LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Department of

EDUCATION

CAPRICORN SOUTH DISTRICT

MATHEMATICS

INVESTIGATION

GRADE 11

MARKING GUIDELINE

DUE DATE: 30 JANUARY 2020 **TOTAL MARKS: 50**

INSTRUCTIONS TO LEARNERS

Read the following instructions carefully before answering questions.

1. Complete ALL the investigations (#1, #2 and #3)
2. Use spaces provided on each investigation sheet to answer
3. Use the CHECKLIST at the end of the investigation to check your work before making final submission
4. Write legibly and neatly for presentable work.

INVESTIGATION # 1:

1.1 State the exponent rules and clearly explain how each rule works.

- When the same bases are multiplied, the exponents are added → $a^m \times a^n = a^{m+n}$
- When the same bases are divided, the exponents are subtracted → $a^m \div a^n = a^{m-n}$
- When a power is raised to an exponent, the exponents are multiplied → $(a^m)^n = a^{m \times n}$
- When a power is under a root sign, the exponent is divided by the root → $\sqrt[m]{a^n} = a^{\frac{n}{m}}$
- Anything to the power of zero is one → $a^0 = 1$
- When a power has a negative exponent, the power is inverted (placed under 1) and the exponent becomes positive → $a^{-n} = \frac{1}{a^n}$

1.2 In the following equations, solve for *x* (to two decimal places where necessary) and write all the steps until the final answer.

a. $\mathbf{5^{3x} - 5^{3x-1} = 4}$

$\therefore 5^{3x}\,(1 - 5^{-1}) = 4$

$\therefore 5^{3x}(\frac{4}{5}) = 4$

$\therefore 5^{3x} = 5$

$\therefore 3x = 1$

$\therefore x = \frac{1}{3}$

b. $\mathbf{3^{x+1} \cdot 5 - 4 \cdot 3^{x+2} = -\frac{7}{3}}$

$\therefore 3^x\,(3.5 - 4.3^2) = -\frac{7}{3}$

$\therefore 3^x\,(-21) = -\frac{7}{3}$

$\therefore 3^x = \frac{1}{9}$

$\therefore 3^x = 3^{-2}$

$\therefore x = -2$

c. $\mathbf{3^{2-x} - 3^{-x-3} = \frac{242}{9}}$

$\therefore 3^{-x}\,(3^2 - 3^{-3}) = \frac{242}{9}$

$\therefore 3^{-x}\,(\frac{242}{27}) = \frac{242}{9}$

$\therefore 3^{-x} = 3$

$\therefore -x = 1$

d. $\mathbf{5^{2x+4} - 25^{x-1} = 78\,120}$

$\therefore 5^{2x+4} - 25^{x-1} = 78120$

$\therefore 5^{2x+4} - 5^{2x-2} = 78120$

$\therefore 5^{2x}\,(5^4 - 5^{-2}) = 78120$

$\therefore 5^{2x}\,(\frac{15624}{25}) = 78120$

$\therefore 5^{2x} = 125$

$\therefore 5^{2x} = 5^3 \quad \therefore x = \frac{3}{2}$

INVESTIGATION # 2

2.1 State the rules for **surds.**

- You may only add or subtract like terms e.g. $3\sqrt{a} + 4\sqrt{a} = 7\sqrt{a}$
- $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$ or vice versa
- $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$ or vice versa

2.2 When we simplify surds, we often leave a square-root or cube-root in the denominator. However, the calculator rationalizes the answer so that there is no surd in the denominator. With that said, rationalise and also solve for *x* in the following:

a. $\frac{3}{1-\sqrt{2}}$

$= \frac{3}{1-\sqrt{2}} \times \frac{1+\sqrt{2}}{1+\sqrt{2}}$

$= \frac{3+3\sqrt{2}}{1-2}$

$= -3 - 3\sqrt{2}$

b. $\sqrt[3]{4+x} = 3$

$\therefore (\sqrt[3]{4+x})^3 = (3)^3$

$\therefore 4 + x = 27$

$\therefore x = 23$

Check: $\sqrt[3]{4+23} = 3$

c. $\sqrt{3x^2} - \sqrt{12} = 0$

$\therefore (\sqrt{3x^2})^2 = (\sqrt{12})^2$

$\therefore 3x^2 = 12$

$\therefore x^2 = 4$

$\therefore x = \pm 2$

Check: $\sqrt{3(2)^2} = \sqrt{12}$

Check: $\sqrt{3(-2)^2} = \sqrt{12}$

d. $\sqrt{18} - x\sqrt{2} = \sqrt{32}$

$\therefore -x\sqrt{2} = \sqrt{32} - \sqrt{18}$

$\therefore -x\sqrt{2} = 4\sqrt{2} - 3\sqrt{2}$

$\therefore -x\sqrt{2} = \sqrt{2}$

$\therefore -x = 1$

$\therefore x = -1$

INVESTIGATION # 3

3.1 The solutions of a quadratic equation are given by $x = \frac{-2 \pm \sqrt{2m+5}}{7}$. For which value(s) of m will this equation have?

a) Two equal solutions?

$2m + 5 = 0$

$\therefore m = \frac{-5}{2}$

b) No real solutions

$2m + 5 < 0$

$\therefore m < \frac{-5}{2}$

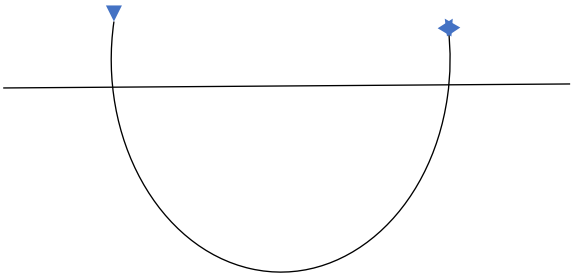
3.2 Show that K lies between -8 and 1 in the following inequality.

$k^2 + 7k \leq 8$

$\therefore k^2 + 7k - 8 \leq 0$

$\therefore (k + 8)(k - 1) \leq 0$

$-8 \leq k \leq 1$



TOTAL: [50]

