LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

MOPANI EAST DISTRICT

GRADE 11

MATHEMATICS
CONTROLLED TEST 1
15 MARCH 2023

MARKS: **100**

TIME: **2 HOUR**

This question paper consists of 5 pages (including this cover page).

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. that 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 to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is not included at the end of the question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $x^2 - 5x - 6 = 0$ (2)

1.1.2 $(3x - 1)(x - 4) = 16$ (correct to TWO decimal places) (4)

1.1.3 $\sqrt{x-1} + 3 = x - 4$ (6)

1.1.4 $2x^2 - 2 \geq 3x$ (4)

1.2 Given: $F(x) = 5x^2 + 6x - 7 = 0$

1.2.1 Solve for x if f(x) = 0 use completing the square method (4)

1.2.2 Calculate the value of d for which $5x^2 + 6x = d$ has equal roots (3)

[23]

QUESTION 2

2.1 Simplify fully WITHOUT using a calculator

2.1.1 $\frac{2^{n+2} \times 4^{n+1}}{8^{n-1}}$. (3)

2.1.2 $\frac{\sqrt{p^2-q^2} \times (p+q)^{\frac{5}{2}}}{(p-q)^{\frac{1}{2}}}$ $if\ p \neq q.$ (3)

2.1.3 $\sqrt{x + \sqrt{2x-1}} \times \sqrt{x - \sqrt{2x+1}}$ (4)

2.1.4 $\frac{5^{a-2} \times 2^{a+2}}{10^a - 10^{a-1} \times 2}$. (5)

[15]

QUESTION 3

3.1.1 $x^{\frac{-3}{4}} = 8$ (3)

3.1.2. If $f(x) = 0\ has\ root\ x = \frac{-5 \pm \sqrt{3-12k^2}}{4}$, for which value of k will the root be real (3)

3.1.3 $2^{3x+1} + 2^{3x} = 12.$ (5)

3.1.4 Solve for x and y simultaneously $3x + 2 = y\ and\ y = -x^2 + 2x + 8$ (7)

[18]

QUESTION 4

4.1.1 Simplify fully: $\sin(90^\circ - x).\cos(180^\circ + x) + \tan x.\cos x.\sin(x - 180^\circ)$ (6)

4.1.2 Simplify WITHOUT using a calculator

$$\frac{\sin 120^0.cos210^0.tan3150^0.cos27^0}{sin63^0.cos540^0}$$ (7)

4.2 The identity $\frac{(\sin x - \cos x)^2 - 1}{sin^2 x - 1} = 2\,tanx$ is given

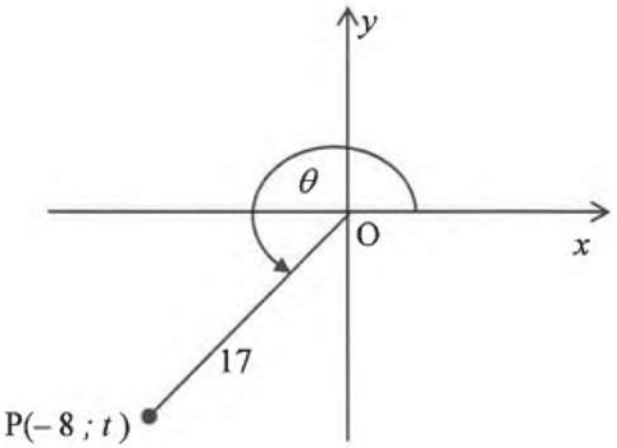
4.2.1 Prove the identity (6)

4.2.2 For which values of x in the interval $0^0 \leq x \leq 360^0$ will the identity in 4.2.1 not be defined? (4)

[23]

QUESTION 5

5.1 In the diagram below, P(–8 ; t) is a point in the Cartesian plane such that OP = 17 units and reflex $\hat{XOP} = \theta$.



5.1.1 Calculate the value of t. (2)

5.1.2 Determine the value of each of the following WITHOUT using a calculator:

(a) $\cos(-\theta)$ (2)

(b) $1 - \sin\theta$ (2)

[6]

QUESTION 6

6.1. If $\sin 17° = a$, WITHOUT using a calculator, express the following in terms of a:

6.1.1 $\tan 17°$ (3)

6.1.2 $\sin 107°$ (2)

6.1.3 $\cos^2 253° + \sin^2 557°$ (4)

6.2. Determine the following general solution of $\sin(x - 30) = Cos2x$ (6)

[15]

TOTAL [100]

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QUESTION 1

S/n	Solution	Mark allocation	Total
1.1.1	$x^2-5x-6=0$	✓$(x-6)(x+1)=0$ ✓$(x=6\ or\ x=-1)$	2
1.1.2	$(3x-1)(x-4)=16$ $3x^2-5x+4-16=0$ $3x^2-5x-12=0$ *Use of Quadratic Formula* $x=3\ or\ x=-\frac{4}{3}\ or\ 1.33$	✓standard form ✓correct substitution in a quadratic formula ✓x = 3 and ✓$x=-\frac{4}{3}\ or\ 1.33$	4 ✓
1.1.3	$\sqrt{x-1}+3=x-4$ $\sqrt{x-1}=x-4-3$ $x-1=(x-7)^2$ $x-1=x^2-14x+49$ $x^2-15x+50=0$ $(x-5)(x-10)=0$ $x\neq 5$ or $x=10$	✓isolate/*isoleer* √ sign/*teken* ✓squaring/*kwadr* both sides ✓ std vorm/*stand vorm* ✓factors/*fakt* ✓$x\neq 5$ ✓$x=10$ (6)	6
1.1.4	$2x^2-2\geq 3x$ $2x^2-3x-2\geq 0$ $(2x+1)(x-2)\geq 0$  $x\leq -\frac{1}{2}$ or/*of* $x\geq 2$	✓std form/*stand. vorm* ✓factors or using formula/ *faktore of gebruik formule* ✓✓$x\leq -\frac{1}{2}$ or/*of* $x\geq 2$ (4)	4

1.2.1	$5x^2 + 6x = 7$ $x^2 + \frac{6}{5x} = \frac{7}{5}$ $x^2 + \frac{6}{5x} + \left(\frac{1}{2} * \frac{6}{5}\right)^2 = \frac{7}{5} + \frac{9}{25}$ $\left(x + \frac{3}{5}\right)^2 = \frac{\sqrt{44}}{5}$ $x = -\frac{3}{5} \pm \frac{\sqrt{44}}{5}$ $x = 0{,}73 \text{ or } x = -1.93$	✓ $simplyfy\ to\ \left(x + \frac{3}{5}\right)^2$ ✓ Simplify to $\frac{\sqrt{44}}{5}$ ✓ $x = -\frac{3}{5} \pm \frac{\sqrt{44}}{5}$ ✓ $x = 0{,}73$ ✓ $x = -1.93$	5
1.2.2	$\Delta = b^2 - 4ac$ $= (6)^2 - 4(5)(-d)$ $36 + 20d = 0$ $d = -\frac{9}{5}$	✓ substitution ✓ $36 + 20d = 0$ ✓ answer/*antwoord* (3)	3

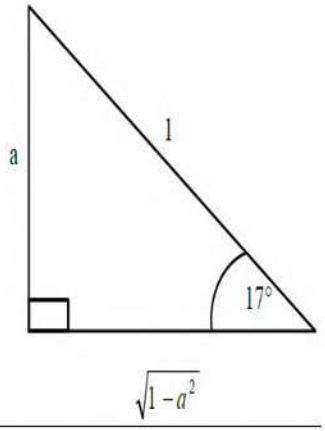
2.1.1	$\frac{2^{n+2}.4^{n+1}}{8^{n-1}}$ $=\frac{2^{n+2}.2^{2n+2}}{2^{3n-3}}$ $=2^{n+2+2n+2-(3n-3)}$ $=2^{7}$ $=128$ **OR/*OF*** $\frac{2^{n}.2^{2}.4^{n}.4}{8^{n}.8^{-1}}$ $=\frac{8^{n}.2^{2}.2^{2}}{8^{n}.2^{-3}}$ $=2^{7}$ $=128$	✓writing as prime bases/ *skryf as priembasisse* ✓applying exponential laws/ *pas ekspon.wette toe* ✓answer/*antwoord* (3)	3
2.1.2	$\frac{\sqrt{p^2-q^2}\times(p+q)^{\frac{5}{2}}}{(p-q)^{\frac{1}{2}}}$ $=\frac{\sqrt{(p-q)(p+q)}\times(p+q)^{\frac{5}{2}}}{(p-q)^{\frac{1}{2}}}$ $=\frac{(p-q)^{\frac{1}{2}}(p+q)^{\frac{1}{2}}\times(p+q)^{\frac{5}{2}}}{(p-q)^{\frac{1}{2}}}$ $=(p+q)^{\frac{1}{2}+\frac{5}{2}}$ $=(p+q)^{3}$	✓difference of 2 squares *verskil van 2 kwadrate* ✓exponent law/*eksponentwet* ✓answer/*antw.* (3)	3

2.1.3	$\sqrt{x+\sqrt{2x-1}}.\sqrt{x-\sqrt{2x-1}}$ $=\sqrt{\left(x+\sqrt{2x-1}\right)\left(x-\sqrt{2x-1}\right)}$ $=\sqrt{x^2-2x+1}$ $=\sqrt{(x-1)^2}$ $=x-1$	✓writing as one surd/ *skryf as een wortel* ✓ $\sqrt{x^2-2x+1}$ ✓ $\sqrt{(x-1)^2}$ ✓answer/*antwoord* (4)	4
2.1.4	$\dfrac{5^a.5^{-2}.2^a\,2^2}{10^a-10^a.10^{-1}.2}$ $=\dfrac{(5.2)^a.5^{-2}.2^2}{10^a\left[1-\dfrac{2}{10}\right]}$ $=\dfrac{10^a.\dfrac{4}{25}}{10^a.\dfrac{8}{10}}$ $=\dfrac{4}{25}\times\dfrac{10}{8}$ $=\dfrac{1}{5}$	✓writing as separate bases/ *skryf as priembasisse* ✓multiplication of bases with same exponents/*vermenigv. van basisse met dies. eksp.* ✓common/*gemene* factor ✓simplification/*vereenv.* ✓answer/*antw.*	5
s/N	Question 3		

3.1.1	$x^{\frac{-3}{4}} = 8$ $x = (2^3)^{\frac{4}{-3}}$ $x = 2^{-4}$ $x = \frac{1}{16}$ **OR/*OF*** $x^{\frac{3}{4}} = 8$ $\sqrt[4]{x^{-3}} = 2^3$ $x^{-3} = 2^{12}$ (4096) $x^{-1} = 2^4$ (16) $x = 2^{-4}$ $x = \frac{1}{16}$	✓change to prime base/ *verander na priembasis* ✓rational exponent/ *rasionele eksp* ✓ answer in any form/ *antw. in enige vorm* (3) ✓use of surds/*gebr van wortls* ✓ $x^{-1} = 2^4$ ✓answer in any form/*antw. in enige vorm*	3
3.1.2	$3 - 12k^2 = 0$ $1 - 4k^2 = 0$ $k^2 = \frac{1}{4}$ $k = \pm\frac{1}{2}$	✓ $3 - 12k^2 = 0$ ✓ $k^2 = \frac{1}{4}$ ✓ $k = \pm\frac{1}{2}$ (3)	3

3.1.3	$2^{3x+1}+2^{3x}=12$ $2^{3x}\left[2^1+1\right]=12$ $2^{3x}.3=12$ $2^{3x}=4$ $2^{3x}=2^2$ $3x=2$ $\therefore x=\frac{2}{3}$	✓common/*gemene* factor ✓ simplificaton/*vereenv.* ✓ equating/*gelykst* exponents ✓answer/*antw.* (4)	4
3.1.4	$3x+2=y$ *and* $y=-x^2+2x+8$ $3x+2=-x^2+2x+8$ $x^2+x-6=0$ $(x-2)(x+3)=0$ $X=2$ *or* $X=-3$ $Y=3(-3)+2$ *or* $Y=3(2)+2$ $Y=-7$ *or* $Y=8$	✓ $y=3x+2$ ✓substitution/*verv* ✓std form/*stand vorm* ✓factors/*fakt* ✓x-values/*wrdes* ✓ y-values/*wrdes*	6
S/N	Question 4		
4.1.1	$\sin(90^\circ-x).\cos(180^\circ+x)+\tan x.\cos x.\sin(x-180^\circ)$ $=\cos x.(-\cos x)+\frac{\sin x}{\cos x}.\cos x.(-\sin x)$ $=-\cos^2 x-\sin^2 x$ $=-(\cos^2 x+\sin^2 x)$ $=-1$	✓ $\cos x$ ✓ $-\sin x$ ✓ $-\cos x$ ✓ $\frac{\sin x}{\cos x}$ ✓common factor/*gemene fakt.* ✓ identity/*identiteit*	6

4.1.2	$LHS = \frac{\sin 120°.\cos 210°.\tan 315°.\cos 27°}{\cos 540°.\sin 63°}$ $= \frac{\sin 60°.(-\cos 30°)(-\tan 45)°.\sin 63°}{\cos 180°.\sin 63°}$ $= \frac{\frac{\sqrt{3}}{2}.\frac{-\sqrt{3}}{2}(-1)}{-1}$ $= -\frac{3}{4}$	✓ $\sin 60° / \cos 30°$ ✓ $-\cos 30°$ ✓ $-\tan 45°$ ✓ $\sin 63° / \cos 27°$ ✓ $\cos 180°$ ✓ special angle ratios/ *spesiale hoeke verhoudings* ✓ answer/ *antwoord*	7
4.2.1	$\frac{(\sin x - \cos x)^2 - 1}{\sin^2 x - 1}$ $= \frac{\sin^2 x - 2\sin x\cos x + \cos^2 x - 1}{\sin^2 x - 1}$ ✓ $= \frac{-2\sin x\cos x + \sin 2x + \cos 2x - 1}{\sin^2 x - 1}$ ✓ $= \frac{-2\sin x\cos x + 1 - 1}{-(1 - \sin^2 x)}$ ✓✓ $= \frac{-2\sin x\cos x}{-\cos^2 x}$ ✓ $= \frac{-2\sin x}{-\cos x}$ ✓ $= 2\tan x$		6
4.2.2	$When\ \sin^2 x - 1 = 0$ $\sin^2 x = 1$ $\sin x = 1\ or \sin x = -1$ $x = 270\ or\ x = 90$		4
S/N	Question 5		
5.1.1	$x^2 + y^2 = r^2$ $(-8)^2 + (t)^2 = 17^2$ $t^2 = 225$ $t = -15$	✓ subst in pyth ✓ answer/*antw*	2

5.1.2 (a)	$\cos(-\theta)$ $= \cos\theta$ $= \frac{-8}{17}$	✓ $\cos\theta$ ✓ answer/*antw* (2)	2
5.1.2 (b)	$1-\sin\theta = 1-\frac{-15}{17}$ $= \frac{17}{17}+\frac{15}{17}$ $= \frac{32}{17}$	✓ subst ✓ answer/*antw*	2
	Question 6		
6.1.1	$\tan 17° = \frac{a}{\sqrt{1-a^2}}$  	✓ sketch ✓ $\sqrt{1-a^2}$ ✓ answer/*antw* (3)	3

6.1.2	$\sin 107°$ $= \sin(90° + 17°)$ $= \cos 17°$ $= \sqrt{1-a^2}$ **OR/*OF*** $\sin 107°$ $= \sin(180° - 73°)$ $= \sin 73°$ $= \sqrt{1-a^2}$	✓ $\cos 17°$ ✓ $\sqrt{1-a^2}$ ✓ $\sin 73°$ ✓ $\sqrt{1-a^2}$	2
6.1.3	$\cos^2 253° + \sin^2 557°$ $= (-\cos 73)^2 + (-\sin 17°)^2$ $= (-a\ )^2 + (-a\ )^2$ $= 2a^2$	✓ $\cos^2 73°$ ✓ $\sin^2 17°$ ✓ subst of ratios ✓ answer/*antw* (4)	4

6.2.1	$\sin(x-30°)=\cos 2x$ $\sin(x-30°)=\sin(90°-2x)$ $x-30°=90°-2x+360°k$ $3x=120°+360°k$ $x=40°+120°k$ *or* $x-30°=180°-(90°-2x)+360k$ $-x=120°+360°k$ $x=-120°+360°k, k\in Z$ **OR/*OF*** $\cos(90°-(x-30°))=\cos 2x$ $\cos(120°-x)=\cos 2x$ $120°-x=2x+360°k$ *or* $-3x=-120°+360°k$ $x=40°+120°k,\ k\in Z$	✓ $\sin(90°-2x)$ ✓ $x-30°=90°-2x+360°k$ ✓ $x=40°+120°k$ ✓ $x-30°=180°-(90°-2x)+360k$ ✓ $x=-120°+360°k$ (5) ✓ $\cos(90°-(x-30°))$ ✓ $120°-x=2x+360°k$ ✓ $x=40°+120°k$ ✓ $120°-x=-2x+360°k$ ✓ $x=240°+360°k$ (5)	5
		TOTAL	100