NCEA Level 1 · AS 91947: Mathematical Reasoning (Number & Algebra)

Name: _____ Date: _____

Kia ora! This standard is all about showing clear algebraic reasoning, solving equations, working with expressions, and generalising patterns. Work through each section in order, always writing out your steps, because in the exam your reasoning earns the marks, not just the final answer.

Revision summary

- Expanding: $a(b + c) = ab + ac$; $(x + p)(x + q) = x^2 + (p + q)x + pq$.
- Factorising: common factor first, then quadratics $x^2 + bx + c = (x + p)(x + q)$ where $p + q = b$ and $pq = c$. Difference of two squares: $a^2 - b^2 = (a + b)(a - b)$.
- Solving linear equations: do the same operation to both sides to isolate the variable. For quadratics, factorise and use the null factor law (if $AB = 0$ then $A = 0$ or $B = 0$).
- Simultaneous equations: use substitution or elimination to find the point that satisfies both equations.
- Exponent laws: $x^a \times x^b = x^{a+b}$; $x^a \div x^b = x^{a-b}$; $(x^a)^b = x^{ab}$; $x^0 = 1$; $x^{-a} = 1/x^a$.
- Inequalities: solve like equations, but reverse the sign (< becomes >) when multiplying or dividing by a negative.
- Proportional reasoning: set up equivalent ratios or a rate, then scale up or down.
- Generalising a linear pattern: term = (common difference) × n + (constant); always justify why the rule works from the structure of the pattern.

Key skills

1. Expand and simplify: $3(2x - 5) + 4x$.

2. Factorise fully: $x^2 + 7x + 12$.

3. Solve for x: $5x - 8 = 27$.

4. Simplify: $(2a^3)^2 \times a^4$.

Achieved

5. Aroha buys 3 iceblocks and a $2 juice at the Avondale dairy and pays $9.50. Write and solve an equation to find the price of one iceblock.

6. Solve the quadratic equation $x^2 - 5x - 14 = 0$.

7. Solve the inequality $4x + 3 \leq 19$ and describe the solution.

8. A recipe for 4 people needs 600 g of kūmara. How much kūmara is needed for 10 people?

Merit

9. A rectangle has length 3 cm more than its width. Its area is 40 cm². Set up and solve an equation to find the dimensions.

10. Solve the simultaneous equations $2x + y = 11$ and $3x - y = 4$, and explain what the solution represents.

11. Simplify the expression $(x^2 - 9) \div (x + 3)$, showing your reasoning.

Excellence

12. A pattern of square tiles grows so that stage 1 uses 4 tiles, stage 2 uses 7 tiles, stage 3 uses 10 tiles. Find a rule for the number of tiles at stage n, justify why it works, and determine which stage uses 100 tiles.

13. Prove that the sum of any three consecutive whole numbers is always a multiple of 3.

14. For what values of k does the equation $x^2 + kx + 9 = 0$ have exactly one solution? Justify your answer.