



D&D Resources Ltd
Mathematics Exam Preparation Made Easy

Algebraic Methods - 91261

Practice External Assessments 2

ALGEBRAIC METHODS

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NCEA 2 Maths

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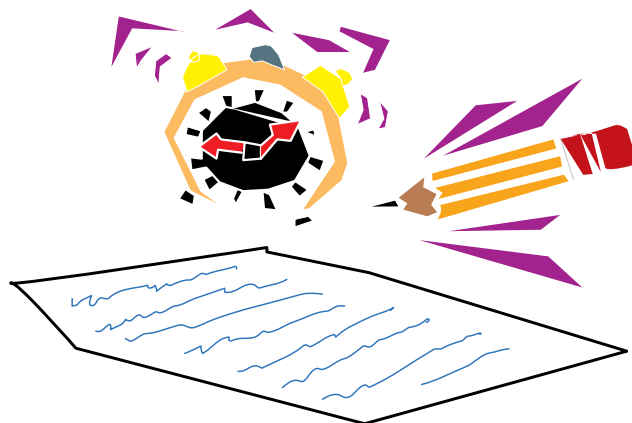
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The questions in the practice assessments are NOT in order of difficulty. Attempt all questions or you may not provide enough evidence to achieve the required standard.

Formulae for this standard are provided below.

Formulae

Quadratics

If $ax^2 + bx + c = 0$
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
and $\Delta = b^2 - 4ac$

Logarithms

If $y = b^x$ then $x = \log_b y$

$\log_b (x^n) = n \log_b x$

If $y = e^x$ then $x = \log_e y (= \ln y)$

Achievement Standard

91261

Apply algebraic methods in solving problems

Achievement	Achievement with Merit	Achievement with Excellence
Apply algebraic methods in solving problems.	Apply algebraic methods using relational thinking in solving problems.	Apply algebraic methods using extended abstract thinking in solving problems.

- ◆ This achievement standard is derived from Level 7 of The New Zealand Curriculum, Learning Media and is related to the achievement objectives:
 - ❖ manipulate rational, exponential, and logarithmic algebraic expressions
 - ❖ form and use linear and quadratic equations in the Mathematics strand of the Mathematics and Statistics Learning Area.
- ◆ Apply algebraic methods in solving problems involves:
 - ❖ selecting and using methods
 - ❖ demonstrating knowledge of algebraic concepts and terms
 - ❖ communicating using appropriate representations.
- ◆ Relational thinking involves one or more of:
 - ❖ selecting and carrying out a logical sequence of steps
 - ❖ connecting different concepts and representations
 - ❖ demonstrating understanding of concepts
 - ❖ forming and using a model;
 and also relating findings to a context, or communicating thinking using appropriate mathematical statements.
- ◆ Extended abstract thinking involves one or more of:
 - ❖ devising a strategy to investigate or solve a problem
 - ❖ identifying relevant concepts in context
 - ❖ developing a chain of logical reasoning, or proof
 - ❖ forming a generalisation;
 and also using correct mathematical statements, or communicating mathematical insight.
- ◆ Problems are situations that provide opportunities to apply knowledge or understanding of mathematical concepts and methods. Situations will be set in real-life or mathematical contexts.
- ◆ Methods include a selection from those related to:
 - ❖ manipulating algebraic expressions including rational expressions
 - ❖ manipulating expressions with exponents, including fractional and negative exponents
 - ❖ determining the nature of the roots of a quadratic equation
 - ❖ solving exponential equations (which may include manipulating logarithms)
 - ❖ forming and solving linear and quadratic equations.

You are advised to spend 60 minutes answering this assessment.

You should show ALL working and answer ALL parts of ALL questions.

QUESTION ONE

- (a) (i) Factorise $8x^2 + 10x - 3$.

- (ii) Give the quadratic equation which has roots that are twice those of the equation in part (i).

- (b) Make x the subject of the formula $A = (bx + c)^{2/3}$.

- (c) Solve the equation: $\frac{5x^2 - 20}{x^2 - 12x + 20} = x - 12$

- (e) (i) A parabola can be used to model the cross-section of a farm hayshed. The shed is 8.5 m wide and 5.6 m high.

Find the equation of the parabola.

- (ii) The hayshed is used to store round hay bales, which have a diameter of 1.2 m.

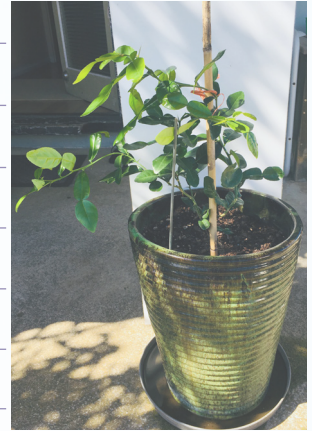
What is the largest number of hay bales that the farmer will be able to store along the front row of the floor of the hayshed?



+ $\frac{8}{x^2} = 0$. You must show algebraic work.

- (c) Solve the equation $3x^4 - 10x + \frac{8}{x^2} = 0$. You must show algebraic working.

- (e) A 42 cm deep glazed green patio pot is to be planted with a kaffir lime plant.
The cross section of the pot can be modelled by a function of the form $d(w) = kw(w-28)$, where k is a constant, d is the depth of the pot in cm and w is the width of the top in cm.
The plant to be potted is cylindrical in shape with a diameter of 19 cm and a height of 21 cm.
Will the plant be able to fit in the pot?



- (f) Write as a single fraction in its simplest form: $\frac{(ax+y)(ax-y) - (bx+y)(bx-y)}{(ax+y)(bx+y) - (ax-y)(bx-y)}$

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PEA 1

TWO				
(b)	$\frac{3a(x-b) + a(x+b) - 2ax}{x^2 - b^2}$ $= \frac{2ax - 2ab}{x^2 - b^2} = \frac{2a(x-b)}{(x-b)(x+b)}$ $= \frac{2a}{x+b}$	expression written as a single fraction and simplified.	expression partially factorised.	expression fully factorised.
(c) (i)	At $t = 0$, $A = 160 \div 0.8^{-1}$ $= 128^\circ\text{C}$	value of A found.		
(c) (ii)	$128 \times 0.8^{t-1} = 100$ $0.8^{t-1} = 0.78125$ $t - 1 = \frac{\log 0.78125}{\log 0.8}$ $t = 2.1$ mins	correct answer only or error in solving.	correctly solved equation to find t.	
(d)	$ax^2 + bx + c = mx$ $ax^2 + (b-m)x + c = 0$ To intersect at one point, $b^2 - 4ac = 0$. $(b-m)^2 - 4ac = 0$ $(b-m)^2 = 4ac$ $b-m = \pm 2\sqrt{ac}$ $m = b \pm 2\sqrt{ac}$	equations equated and rearranged to equal zero.	discriminant equated to zero with some progress towards finding an expression for m.	correct, logical setting out with expression for m found in terms of a, b and c.
THREE				
(a) (i)	$\log(x^3y^4)$	correct answer.		
(a) (ii)	$3^x = \sqrt{3}$ and $x = \frac{1}{2}$	correct solution.		
(b) (i)	$b^2 - 4ac = -15$ $-15 < 0$ so quadratic does not have real solutions therefore it does not cut the t axis.	discriminant found.	discriminant found with explanation.	
(b) (ii)	$d = (t - 1.5)^2 + 3.75$ The quad bike riders are at their minimum distance of 3.75 km from each other after 1.5 hours.	value of a or b found.	equation correct.	equation correct and clear explanation in context.
(c) (i)	at $t = 1$, $V = \$5.03$ at $t = 3$, $V = \$5.93$ Increase in value of \$0.90	values found for $t = 1$ and $t = 3$.	correct solution with working.	
(c) (ii)	$2.95 + 2\log_{10}(10t + 1) = 7$ $\log_{10}(10t + 1) = 2.025$ $10t + 1 = 10^{2.025}$ $t = \frac{10^{2.025} - 1}{10}$ $t = 10.49$. In the 11th year.		equation established and index statement given.	equation and problem solved.

Marking Schedule for Questions 1, 2 and 3

N1	N2	A3	A4	M5	M6	E7	E8
One partial solution	1 of A	2 of A	3 of A	1 of M	2 of M	1 of E with minor error(s)	1 of E