91261

2

SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 2 Mathematics and Statistics, 2012

91261 Apply algebraic methods in solving problems

2.00 pm Monday 19 November 2012
Credits: Four

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.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Show ALL working.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

You are required to show algebraic working in this paper. Guess and check methods do not demonstrate relational thinking. Guess and check methods will limit grades to Achievement.

Check that this booklet has pages 2–10 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

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You are advised to spend 60 minutes answering the questions in this booklet.

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QUESTION ONE

(a) Solve

(i) $\log x = 3\log 2$

(ii) $\log_5 x = 2$

(b) Tara's aunt invests $2000 for her when she is born.

The interest rate is 3.5% per year.

This rate does not change as long as the money stays invested.

The interest is added to the amount she has invested on her birthday each year.

The value of the investment after t years can be modelled by the equation

$$A = 2000 \times (1.035)^t$$

where the A is the value of the investment.

(i) How long would it take for the value of the investment to be $2250?

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(ii) Tara reaches her 18th birthday.

Calculate how much **extra** the investment will be worth if she leaves the money invested for another 3 years beyond her 18th birthday.

(iii) Tara is calculating $2000 \times 1.035^m (1.035^n - 1)$

With reference to the investment, explain what Tara is calculating.

(c) Solve $9^n - (6 \times 3^n) - 27 = 0$ and explain why it has only one real solution.

Hint: let $3^n = x$

QUESTION TWO

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(a) (i) Factorise $5x^2 - 9x - 2$

(ii) Solve $5x^2 - 9x - 2 = 0$

(b) Solve $\dfrac{x^2 + 5x + 2}{x + 2} = 3$

Show algebraic working.

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(c) Mark solves the equation $\frac{x^2 - 5x + 6}{x^2 + x - 6} = 4$

His working is shown below.

$x^2 - 5x + 6 = 4x^2 + 4x - 24$

$3x^2 + 9x - 30 = 0$

$3(x^2 + 3x - 10) = 0$

$3(x + 6)(x - 2) = 0$

$x = -6$ or $x = 2$

Is Mark's answer correct?

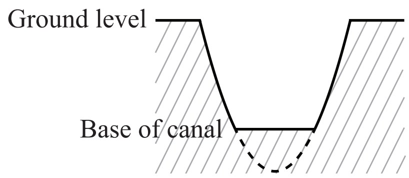
Fully justify your answer.

(d) Find the value of c if $\frac{x^2 + x - 6}{6x^2 + 4x + c} = \frac{x + 3}{2(3x + 8)}$

(e) The width of a canal at ground level is 16 m.

The **sides** of the canal can be modelled by a quadratic expression that would give a maximum depth of 16 m.

However, the base of the canal is **flat** and has a width of 12 m.



What is the actual depth of the canal?

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QUESTION THREE

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(a) Simplify

(i) $(x^5)^2(2x)^3$

(ii) $\left(8x^{\frac{1}{2}}\right)^{\frac{2}{3}}$

(iii) $\sqrt{\dfrac{\left(8x^{\frac{1}{2}}\right)^{\frac{2}{3}}}{x^{\frac{-1}{2}}}}$

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(b) (i) Mark is solving $(2x - 3)(x + 4) = 13$ by using the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Give the values of a, b and c and hence solve the equation.

(ii) The equation $(2x - 3)(x + 4) = k$ has only one real solution.

Find the value of k.

(c) Find the possible values of d if real solutions exist for $x^2 + 5x - 1 - d(x^2 + 1) = 0$.

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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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91261