KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS

COMMON TEST

APRIL 2021

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. 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 4.3 AND QUESTION 5 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 $(2x+3)(6-x)=0$ (2)

1.1.2 $5x^2+x-7=0$ (correct to two decimals) (3)

1.1.3 $x^2+8x+15>0$ (3)

1.2 Solve for x and y:

$4x-y=3$ and $y^2-2xy+1=0$ (6)

1.3 Given: $kx^2-5x-1=0$, with $k\neq 0$.

1.3.1 For which value(s) of k will $kx^2-5x-1=0$ have real roots? (3)

1.3.2 Determine two integral values of k for which the roots of $kx^2-5x-1=0$ will be rational. (2)

[19]

QUESTION 2

2.1 Without using a calculator, rationalise the denominator and simplify:

$$\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$$

(3)

2.2 Solve for x:

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

2.3 Simplify:

$$\left(\frac{3^{x+1}+12.3^{x-1}}{7.9^{x}}\right)^{\frac{1}{x}}$$

(4)

[12]

QUESTION 3

3.1 Simplify, without the use of a calculator:

$$\frac{\sin(-20^\circ)}{\cos 430^\circ}$$ (4)

3.2 Without using a calculator, simplify to a single trigonometric ratio:

$$1+\sin x.\tan(180^\circ - x).\cos(-x)$$ (5)

3.3 If $3\tan\theta+1=0$ and $\cos\theta>0$, calculate without the use of a calculator, and with the aid of a diagram, the value of:

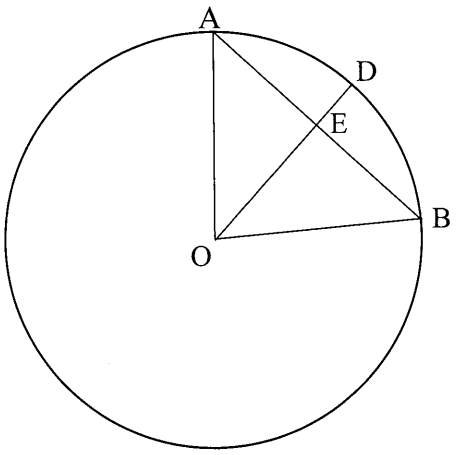
$$30\sin^2\theta+\sqrt{40}\cos\theta.$$ (6)

[15]

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

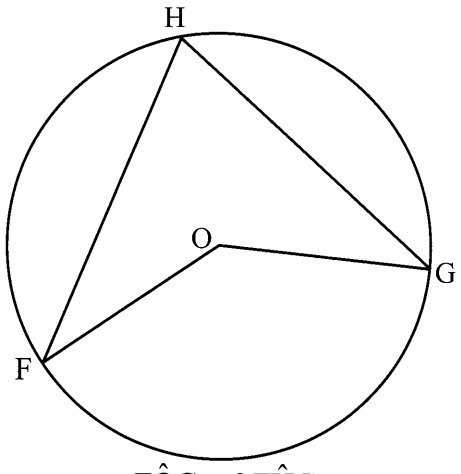
QUESTION 4

4.1 In the diagram, O is the centre of the circle. A, B and D are points on the circle. OA, OB, OD and AB are drawn. AB and OD intersect at E.
AE = EB = 6 cm. DE = 2 cm.
If the radius of the circle is x cm, calculate the numerical value of x.



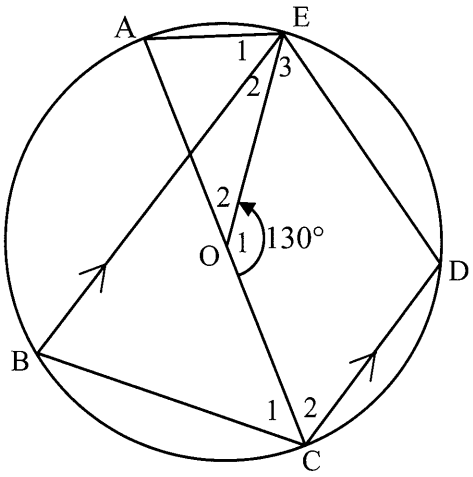
(7)

4.2 In the diagram, O is the centre of the circle. F, G and H are points on the circle. FH, FO and GO are drawn.



Prove the theorem which states that $F\hat{O}G = 2F\hat{H}G$. (5)

4.3 O is the centre of circle ABCDE. BE || CD and $\hat{O}_1 = 130^\circ$.



4.3.1 Determine, with reasons, the size of the following angles:

(a) $\hat{B}$ (2)

(b) $\hat{A}$ (2)

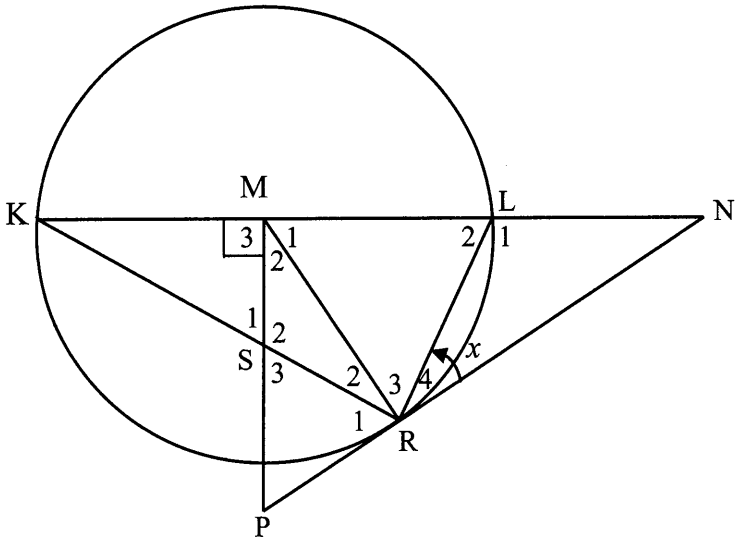
(c) $\hat{D}$ (2)

4.3.2 Prove that $\hat{E}_1 = \hat{E}_3$. (4)

[22]

QUESTION 5

In the diagram, M is the centre of the circle and diameter KL is produced to N.
MP is drawn perpendicular to KN such that PRN is a tangent to the circle at R.
MP and chord KR intersect at S. MR and LR are drawn. Let $\hat{R}_4 = x$.



5.1 Write down with reasons two other angles each equal to x. (3)

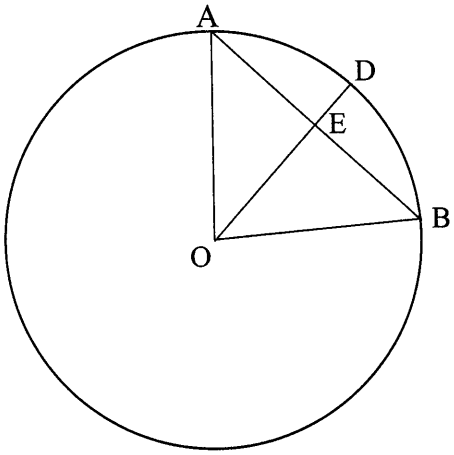
5.2 Prove that KM is a tangent at M to the circle passing through M, P and R. (4)
[7]

TOTAL: 75

NAME & SURNAME:

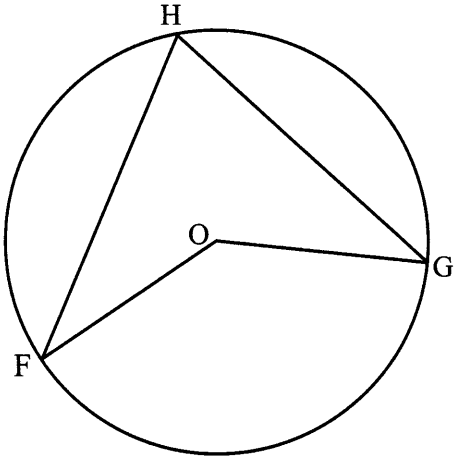
DIAGRAM SHEET 1

QUESTION 4.1



TEAR OFF

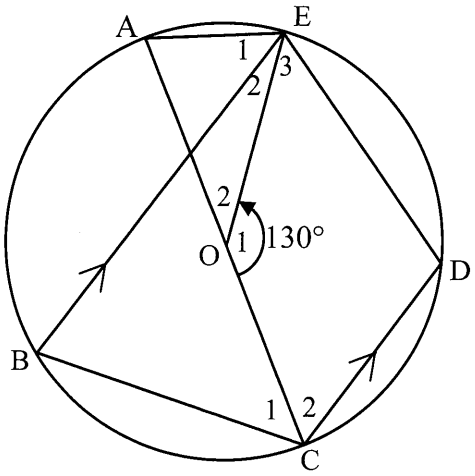
QUESTION 4.2



NAME & SURNAME:

DIAGRAM SHEET 2

QUESTION 4.3



QUESTION 5

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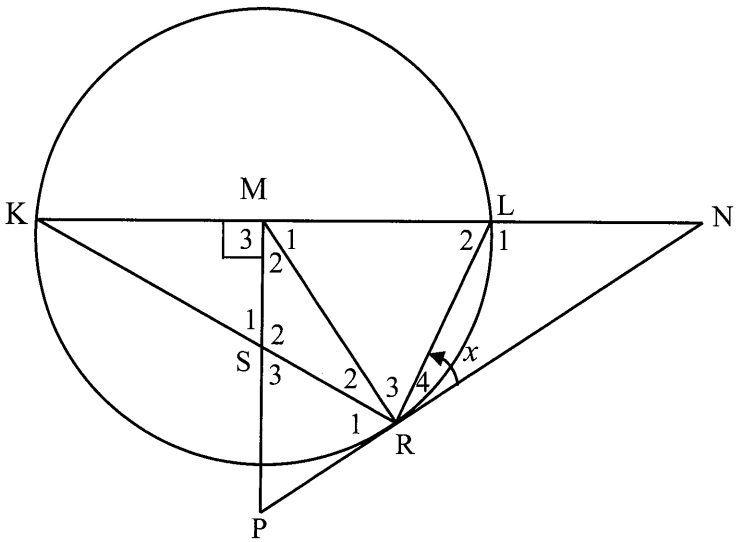

 MATHS GR 11 P 10

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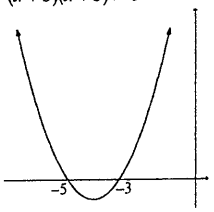
APRIL 2021
MARKING GUIDELINE

MARKS: 75

This marking guideline consists of 9 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	$x=-\frac{3}{2}$ or $x=6$	✓ answer ✓ answer (2)
1.1.2	$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-1\pm\sqrt{1^2-4(5)(-7)}}{2(5)}$ $=\frac{-1\pm\sqrt{141}}{10}$ $=1{,}09$ or $-1{,}29$	✓ substitution ✓ answer ✓ answer (3)
1.1.3	$x^2+8x+15>0$ $(x+5)(x+3)>0$  $x<-5$ or $x>-3$	✓ critical values ✓ ✓ answer (3)

1.2	$y=4x-3$ Substitute in $y^2-2xy+1=0$: $(4x-3)^2-2x(4x-3)+1=0$ $16x^2-24x+9-8x^2+6x+1=0$ $8x^2-18x+10=0$ $4x^2-9x+5=0$ $(4x-5)(x-1)=0$ $x=\frac{5}{4}$ or $x=1$ $y=2$ or $y=1$	✓ making y the subject of the formula ✓ substitution ✓ standard form ✓ factorisation ✓ values of x ✓values of y (6)
1.3.1	$b^2-4ac\geq 0$ $(-5)^2-4k(-1)\geq 0$ $25+4k\geq 0$ $k\geq -\frac{25}{4}$ $k\geq -6\frac{1}{4}$	✓ condition for real roots ✓ substitution ✓ answer: $k\geq -\frac{25}{4}$ or $k\geq -6\frac{1}{4}$ (3)
1.3.2	E.g.: $k=-4:-6:6:14\ldots$ Any two values of k that will result in b^2-4ac being a perfect square.	✓ any correct value of k ✓ another correct value of k (2)
		[19]

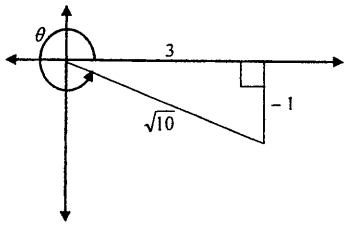
QUESTION 2

2.1	$\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ $=\frac{(\sqrt{3}-\sqrt{2})}{(\sqrt{3}+\sqrt{2})}\times\frac{(\sqrt{3}-\sqrt{2})}{(\sqrt{3}-\sqrt{2})}$ $=\frac{3-2\sqrt{2}\sqrt{3}+2}{3-2}$ $=5-2\sqrt{6}$	✓ $\times\frac{(\sqrt{3}-\sqrt{2})}{(\sqrt{3}-\sqrt{2})}$ ✓ multiplying out denominator correctly ✓ answer (3)
2.2	$x-2\sqrt{x}-8=0$ $x-2x^{\frac{1}{2}}-8=0$ $(x^{\frac{1}{2}}-4)(x^{\frac{1}{2}}+2)=0$ $x^{\frac{1}{2}}=4$ or $x^{\frac{1}{2}}=-2$ $x=16$ no solution **OR** $x-2\sqrt{x}-8=0$ $2\sqrt{x}=x-8$ $4x=x^2-16x+64$ $x^2-20x+64=0$ $(x-16)(x-4)=0$ $x=16$ or $x=4$ N/A	✓ exponential form ✓ factorisation ✓ $x^{\frac{1}{2}}=4$ or $x^{\frac{1}{2}}=-2$ ✓ $x=16$ ✓ no solution (5) **OR** ✓ isolate surd ✓ squaring both sides ✓ standard form ✓ $x=16$ or $x=4$ ✓ rejecting $x=4$ (5)

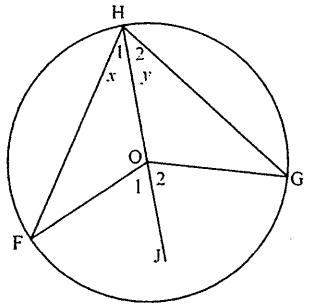
2.3	$\left(\frac{3^{x+1}+12.3^{x-1}}{7.9^x}\right)^{\frac{1}{x}}$ $=\left[\frac{3^x\left(3+12.3^{-1}\right)}{7.3^{2x}}\right]^{\frac{1}{x}}$ $=\left[\frac{7.3^x}{7.3^{2x}}\right]^{\frac{1}{x}}$ $=\left[3^{-x}\right]^{\frac{1}{x}}$ $=3^{-1}$ $=\frac{1}{3}$ **OR** $\left(\frac{3^{x+1}+12.3^{x-1}}{7.9^x}\right)^{\frac{1}{x}}$ $=\left[\frac{3.3^x\left(1+\frac{4}{3}\right)}{7.3^x.3^3}\right]^{\frac{1}{x}}$ $=\left[\frac{3.\frac{7}{3}}{7.3^x}\right]^{\frac{1}{x}}$ $=\left(3^{-x}\right)^{\frac{1}{x}}$ $=3^{-1}$ $=\frac{1}{3}$	✓ factorising numerator ✓ 3^{2x} ✓ simplification ✓ answer (4) **OR** ✓ factorising numerator ✓ $3^x.3^x$ ✓ simplification ✓ answer (4)
		[12]

QUESTION 3

3.1	$\frac{\sin(-20^\circ)}{\cos 430^\circ}$ $=\frac{-\sin 20^\circ}{\cos 70^\circ}$ $=\frac{-\sin 20^\circ}{\sin 20^\circ}$ $=-1$ OR $\frac{\sin(-20^\circ)}{\cos 430^\circ}$ $=\frac{-\sin 20^\circ}{\cos 70^\circ}$ $=\frac{-\cos 70^\circ}{\cos 70^\circ}$ $=-1$	✓ $-\sin 20^\circ$ ✓ $\cos 70^\circ$ ✓ co-function ✓ answer (4) OR ✓ $-\sin 20^\circ$ ✓ $\cos 70^\circ$ ✓ co-function ✓ answer (4)
3.2	$1+\sin x.\tan(180^\circ - x).\cos(-x)$ $=1+\sin x.-\tan x.\cos x$ $=1-\sin x.\frac{\sin x}{\cos x}.\cos x$ $=1-\sin^2 x$ $=\cos^2 x$	✓ $-\tan x$ ✓ $\cos x$ ✓ $\frac{\sin x}{\cos x}$ ✓ $1-\sin^2 x$ ✓ answer (5)

3.3	$\tan\theta = -\frac{1}{3}$ 	✓ standard form
		✓ 4th quadrant
	$r = \sqrt{x^2 + y^2}$ $= \sqrt{3^2 + (-1)^2}$ $= \sqrt{10}$	✓ value of r
	$30\sin^2\theta + \sqrt{40}\cos\theta$ $= 30\left(\frac{-1}{\sqrt{10}}\right)^2 + \sqrt{40}\left(\frac{3}{\sqrt{10}}\right)$	✓ substitution
	$= 30\left(\frac{1}{10}\right) + 2\sqrt{10}\left(\frac{3}{\sqrt{10}}\right)$	✓ simplification
	$= 3 + 6$ $= 9$	✓ answer (6)
		[15]

QUESTION 4

4.1	$OE \perp AB$ [line from centre to midpoint of chord] $OE = x - 2$ $OA^2 = OE^2 + AE^2$ [Pythagoras] $x^2 = (x-2)^2 + 6^2$ $x^2 = x^2 - 4x + 4 + 36$ $4x = 40$ $x = 10$	✓ S ✓ R ✓ $OE = x - 2$ ✓ R ✓ substitution ✓ simplification ✓ answer (7)
4.2	Contruction: Draw line HOJ 	✓ construction
	Let $\hat{H}_1 = x$.	
	$\hat{F} = x$ [radii; ∠s opp. = sides]	✓ S/R
	$\hat{O}_1 = 2x$ [ext. ∠ of ΔHFO]	✓ S/R
	Let $\hat{H}_2 = y$.	
	$\hat{G} = y$ [radii; ∠s opp. = sides]	
	$\hat{O}_2 = 2y$ [ext. ∠ of ΔHGO]	✓ S
	$\hat{O}_1 + \hat{O}_2 = 2x + 2y$	
	$F\hat{O}G = 2(x + y)$	✓ S
	$F\hat{O}G = 2F\hat{H}G$	(5)
4.3.1 (a)	$\hat{B} = 65°$ [∠ at centre = 2 × ∠ at circumference]	✓ S ✓ R (2)
4.3.1 (b)	$\hat{A} = 65°$ [∠s in the same segment]	✓ S ✓ R (2)
	OR	OR
	$\hat{A} = 65°$ [ext. ∠ of ΔAOE; ∠s opp. = radii]	✓ S ✓ R (2)
4.3.1 (c)	$\hat{D} = 115°$ [opp. ∠s of a cyclic quadrilateral]	✓ S ✓ R (2)

4.3.2	$\hat{E}_3 + \hat{E}_2 = 180^\circ - 115^\circ$ [co-interior ∠s : BE ∥ CD] $= 65^\circ$ $\hat{E}_1 + \hat{E}_2 = \hat{A}$ [∠s opp. = radii] $= 65^\circ$ $\therefore \hat{E}_1 = \hat{E}_3$	✓S ✓R ✓S ✓R (4)
		[22]

QUESTION 5

5.1	$\hat{K} = x$ [tan-chord-theorem] $\hat{R}_2 = \hat{K}$ $= x$ [radii; ∠s opp. = sides]	✓S ✓R ✓S/R (3)
5.2	$M\hat{R}P = 90^\circ$ [radius ⊥ tangent] $\therefore \hat{M}_3 = M\hat{R}P$ [both $= 90^\circ$] ∴ KM is a tangent at M to the circle through M, P and R [converse: tan-chord-theorem] OR $M\hat{R}P = 90^\circ$ [radius ⊥ tangent] $\hat{M}_1 = 2x$ [ext ∠ of ΔMKR] $\hat{M}_2 = 180^\circ - (90^\circ + 2x)$ [∠s on a straight line] $= 90^\circ - 2x$ $\hat{P} = 180^\circ - (90^\circ + 90^\circ - 2x)$ [sum of ∠s of ΔMPR] $= 2x$ $\hat{M}_1 = \hat{P}$ ∴ KM is a tangent at M to the circle through M, P and R [converse: tan-chord-theorem]	✓S ✓R ✓S ✓R (4) OR ✓S ✓R ✓S ✓R (4)
		[7]

TOTAL MARKS : 75