2

SUPERVISOR'S USE ONLY

91261

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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
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Level 2 Mathematics and Statistics, 2017

91261 Apply algebraic methods in solving problems

2.00 p.m. Friday 24 November 2017
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.

Make sure that you have Formulae Sheet L2–MATHF.

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, and correct answer(s) only, will generally limit grades to Achievement.

Check that this booklet has pages 2–12 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.

Achievement

TOTAL 11

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QUESTION ONE

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(a) Simplify the following, leaving your answer with positive indices:

(i) $3(4x)^{-2}$

$\frac{3}{4x^2}$ //

(ii) $\left(\frac{16x^4}{x^6}\right)^{\frac{3}{2}}$

$64x^6$

$\frac{64x^6}{(x^6)^{\frac{2}{3}}}$ //

(b) Fully simplify the expression $\frac{2x^2-50}{9x^2-39x-30}$.

$\frac{(x+5)(x-5)}{(ax\ )(x\ )}$

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

$= \frac{-39 \pm \sqrt{39^2-4\times9\times30}}{2\times9}$

$x = -1,\ 3.333$ //

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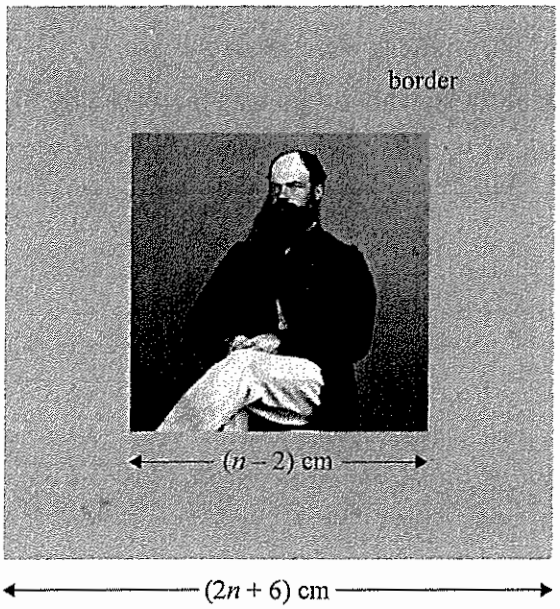
(c) David has mounted a square photo on a square piece of card as shown below.



The border around the photo is of constant width.

The photo has sides of length $(n - 2)$ cm while the card has sides of $(2n + 6)$ cm.

If the total area of the border is 200 cm^2, find the width of the border.

~~n – 2~~

$(2n+6)(2n+6) - (n-2)(n-2) = 200$

$4n^2 + 12n + 12n + 36 - n^2 - 2n - 2n - 4 - 200 = 0$

$4n^2 + 24n + 36 - n^2 - 4n - 4 - 200 = 0$

$3n^2 + 20n - 168 = 0$

$3n^2 + 20n + 32 = 200$

$n = 4.86, -11.525$

can not have -ve length

$2 \times 4.86 + 6 = 15.7176$ cm

~~15.72 cm~~

(d) A teacher has hired a school bus for $560 for a day trip with students.
The cost of hiring the bus is to be shared equally between the students.
At the last moment, three of the students were unable to go.
As a result, the cost to each of those who did go was increased by $1.50.

How many students finally went on the trip?
Justify your answer.

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$$\frac{560}{x-3} = C + 1.5$$

$$\frac{560}{x} = C$$

A3

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QUESTION TWO

(a) Solve the following equation for x:

$\log_2 x = 10$

$2^{10} = x$

$x = 1024$

(b) Solve the following equation for x:

$\log_x 49 = 2$

Justify your answer.

$x^2 = 49$ $7^2 = 49$

$\sqrt{49} = 7$

(c) Find the value of $\log_{\sqrt{5}}\left(\frac{1}{125}\right) = x$

$\left(\sqrt{5}\right)^x = \frac{1}{125}$ $x = -6$

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(d) A computer depreciates continuously in value from \$4699 to \$1500 over a period of 4.25 years.

The value, \$$y$, of the computer t years after its value was \$4699 can be modelled by a function of the form

$y = Ar^t$, where r is a constant.

Find the computer's value after six years.

$1500 = 4699(r)^{4.25}$

$\frac{1500}{4699} = 0.31922$

$\sqrt[4.25]{0.31922} = 0.7644$

$y = 4699(.7644)^6$

$= \$937.41$ after 6 years

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(e) Make p the subject of the formula:

$$81^{\left(\frac{px}{q}-3\right)} = 243$$

$\left(\frac{px}{q}-3\right)\sqrt{243} = 81$

$81^x = 243$

$x = 1.25$

$\left(\frac{px}{q}-3\right) = 1.25$

$\times q \quad (1.25+3) = p$

2

E7

QUESTION THREE

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(a) The quadratic equation $4x^2 + bx - 5 = 0$ has solutions $-\frac{1}{2}$ and $\frac{5}{2}$.

Find the value of b.

$$-\frac{1}{2} \& \frac{5}{2} = \frac{-b \pm \sqrt{b^2 - 4 \times 4 \times -5}}{2 \times 4}$$

$$\left(x + \frac{1}{2}\right)\left(x - \frac{5}{2}\right) = 0$$

(b) For what value(s) of m does the equation $6x^2 - mx = -3$ have two equal roots?

$$6x^2 - mx + 3 = 0$$

$$b^2 - 4ac$$

$$m^2 - 4 \times 6 \times 3$$

$$m^2 - 72$$

~~when $-m^2 = 4(6$~~

~~when $m^2 - 4 \times 6 \times -3$~~

(c) Find the value(s) for k for which the expression $kx^2 - 12x + 5k$ is always greater than zero.

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$kx^2 - 12x + 5k > 0$

$kx^2 - 12x + 5k = 0$

$kx^2 - 12x = -5k$

Question Three continues on the following page.

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(d) Write $\frac{9}{x^2-9}+\frac{3}{2x+6}$ as a single fraction in its simplest form.

$\frac{9}{x^2-9} + \frac{3}{2x+6}$

$\frac{(18x+54)+(3x^2-27)}{2x^3+6x^2-18x-54}$

$\frac{(18x+54)+(3x^2-27)}{8x^2-18x-54}$

(e) Find the value(s) of m for which the equation $2^{mx-3}=8^{x^2}$ has exactly one solution.

$2^{mx-3} = 8^{x^2}$

N1

Subject:	Mathematics	Standard:	91261	Total score:	11

Q	Grade score	Annotation
1	A3	1ai Has not squared the 4. 1aii Successfully found the power of 16. 1b Would have received 'u' for $2(x + 5)(x – 5)$. 1c Gains 'u' for partially setting up the quadratic equation.
2	E7	2c Converted to exponent form and then solved correctly. 2d Found r by taking the root and then successfully substituting. 2e Correct to second last line.
3	N1	3a Has failed to expand brackets to find b. 3b Has not shown $\Delta = 0$ for equal roots. 3d Has not simplified the numerator or found the lowest common denominator