LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

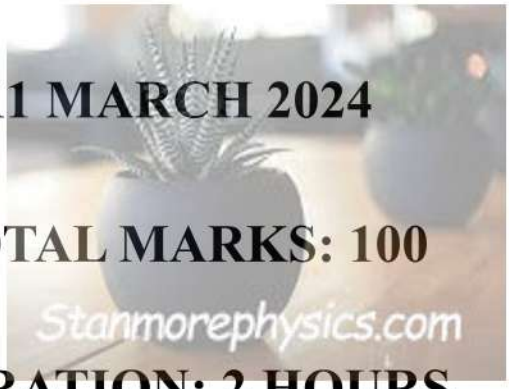
DEPARTMENT OF
EDUCATION

SEKHUKHUNE EAST DISTRICT – DISTRICT ON THE RISE

GRADE 11

MATHEMATICS

TEST 1



11 MARCH 2024

TOTAL MARKS: 100

DURATION: 2 HOURS

This question paper consists of 4 pages including the cover page.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of THREE 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, et cetera 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. Write neatly and legibly.

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QUESTION 1

Simplify each of the following without using a calculator. Show ALL calculations.

1.1 $\left(\frac{8a^4}{a}\right)^{\frac{2}{3}}$ (4)

1.2 $(27)^{\frac{2}{3}} + \left(\frac{1}{2}\right)^{-2} - 5^0$ (5)

1.3 $\sqrt{32} - \sqrt{18} + 2\sqrt{50}$ (4)

1.4 $\frac{2^{p+4} - 6.2^{p+1}}{5.2^{p+2}}$ (4)

1.5 $\frac{9^x + 3^{2x+1}}{18^x . 2^{-x}}$ (4)

1.6 $\frac{x-3}{x+3} - \frac{x+3}{x^2-9}$ (5)

[26]

QUESTION 2

2.1 Solve for x:

2.1.1 $(3x-5)(x+1) = 0$ (2)

2.1.2 $3x^2 + 5x + 1 = 0$ (Correct to two decimal digits.) (3)

2.1.3 $3\sqrt{x+2} - 1 = 2x - 6$ (6)

2.1.4 $\frac{x}{x-1} - \frac{2x+4}{3x+1} = -4$ (6)

2.1.5 $7^{x-1} = 49$ (3)

2.1.6 $(2x-3)(x+1) < 3$ (6)

2.2 Solve for x and y simultaneously:

$2x - 2 = y$ and $2x^2 + y^2 = 2$ (6)

[32]

QUESTION 3

3.1 Determine the values of m for which the following equation has equal roots:

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

3.2 Show that the roots of

$mx^2 + mx - 12 = 0$, will be real and unequal if $m > 0$. (4)

[8]

QUESTION 4

4.1 If $\cos 15° = p$, express the following in terms of p.

4.1.1 $\cos 195°$ (3)

4.1.2 $\sin 105°$ (3)

4.1.3 $\sin 15°$ (2)

4.2 $$\frac{\sin(180° - A).\tan A.\sin(90° + A)}{\tan(180° + A).\sin(-A).\cos(-A)}$$ (6)

4.3 $$\frac{\cos(x - 360°).\tan(180 - x).\cos(90° - x)}{\sin(180° + x).(1 - cos^2(-x))}$$ (9)

[23]

QUESTION 5

5.1 Prove that: $(\sin x + \cos x)^2 = 1 + 2\sin x.\cos x$ (3)

5.2 Given:

$$\frac{\sin x}{1 + \cos x} + \frac{\cos x}{\sin x} = \frac{1}{\sin x}$$

5.2.1 Prove the given identity. (5)

5.2.2 For what values of x in the interval $0° \leq x \leq 360°$ will the identity be undefined? (3)

[11]

TOTAL: 100 MARKS

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MATHEMATICS

TEST 1

MARKING GUIDELINES

11 MARCH 2024

TOTAL MARKS: 50

This marking guidelines consists of 7 pages including the cover page.

NOTE:

- **If a candidate answers a question TWICE, mark only the first one.**
- **Consistent accuracy applies in ALL aspects of the marking memorandum.**

QUESTION 1

1.1	$\left(\frac{8a^4}{a}\right)^{\frac{2}{3}}$ $= (2^3a^3)^{\frac{2}{3}}$ $= 2^2a^2$ $= 4a^2$	✓ 2^3 ✓ a^3 ✓ 4 ✓a^2	(4)
1.2	$(27)^{\frac{2}{3}} + \left(\frac{1}{2}\right)^{-2} - 5^0$ $= (3^3)^{\frac{2}{3}} + (2^{-1})^{-2} - 1$ $= 3^2 + 2^2 - 1$ $= 12$	✓ 3^3 ✓ -1 ✓ 3^2 ✓ 2^2 ✓ Answer	(5)
1.3	$\sqrt{32} - \sqrt{18} + 2\sqrt{50}$ $= 4\sqrt{2} - 3\sqrt{2} + 10\sqrt{2}$ $= 11\sqrt{2}$	✓ $4\sqrt{2}$ ✓ $3\sqrt{2}$ ✓ $10\sqrt{2}$ ✓ Answer	(4)
1.4	$\frac{2^{p+4} - 6.2^{p+1}}{5.2^{p+2}}$ $= \frac{2^{p+1}(2^3 - 6)}{5.2^{p+2}}$ $= \frac{2^{p+1}(2^3 - 6)}{5.2^1.2^{p+1}}$ $= \frac{(2^3 - 6)}{5.2^1}$ $= \frac{2}{10}$ $= \frac{1}{5}$	✓ Common factor ✓ Denominator ✓ Simplifying ✓ Answer	(4)

1.5	$\frac{9^x + 3^{2x+1}}{18^x . 2^{-x}}$ $= \frac{3^{2x} + 3^{2x+1}}{2^x . 3^{2x} . 2^{-x}}$ $= \frac{3^{2x}(1 + 3^1)}{2^0 . 3^{2x}}$ $= 4$	✓ Prime bases ✓Common factor ✓2^0 ✓ Answer	(4)
1.6	$\frac{x-3}{x+3} - \frac{x+3}{x^2-9}$ $= \frac{x-3}{x+3} - \frac{x+3}{(x-3)(x+3)}$ $= \frac{(x-3)(x-3) - (x+3)}{(x-3)(x+3)}$ $= \frac{x^2 - 6x + 9 - x - 3}{(x-3)(x+3)}$ $= \frac{x^2 - 7x + 6}{(x-3)(x+3)}$	✓ $(x-3)(x+3)$ ✓ LCD ✓$x^2 - 6x + 9$ ✓$-x - 3$ ✓ Answer	(5)
			[26]

QUESTION 2

2.1.1	$(3x - 5)(x + 1) = 0$ $\therefore x = \frac{5}{3}$ or $x = -1$	✓ $x = \frac{5}{3}$ ✓ $x = -1$	(2)
2.1.2	$3x^2 + 5x + 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-5 \pm \sqrt{5^2 - 4(3)(1)}}{2(3)}$ $x = \frac{-5 \pm \sqrt{13}}{6}$ $\therefore x = -0{,}23$ or $x = -1{,}43$	✓Substitution ✓✓ Answers	(3)

2.1.3	$3\sqrt{x+2}-1=2x-6$ $3\sqrt{x+2}=2x-5$ $\left(3\sqrt{x+2}\right)^2=(2x-5)^2$ $9(x+2)=4x^2-20x+25$ $0=4x^2-29x+7$ $0=(4x-1)(x-7)$ $x\neq\frac{1}{4}$ or $x=7$	✓ Isolating surd ✓ Squaring both sides ✓ Standard form ✓ Factors ✓ $x\neq\frac{1}{4}$ ✓ $x=7$	(6)
2.1.4	$\frac{x}{x-1}-\frac{2x+4}{3x+1}=-4$ $x(3x+1)-(2x+4)(x-1)=-4(x-1)(3x+1)$ $x^2-x+4=-12x^2+8x+4$ $13x^2-9x=0$ $x(13x-9)=0$ $x=0$ or $x=\frac{9}{13}$	✓ × LCD ✓ Simplifying ✓ Standard form ✓ Factors ✓ $x=0$ ✓ $x=\frac{9}{13}$	(6)
2.1.5	$7^{x-1}=49$ $7^{x-1}=7^2$ $x-1=2$ $x=3$	✓ Prime base ✓ Equating exponents ✓ Answer	(3)
2.1.6	$(2x-3)(x+1)<3$ $2x^2-x-3<3$ $2x^2-x-6<0$ $(2x+3)(x-2)<0$ C.V. $x=-\frac{3}{2}$ or $x=2$ + $-\frac{3}{2}$ - 2 + $-\frac{3}{2}<x<2$	✓ Multiplying out () ✓ Standard from ✓ Factors ✓ Critical values ✓✓ Answer	(6)

2.2	$2x - 2 = y$ ... ① $2x^2 + y^2 = 2$ ... ② Substitute ① into ② $2x^2 + (2x - 2)^2 = 2$ $6x^2 - 8x + 2 = 0$ $(6x - 1)(x - 2) = 0$ $x = \frac{1}{6}$ or $x = 2$ $2\left(\frac{1}{6}\right) - 2 = y$ or $2(2) - 2 = y$ $y = -\frac{5}{3}$ or $y = 2$	✓ Substitution ✓ Standard from ✓ Factors ✓ x – values ✓ Substitution ✓ y – values	(6)
			[32]

QUESTION 3

3.1	$x^2 - 3x - m = 0$ $\Delta = b^2 - 4ac$ $\Delta = (-3)^2 - 4(1)(-m)$ $\Delta = 9 + 4m$ $0 = 9 + 4m$ $m = -\frac{9}{4}$	✓ Substitution ✓ Δ ✓ $\Delta = 0$ ✓ Answer	(4)
3.2	$mx^2 + mx - 12 = 0$ $\Delta = (m)^2 - 4(m)(-12)$ $\Delta = m^2 + 48m$ $m^2 > 0$ if $m > 0$ and $48m > 0$ if $m > 0$ $\therefore \Delta > 0$	✓ Substitution ✓ Δ ✓ $m^2 > 0$ ✓ $48m > 0$	(4)
			[8]

QUESTION 4

4.1.1	$\cos 195°$ $= \cos(180° + 15°)$ $= -\cos 15$ $= -p$	✓ Reduction formula ✓ Simplifying ✓ Answer	(3)
4.1.2	$\sin 105°$ $= \sin(90° + 15°)$ $= \cos 15°$ $= p$	✓ Co-ratio ✓ Simplifying ✓ Answer	(3)
4.1.3	$y = \sqrt{1-p^2}$ Pythagoras theorem $\sin 15°$ $= \frac{\sqrt{1-p^2}}{1}$	✓ $y = \sqrt{1-p^2}$ ✓ Answer	(2)
4.2	$\frac{\sin(180° - A).\tan A.\sin(90° + A)}{\tan(180° + A).\sin(-A).\cos(-A)}$ $= \frac{\sin(A).\tan A.\cos(A)}{\tan(A).(-\sin(A)).\cos(A)}$ $= -1$	$\frac{\checkmark \sin(A).\tan A.\checkmark\cos(A)}{\checkmark\tan(A).\checkmark(-\sin(A)).\checkmark\cos(A)}$ ✓ Answer	(6)
4.3	$\frac{\cos(x - 360°).\tan(180 - x).\cos(90° - x)}{\sin(180° + x).(1 - cos^2(-x))}$ $= \frac{\cos(-(360° - x)).\tan(180 - x).\cos(90° - x)}{\sin(180° + x).(1 - cos^2(x))}$ $= \frac{\cos(x).(-\tan(x)).\sin x}{-\sin(x).(sin^2(x))}$ $= \frac{\frac{\cos x}{1}.\frac{-\sin x}{\cos x}.\frac{\sin x}{1}}{-sin^3 x}$ $= \frac{1}{\sin x}$	$\frac{\checkmark\cos(-(360° - x))}{(1 - \ \checkmark cos^2(x))}$ $\frac{\checkmark\cos(x).\ \checkmark(-\tan(x)).\ \checkmark\sin x}{\checkmark -\sin(x).\ \checkmark(sin^2(x))}$ ✓ $\frac{-\sin x}{\cos x}$ ✓ Answer	(9)
			[23]

QUESTION 5

5.1	$(\sin x + \cos x)^2 = 1 + 2\sin x . \cos x$ LHS $= (\sin x + \cos x)^2$ LHS $= sin^2x + 2\sin x \cos x + cos^2x$ LHS $= 1 + 2\sin x \cos x$ LHS = RHS	✓ $\sin^2x + \cos^2x$ ✓ $2\sin x \cos x$ ✓ 1	(3)
5.2.1	$\frac{\sin x}{1+\cos x} + \frac{\cos x}{\sin x} = \frac{1}{\sin x}$ LHS $= \frac{\sin x}{1+\cos x} + \frac{\cos x}{\sin x}$ LHS $= \frac{sin^2x + \cos x\,(1+\cos x)}{(1+\cos x).\sin x}$ LHS $= \frac{sin^2x + \cos x + cos^2x}{(1+\cos x).\sin x}$ LHS $= \frac{1+\cos x}{(1+\cos x).\sin x}$ LHS $= \frac{1}{\sin x}$ LHS = RHS	✓ Numerator ✓ LCM ✓ Simplifying ✓1 ✓ Simplifying	(5)
5.2.2	$x = 0°;\ 180°; 360°$	✓ 0° ✓180° ✓ 360°	(3)
			[11]

TOTAL: 50 MARKS