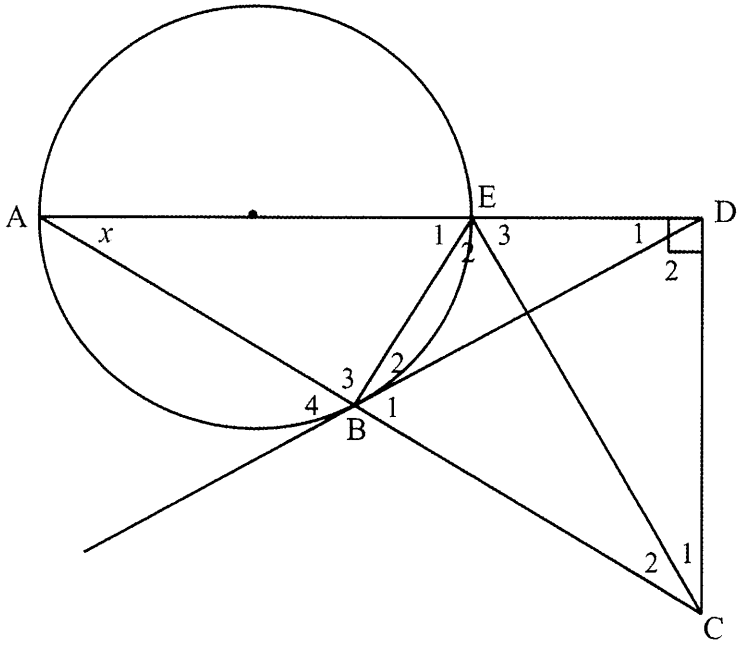
QUESTION 5

5.1 In the figure below, JLH is a tangent to the circle having centre O at L. K and M are points on the circle.



Prove the theorem which states that $M\hat{L}H = \hat{K}$. (5)

5.2 AE is a diameter of the circle in the diagram below. AE is produced to D. DB is a tangent to the circle at B. DC is perpendicular to AD. CBA is a straight line. BE and EC are drawn. Let $\hat{A} = x$.



5.2.1 Prove that BCDE is a cyclic quadrilateral. (3)

5.2.2 Prove that $\hat{C}_1 = x$. (4)

5.2.3 Prove that $\hat{E}_1 = \hat{E}_3$. (2)

5.2.4 Is CE a tangent to the circle through A, B and E? Give a reason for your answer. (2)

[16]

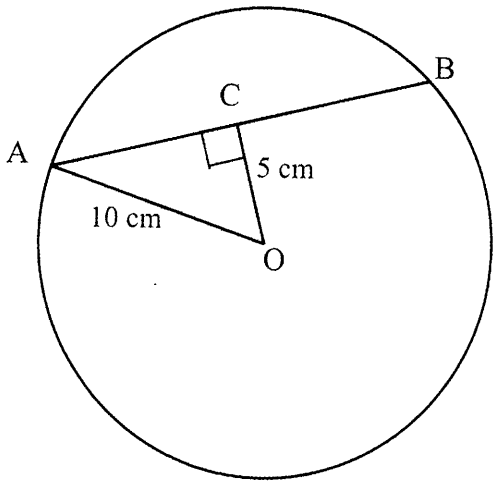
TOTAL: 75

NAME & SURNAME:

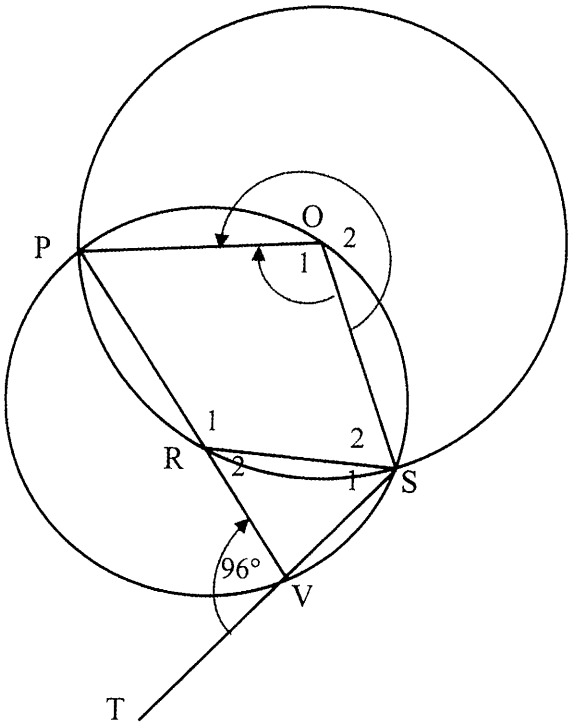
DIAGRAM SHEET 1

TEAR OFF

QUESTION 4.1



QUESTION 4.2

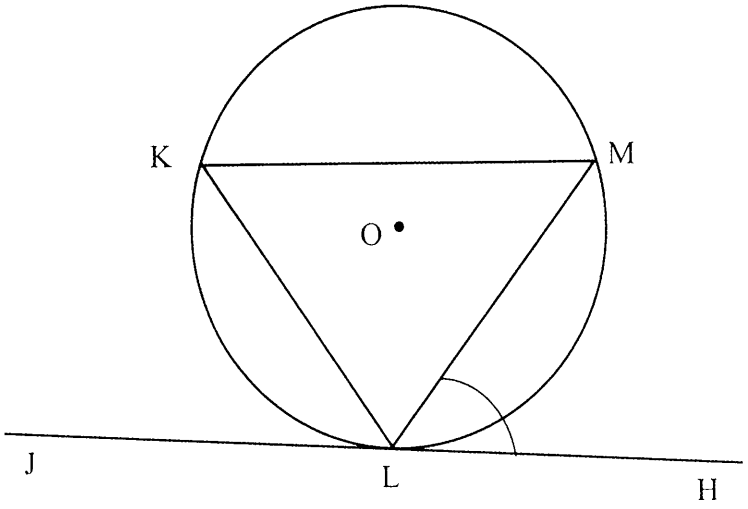


NAME & SURNAME:

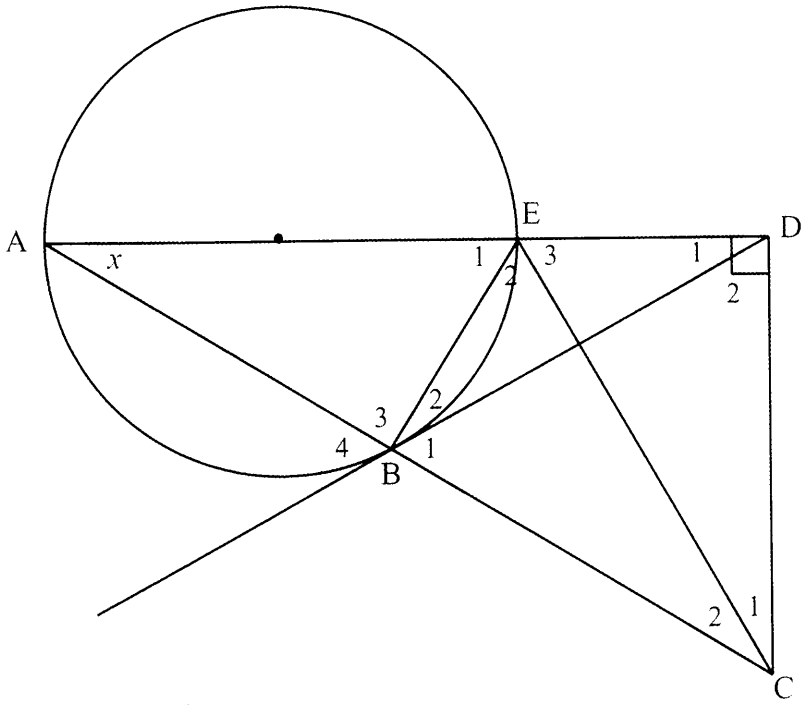
DIAGRAM SHEET 2

TEAR OFF

QUESTION 5.1



QUESTION 5.2



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MATHEMATICS

MARKING GUIDELINE

COMMON TEST

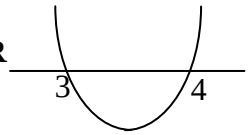
MARCH 2020

MARKS: 75

This marking guideline consists of 7 pages.

GEOMETRY • *MEETKUNDE*	
S	**A mark for a correct statement** **(A statement mark is independent of a reason)**
	'n Punt vir 'n korrekte bewering ***('n Punt vir 'n bewering is onafhanklik van die rede)***
R	**A mark for the correct reason** **(A reason mark may only be awarded if the statement is correct)**
	'n Punt vir 'n korrekte rede ***('n Punt word slegs vir die rede toegeken as die bewering korrek is)***
S/R	**Award a mark if statement AND reason are both correct**
	Ken 'n punt toe as die bewering EN rede beide korrek is

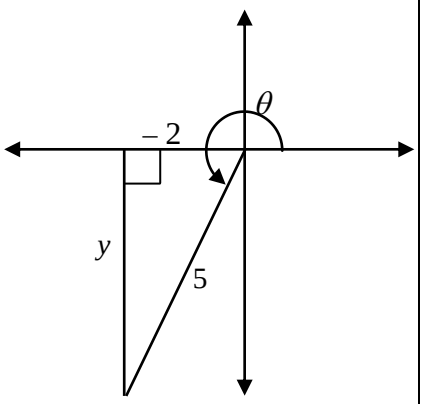
QUESTION 1

1.1.1	$2x\left(x-\frac{1}{2}\right)=0$ $x=0 \quad \text{or} \quad x=\frac{1}{2}$	$x=0 \quad ✓ \quad x=\frac{1}{2}$ (2)
1.1.2	$4x^2+11x=2$ $4x^2+11x-2=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-11\pm\sqrt{(11)^2-4(4)(-2)}}{2(4)}$ $x=0{,}17 \quad \text{or} \quad x=-2{,}92$	✓ standard form ✓ substitution into the correct formula ✓ x-value ✓ x-value (4)
1.1.3	$x-\sqrt{8-2x}=0$ $x=\sqrt{8-2x}$ $x^2=8-2x$ $x^2+2x-8=0$ $(x+4)(x-2)=0$ $x\neq -4 \quad \text{or} \quad x=2$ $\therefore x=2$ only	✓ isolate $\sqrt{8-2x}$ ✓squaring both sides ✓ factors ✓ rejecting $x=-4$ ✓ correct solution (5)
1.1.4	$x(x-7)+12<0$ $x^2-7x+12<0$ $(x-3)(x-4)=0$ + ○ 3 − ○ 4 + **OR**  $3<x<4$ **OR** $x\in(3;4)$	✓standard form ✓ method ✓✓correct solution (4)
1.2	$x=3y-5 \quad \ldots\ldots\ldots(1)$ $(2x-y-2)(x+y)=0 \ldots\ldots\ldots\ldots(2)$ Substitute (1) into (2): $(2(3y-5)-y-2)(3y-5+y)=0$ $(6y-10-y-2)(4y-5)=0$ $(5y-12)(4y-5)=0$ $y=\frac{12}{5} \quad \text{or} \quad y=\frac{5}{4}$ $x=\frac{11}{5} \quad \text{or} \quad x=-\frac{5}{4}$	✓correct substitution ✓ factors ✓values of y ✓values of x (4)
		[19]

QUESTION 2

2.1	$\sqrt{18}+2\sqrt{2}+\frac{1}{\sqrt{2}}$ $= 3\sqrt{2}+2\sqrt{2}+\frac{1}{\sqrt{2}}$ $= 5\sqrt{2}+\frac{1}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}$ $= 5\sqrt{2}+\frac{\sqrt{2}}{2}$ $=\frac{11\sqrt{2}}{2}$	✓ for $3\sqrt{2}$ ✓rationalizing denominator ✓answer (3)
2.2.1	$\sqrt[x]{16}=128$ $2^{\frac{4}{x}}=2^7$ $\frac{4}{x}=7$ $x=\frac{4}{7}$	✓ $2^{\frac{4}{x}}$ ✓ 2^7 ✓ equating exponents ✓answer (4)
2.2.2	$\frac{3^{2x+1}-3^{2x-1}}{3^x}=24$ $\frac{3^{2x}(3^1-3^{-1})}{3^x}=24$ $3^x\left(2\frac{2}{3}\right)=24$ $3^x=9$ $3^x=3^2$ $x=2$	✓ factorising ✓simplification ✓like bases ✓ answer (4)
		[11]

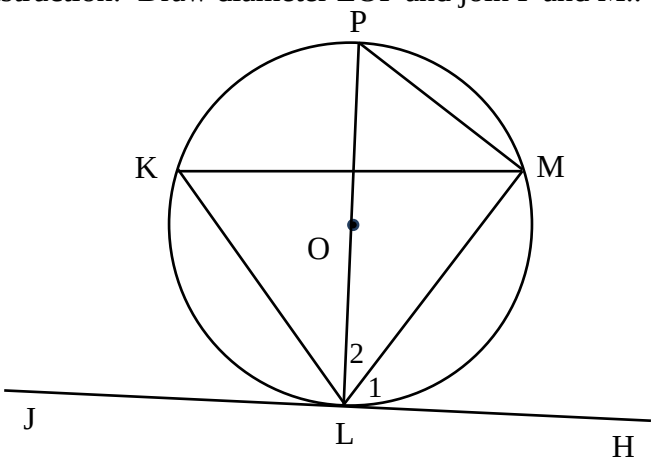
QUESTION 3

3.1	$y^2 = r^2 - x^2$ $= 5^2 - (-2)^2$ $= 21$ $y = -\sqrt{21}$ $\tan\theta = \frac{-\sqrt{21}}{-2}$ $= \frac{\sqrt{21}}{2}$  	✓ correct sketch in correct quadrant ✓ value of y ✓ answer (3)
3.2	$\frac{\cos 115^\circ . \cos 214^\circ}{\cos 65^\circ . \sin 236^\circ}$ $= \frac{-\cos 65^\circ . -\cos 34^\circ}{\cos 65^\circ . -\sin 56^\circ}$ $= \frac{\cos 34^\circ}{-\sin 56^\circ}$ $= -\frac{\cos 34^\circ}{\cos 34^\circ}$ **OR** $= -\frac{\cos 56^\circ}{\cos 56^\circ}$ $= -1$	$-\cos 65^\circ$ $-\cos 34^\circ$ $-\sin 56^\circ$ $\cos 34^\circ$ **OR** $\sin 56^\circ$ -1 (5)
3.3	$\cos(90^\circ + x).\tan(540^\circ + x).\cos(180^\circ - x) + \sin(-90^\circ)$ $= (-\sin x).\tan(180^\circ + x)(-\cos x) - \sin 90^\circ$ $= (-\sin x)(\tan x)(-\cos x) - 1$ $= (-\sin x)\left(\frac{\sin x}{\cos x}\right)(-\cos x) - 1$ $= \sin^2 x - 1$ $= -(1 - \sin^2 x)$ $= -\cos^2 x$	$-\sin x$ $\tan x$ $-\cos x$ -1 $\frac{\sin x}{\cos x}$ $\sin^2 x - 1$ ✓ answer (7)
		[15]

QUESTION 4

4.1	$AC^2 = AO^2 - OC^2$ [Pythagoras] $= 10^2 - 5^2$ $= 75$ $AC = \sqrt{75} = 8{,}66\,cm$ $AB = 2 \times AC$ [line from centre $\perp$ to chord] $= 17{,}32\,cm$	✓ S/ R ✓ value of AC ✓R ✓ answer (4)
4.2	$T\hat{V}R = \hat{O}_1$ [ext. $\angle$ of cyclic quad.] $= 96^\circ$ $\hat{O}_2 = 360^\circ - \hat{O}_1$ [$\angle$s around a point] $= 360^\circ - 96^\circ$ $= 264^\circ$ $\hat{R}_1 = \frac{1}{2}\hat{O}_2$ [$\angle$ at centre = $2 \times \angle$ at circumf.] $= \frac{1}{2}(264^\circ)$ $= 132^\circ$ $\hat{R}_2 = 180^\circ - \hat{R}_1$ [$\angle$s on a straight line] $= 180^\circ - 132^\circ$ $= 48^\circ$	✓ S ✓ R ✓ size of $\hat{O}_2$ ✓ S ✓ R ✓ size of $\hat{R}_1$ ✓ answer (7)
4.3	$\hat{S}_1 = R\hat{V}T - \hat{R}_2$ [ext. $\angle$ of ΔRVS] $= 96^\circ - 48^\circ$ $= 48^\circ$ $\therefore \hat{S}_1 = \hat{R}_2$ [both $= 48^\circ$] $\therefore VS = VR$ [sides opp. to = $\angle$s] And ΔRVS is isosceles.	✓ S / R ✓ S ✓ S / R (3)
		[14]

QUESTION 5

5.1	Construction: Draw diameter LOP and join P and M..  Proof: $\hat{L}_1 + \hat{L}_2 = 90^\circ$ [tangent $\perp$ radius] $P\hat{M}L = 90^\circ$ [$\angle$ in a semi-circle] $\hat{P} + \hat{L}_2 = 90^\circ$ [sum of $\angle$s of ΔPML] $\therefore \hat{P} = \hat{L}_1$ But: $\hat{P} = \hat{K}$ [$\angle$s in the same segment] $\therefore \hat{L}_1 = \hat{K}$	✓ construction ✓ S /R ✓ S/R ✓ S ✓R (5)
5.2.1	$\hat{B}_3 = 90^\circ$ [$\angle$ in a semi-circle] $\therefore \hat{B}_3 = C\hat{D}E$ [both $= 90^\circ$] $\therefore$ BCDE is a cyclic quadrilateral [converse: ext. $\angle$ of a cyclic quadrilateral]	✓ S ✓ R ✓ R (3)
5.2.2	$\hat{B}_2 = \hat{A} = x$ [tan-chord-theorem] $\hat{B}_2 = \hat{C}_1 = x$ [$\angle$s in the same segment] $\therefore \hat{C}_1 = \hat{A} = x$	✓ S ✓ R ✓ S ✓ R (4)

5.2.3	$\hat{E}_1 = 180^\circ - (\hat{A} + \hat{B}_3)$ [sum of $\angle$s of ΔABE] $= 180^\circ - (x + 90^\circ)$ $= 90^\circ - x$ $\hat{E}_3 = 180^\circ - (\hat{C}_1 + C\hat{D}E)$ $= 180^\circ - (x + 90^\circ)$ [sum of $\angle$s of ΔCDE] $= 90^\circ - x$ $\therefore \hat{E}_1 = \hat{E}_3$	$\hat{E}_1 = 90^\circ - x$ $\hat{E}_3 = 90^\circ - x$ (2)
5.2.4	$\hat{E}_2 = 180^\circ - (\hat{E}_1 + \hat{E}_3)$ [$\angle$s on a straight line] $= 180^\circ - (90^\circ - x + 90^\circ - x)$ $= 2x$ $\therefore \hat{E}_2 \neq \hat{A}$ $\therefore$ CE is not a tangent to the circle through A, B and E. [converse of tan-chord-theorem does not apply]	$\hat{E}_2 = 2x$ $\therefore \hat{E}_2 \neq \hat{A}$ (2)
		[16]

TOTAL: 75