education

Department:
Education
PROVINCE OF KWAZULU-NATAL

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MATHEMATICS

COMMON TEST

MARCH 2019

MARKS: **75**

TIME: **1½ hours**

This question paper consists of 6 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. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.

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

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

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

7. Diagrams are NOT necessarily drawn to scale.

8. Write neatly and legibly.

9. Diagrams for QUESTION 4.1, QUESTION 4.2, QUESTION 5.1 and QUESTION 5.2 on the DIAGRAM SHEETS provided.
Detach the DIAGRAM SHEETS and hand in together with your Answer Book.

QUESTION 1

1.1 Solve for *x*:

1.1.1 $7x^2 - 2x - 3 = 0$ (correct to TWO decimal places) (3)

1.1.2 $(x-2)^2 - 4 = 0$ (3)

1.1.3 $\sqrt{7x+2} + 2x = 0$ (4)

1.1.4 $x^2 - x - 56 < 0$ (3)

1.2 Solve for x and y simultaneously: $2x + y = 1$ and $2x^2 - xy + y^2 = 4$ (6)

[19]

QUESTION 2

2.1 Solve for x without the use of a calculator : $x^{\frac{3}{4}} = 64$ (2)

2.2 Simplify without the use of a calculator :

2.2.1 $\dfrac{5^{-x}.125^{1-x}.25^{2x}}{5}$ (3)

2.2.2 $\sqrt{12} - \sqrt{147} + 3^{1,5}$ (3)

2.3 If $\dfrac{5^{2006} - 5^{2004} + 24}{5^{2004} + 1} = a$, calculate a without the use of a calculator. (3)

[11]

QUESTION 3

ANSWER QUESTION 3 WITHOUT USING A CALCULATOR.

3.1 Given: $\tan\theta = -\dfrac{9}{40}$ and $180° < \theta < 360°$.
Use a sketch to determine the value of $\sin\theta + \cos\theta$. (4)

3.2 Simplify fully:

$$\frac{\sin(90° - \theta).\tan(360° - \theta).\sin(\theta - 180°)}{1 - \cos^2\theta}$$ (6)

3.3 Determine the value of the following in terms of p, if $\cos 32° = p$:

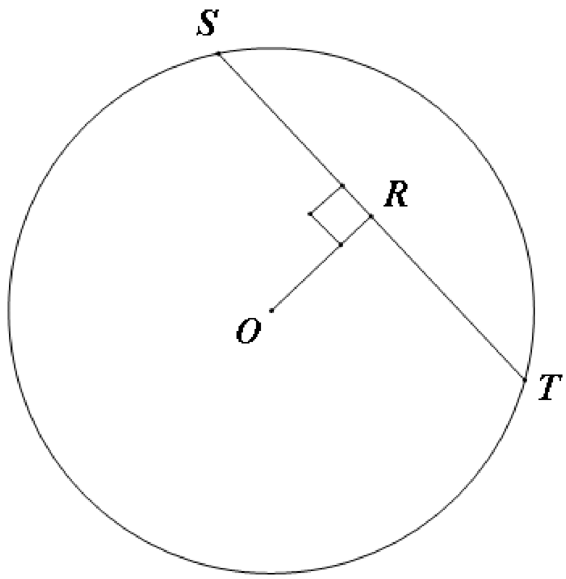
3.3.1 $\cos 212°$ (2)

3.3.2 $\sin(-328°)$ (3)
[15]

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

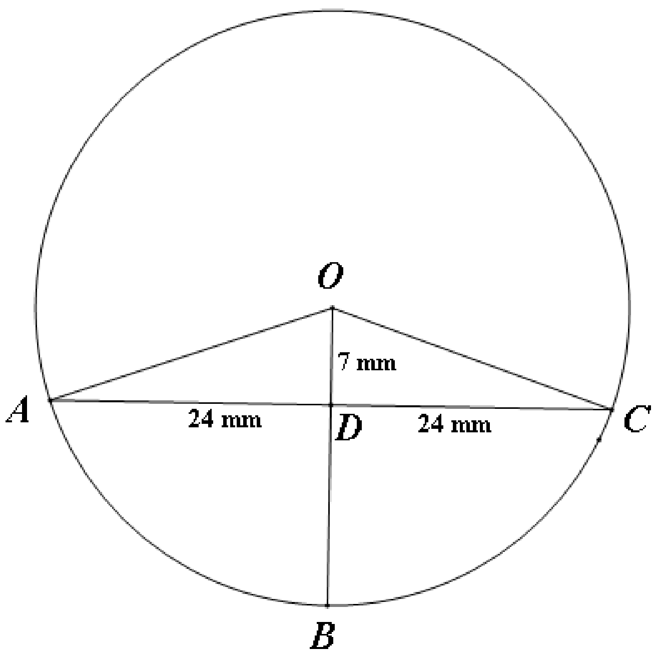
QUESTION 4

4.1 In the diagram, O is the centre of the circle and R is a point on chord ST, such that OR is perpendicular to ST.



Prove the theorem which states that SR = RT. (5)

4.2 In the diagram, O is the centre of the circle and D is a point on chord AC such that AD = DC = 24 mm. OD is drawn and produced to meet the circle at B. OD = 7 mm. OA and OC are drawn.

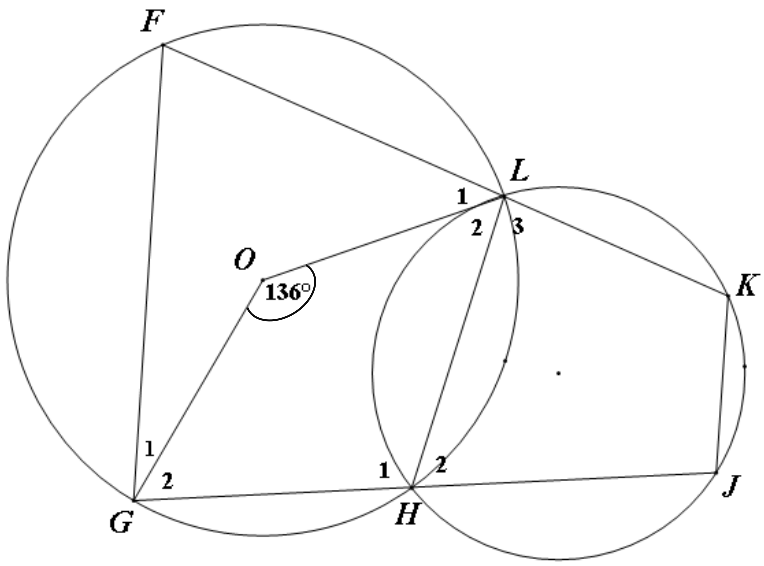


Calculate the length of BD. (5)

[10]

QUESTION 5

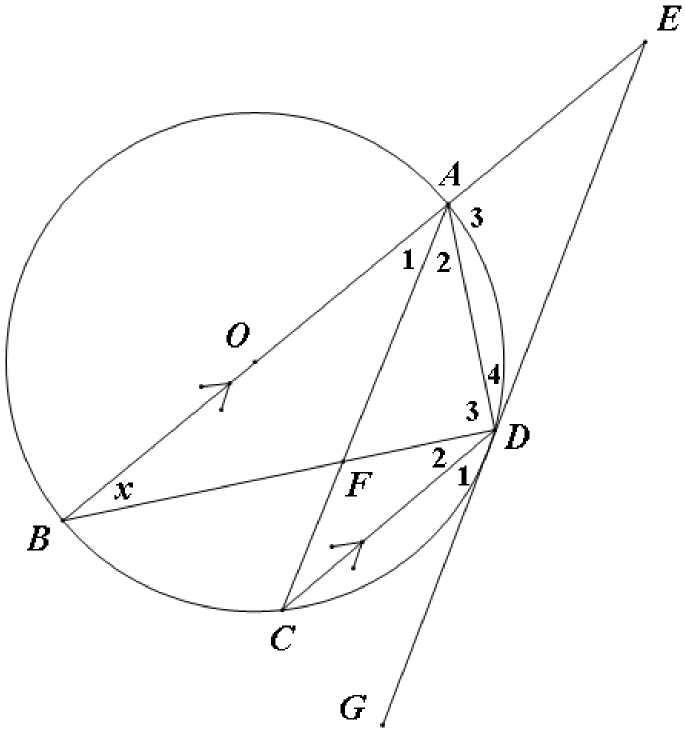
5.1 In the diagram two circles intersect at L and H. O is the centre of the circle passing through F, G, H and L. GO and LO are drawn. LHJK is a cyclic quadrilateral. FLK and GHJ are straight lines. $G\hat{O}L = 136°$



5.1.1 Calculate the size of $\hat{F}$. (2)

5.1.2 Calculate the size of $\hat{K}$. (4)

5.2 In the diagram, O is the centre of the circle. Diameter BOA is produced to E such that EDG is a tangent to the circle at D. C is a point on the circle such that BA || CD. AD, BD and AC are drawn. F is a point of intersection of AC and BD. Let $\hat{B} = x$.



5.2.1	Write down, with reasons, four other angles each equal to x.	(6)
5.2.2	Determine the size of $\hat{E}$ in terms of x.	(4)
5.2.3	Prove that CA is a tangent to the circle passing through A, D and E.	(4)
		[20]

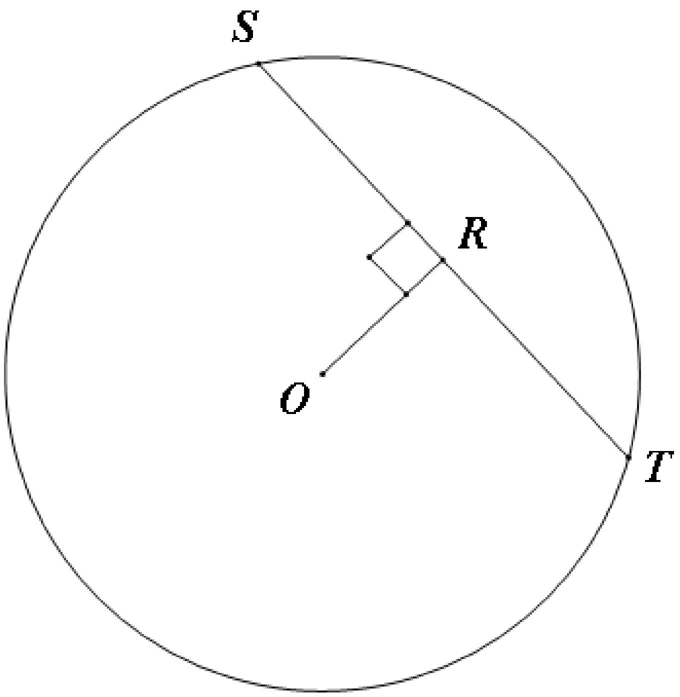
TOTAL: 75

NAME & SURNAME:

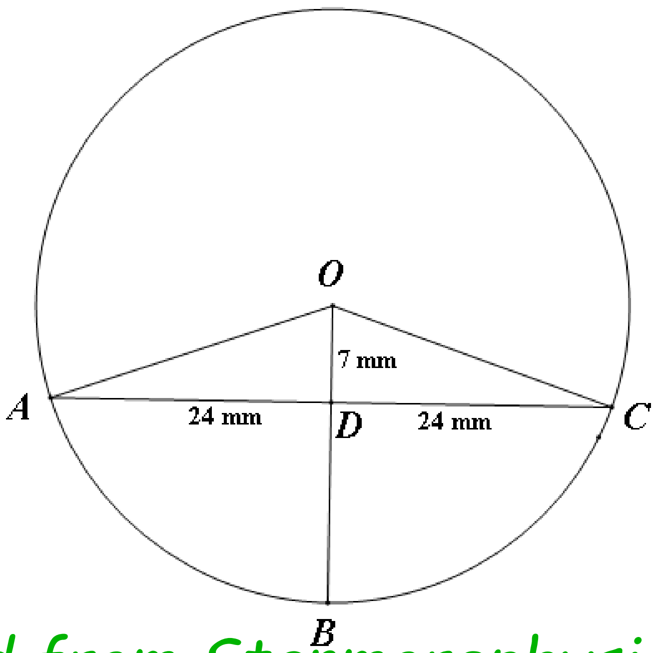
TEAR OFF

DIAGRAM SHEET 1

QUESTION 4.1



QUESTION 4.2

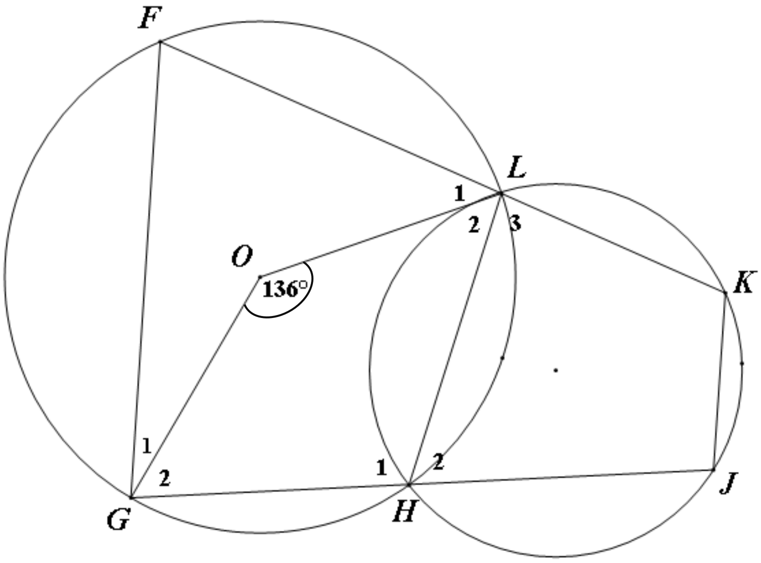


NAME & SURNAME:

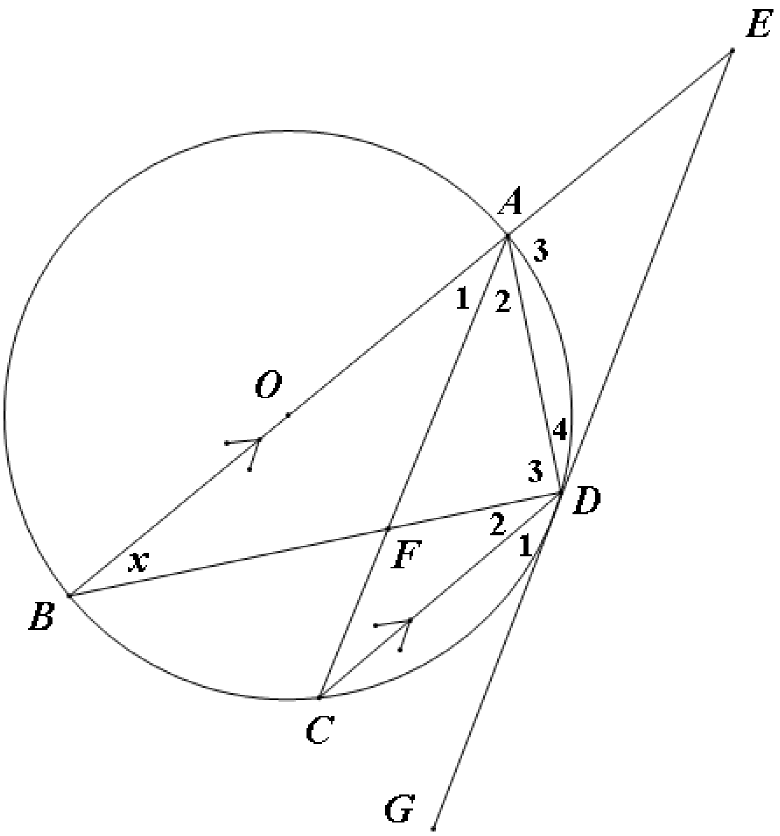
TEAR OFF

DIAGRAM SHEET 2

QUESTION 5.1



QUESTION 5.2



education

Department:
Education
PROVINCE OF KWAZULU-NATAL

MATHEMATICS

COMMON TEST

MARCH 2019

MARKING GUIDELINES

NATIONAL
SENIOR CERTIFICATE

GRADE 11

MARKS: **75**

These marking guideline consists of 8 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

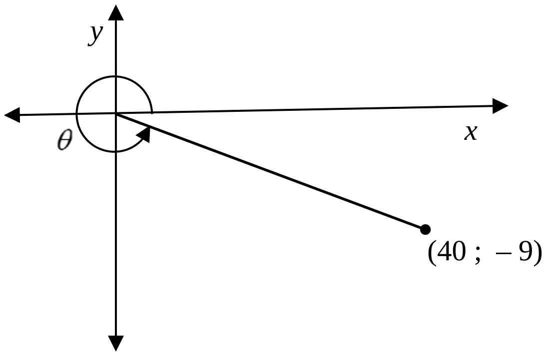
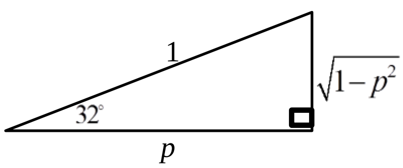
1.1.1	$7x^2 - 2x - 3 = 0$ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \dfrac{-(-2) \pm \sqrt{(-2)^2 - 4(7)(-3)}}{2(7)}$ $x = -0{,}53$ or $x = 0{,}81$	✓ substituting in correct formula ✓ x-values ✓ x-values (3)
1.1.2	$(x-2)^2 - 4 = 0$ $(x-2)^2 = 4$ $x - 2 = \pm 2$ $x = 4$ or $x = 0$ **OR** $(x-2)^2 - 4 = 0$ $x^2 - 4x + 4 - 4 = 0$ $x^2 - 4x = 0$ $x(x-4) = 0$ $x = 4$ or $x = 0$	✓ isolate $(x-2)^2$ ✓ ± 2 ✓ both answers **OR** ✓ $x^2 - 4x + 4$ ✓ factors ✓ both answers (3)
1.1.3	$\sqrt{7x+2} + 2x = 0$ $(\sqrt{7x+2})^2 = (-2x)^2$ $7x + 2 = 4x^2$ $4x^2 - 7x - 2 = 0$ $(4x+1)(x-2) = 0$ $x = -\dfrac{1}{4}$ or $x = 2$ $\therefore x = -\frac{1}{4}$ only	✓ isolate $\sqrt{7x+2}$ ✓standard form ✓ factors ✓ correct solution (4)

1.1.4	$x^2 - x - 56 < 0$ $(x-8)(x+7) < 0$ CV $x = 8$ *or* $x = -7$ $+ \quad \mid \quad - \quad \mid \quad +$ $\quad -7 \qquad\quad 8$ $-7 < x < 8$	✓correct factors ✓✓correct solution (3)
1.2	$2x + y = 1$ and $2x^2 - xy + y^2 = 4$ $y = 1 - 2x$ $2x^2 - x(1-2x) + (1-2x)^2 = 4$ $2x^2 - x + 2x^2 + 1 - 4x + 4x^2 = 4$ $8x^2 - 5x - 3 = 0$ $(8x+3)(x-1) = 0$ $x = -\frac{3}{8}$ or $x = 1$ $y = 1 - 2\left(-\frac{3}{8}\right)$ or $y = 1 - 2(1)$ $y = 1\frac{3}{4}$ or $y = -1$ **OR** $2x + y = 1$ and $2x^2 - xy + y^2 = 4$ $x = \frac{1-y}{2}$ $2\left(\frac{1-y}{2}\right)^2 - y\left(\frac{1-y}{2}\right) + y^2 = 4$ $2\left(\frac{1-2y+y^2}{4}\right) - y\left(\frac{1-y}{2}\right) + y^2 - 4 = 0$ $1 - 2y + y^2 - y + y^2 + 2y^2 - 8 = 0$ $4y^2 - 3y - 7 = 0$ $(4y-7)(y+1) = 0$ $y = 1\frac{3}{4}$ or $y = -1$ $x = \frac{1 - 1\frac{3}{4}}{2}$ or $x = \frac{1-(-1)}{2}$ $x = -\frac{3}{8}$ or $x = 1$	$y = 1 - 2x$ ✓substitution ✓ standard form ✓ factors ✓ x values ✓y values (6) **OR** $x = \frac{1-y}{2}$ ✓substitution ✓ standard form ✓ factors ✓ y values ✓x values (6)
		[19]

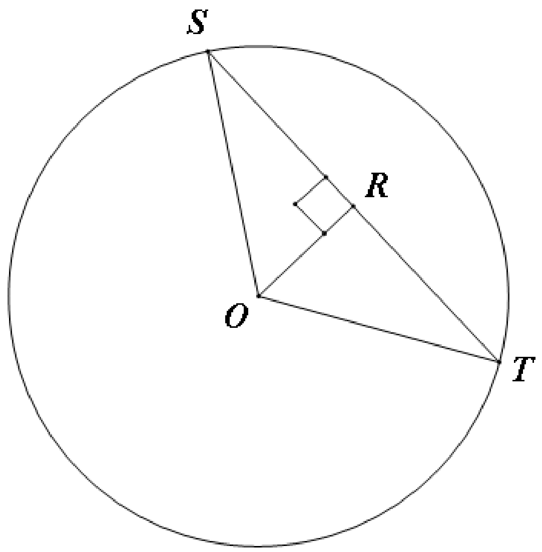
QUESTION 2

2.1	$x^{\frac{3}{4}} = 64$ $\left(x^{\frac{3}{4}}\right)^{\frac{4}{3}} = (2^6)^{\frac{4}{3}}$ $x = 256$ or 2^8	✓ raising both sides to the $\frac{4}{3}$ ✓ answer (2)
2.2.1	$\frac{5^{-x}.125^{1-x}.25^{2x}}{5}$ $= \frac{5^{-x}.\left(5^3\right)^{1-x}.\left(5^2\right)^{2x}}{5}$ $= \frac{5^{-x}.5^{3-3x}.5^{4x}}{5}$ $= 5^{-x+3-3x+4x-1}$ $= 5^2$ $=25$	✓rewriting as base 3 ✓using exponential rules ✓ answer (3)
2.2.2	$\sqrt{12} - \sqrt{147} + 3^{1,5}$ $= \sqrt{4 \times 3} - \sqrt{49 \times 3} + 3^{\frac{3}{2}}$ $= 2\sqrt{3} - 7\sqrt{3} + \sqrt{9 \times 3}$ $= 2\sqrt{3} - 7\sqrt{3} + 3\sqrt{3}$ $= -2\sqrt{3}$	✓ simplifying surds ✓ $3\sqrt{3}$ ✓ answer (3)
2.3	$\frac{5^{2006} - 5^{2004} + 24}{5^{2004} + 1} = a$ $\frac{5^{2004}(5^2 - 1) + 24}{5^{2004} + 1} = a$ $\frac{5^{2004}(24) + 24}{5^{2004} + 1} = a$ $\frac{24(5^{2004} + 1)}{5^{2004} + 1} = a$ $a = 24$	✓factorising ✓factorising ✓answer (3)
		[11]

QUESTION 3

3.1	 $x^2+y^2=r^2$ $40^2+(-9)^2=r^2$ $r=41$ $\sin\theta+\cos\theta$ $=\frac{-9}{41}+\frac{40}{41}$ $=\frac{31}{41}$	✓ correct sketch in 4th quadrant ✓ value of r ✓ substitution ✓ answer (4)
3.2	$\frac{\sin(90^\circ-\theta).\tan(360^\circ-\theta).\sin(\theta-180^\circ)}{1-\cos^2\theta}$ $=\frac{\cos\theta.-\tan\theta.-\sin\theta}{\sin^2\theta}$ $=\frac{\cos\theta.-\frac{\sin\theta}{\cos\theta}.-\sin\theta}{\sin^2\theta}$ $=1$	$\cos\theta$ $-\tan\theta$ $-\sin\theta$ $\sin^2\theta$ $\frac{\sin\theta}{\cos\theta}$ ✓ answer (6)
3.3.1	$\cos 212°$ $=\cos(180°+32°)$ $=-\cos 32°$ $=-p$	$-\cos 32°$ ✓ answer (2)
3.3.2	$\sin(-328°)$ $=\sin 32°$ $=\sqrt{1-\cos^2 32°}$ $=\sqrt{1-p^2}$ 	$\sin 32°$ ✓ correct sketch or identity ✓ answer (3)
		[15]

QUESTION 4

4.1	 Construction: Draw OS and OT. Proof: In ΔOSR and ΔOTR : 1. OS = OT [radii] 2. OR = OR [common] 3. $S\hat{R}O = T\hat{R}O = 90°$ [$\angle s$ on a straight line] $\therefore \Delta OSR \equiv \Delta OTR$ [90°; H; S] $\therefore$ SR = RT [$\equiv \Delta s$]	✓ construction ✓ S/R ✓ S (OR is common) ✓ S/R ✓ S/R (5)
4.2	$OD \perp AC$ [line from centre to midpoint of chord] $OA^2 = AD^2 + OD^2$ [Pythagoras] $= 24^2 + 7^2$ $= 625$ OA = 25 mm OB = OA [radii] $\therefore BD = 25 - 7 = 18\text{mm}$	✓ S/R ✓ S/R ✓ length of the radius ✓ S/R ✓ answer (5)
		[10]

QUESTION 5

5.1.1	$\hat{F}=\frac{1}{2}G\hat{O}L$ [$\angle$ at centre $=2\times\angle$ at circumference] $=68°$	✓ R ✓ answer (2)
5.1.2	$\hat{F}+\hat{H}_1=180°$ [opp. $\angle$s of cyclic quadrilateral] $\hat{H}_1=180°-68°$ $=112°$ $\hat{K}=\hat{H}_1$ [ext. $\angle$ of cyclic quadrilateral] $=112°$ **OR** $\hat{H}_2=\hat{F}=68°$ [ext. $\angle$ of cyclic quadrilateral] $\hat{K}=112°$ [opp. $\angle$s of cyclic quadrilateral]	✓ R ✓ size of $\hat{H}_1$ ✓ R ✓ answer (4) **OR** ✓ S ✓ R ✓ S ✓ R (4)
5.2.1	$\hat{C}=x$ [$\angle$s in the same segment] $\hat{A}_1=\hat{C}=x$ [alt. $\angle$s; BA || CD] $\hat{D}_2=\hat{A}_1=x$ [$\angle$s in the same segment] $\hat{D}_4=\hat{B}=x$ [tan-chord theorem] **OR** $\hat{D}_2=x$ [alt. $\angle$s; BA || CD] $\hat{A}_1=\hat{D}_2=x$ [$\angle$s in the same segment] $\hat{C}=\hat{B}=x$ [$\angle$s in the same segment] $\hat{D}_4=\hat{B}=x$ [tan-chord theorem]	✓ S ✓ R ✓ S/R ✓ S/R ✓ S ✓ R (6) **OR** ✓ S/R ✓ S ✓ R ✓ S/R ✓ S ✓ R (6)
5.2.2	$\hat{D}_3=90^\circ$ [$\angle$ in a semicircle] $\hat{E}=180^\circ-\left(\hat{B}+B\hat{D}E\right)$ [sum of $\angle$s in Δ] $=180^\circ-\left(x+90^\circ+x\right)$ $=90^\circ-2x$ **OR** $\hat{D}_3=90^\circ$ [$\angle$ in a semicircle] $\hat{E}+C\hat{D}E=180^\circ$ [co-interior $\angle$s; BA || CD] $\hat{E}=180^\circ-C\hat{D}E$ $=180^\circ-\left(x+90^\circ+x\right)$ $=90^\circ-2x$	✓ S ✓ R ✓ S ✓ answer (4) **OR** ✓ S ✓ R ✓ S ✓ answer (4)

5.2.3	$\hat{A}_2 = 180^\circ - (\hat{B} + \hat{D}_3 + \hat{A}_1)$ [sum of $\angle$s in ΔABD] $= 180^\circ - (x + 90^\circ + x)$ $= 90^\circ - 2x$ $\therefore \hat{A}_2 = \hat{E}$ [both $= 90^\circ - 2x$] $\therefore$ AE is a tangent to the circle through A, D and E [converse: tan-chord-theorem] **OR** $\hat{D}_1 = 180^\circ - (\hat{D}_2 + \hat{D}_3 + \hat{D}_4)$ [$\angle$s on a straight line] $= 180^\circ - (x + 90^\circ + x)$ $= 90^\circ - 2x$ $\hat{D}_1 = \hat{A}_2$ [tan-chord-theorem] $\therefore \hat{A}_2 = 90^\circ - x$ $\therefore \hat{A}_2 = \hat{E}$ [both $= 90^\circ - 2x$] $\therefore$ AE is a tangent to the circle through A, D and E [converse: tan-chord-theorem]	✓ S $\hat{A}_2 = 90^\circ - 2x$ $\hat{A}_2 = \hat{E}$ ✓ R (4) **OR** ✓ S $\hat{A}_2 = 90^\circ - 2x$ $\hat{A}_2 = \hat{E}$ ✓ R (4)
		[20]

TOTAL MARKS: 75