SUPERVISOR'S USE ONLY

2

91261

912610

Draw a cross through the box (☒) if you have NOT written in this booklet

+

NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Mathematics and Statistics 2024

91261 Apply algebraic methods in solving problems

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.

Make sure that you have the Formulae Sheet L2–MATHF.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (⁄⁄⁄). This area will be cut off when the booklet is marked.

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

QUESTION ONE

(a) Write $x^2 + 8x - 5$ in the form $(x + p)^2 - q$.

(b) Find the discriminant of the quadratic equation $3x^2 + 2 = 5x$.

(c) Write as a single fraction $\frac{1}{t} + \frac{(t-5)}{t^2} - \frac{1}{3t}$.

(d) A cubic polynomial is given by $f(x) = 3x^3 + ax^2 + bx + c$, where a, b, and c are constants.

The graph of the polynomial has three roots, and cuts the x axis at -2, $\frac{1}{3}$, and 4.

Using your knowledge of roots, find the value of the constants.

(e) Show that $\dfrac{\left(x^{\frac{3}{2}}+x^{\frac{1}{2}}\right)\left(x^{\frac{1}{2}}-x^{\frac{-1}{2}}\right)}{\left(x^{\frac{3}{2}}-x^{\frac{1}{2}}\right)^2}$ can be simplified to $\dfrac{x+1}{x(x-1)}$.

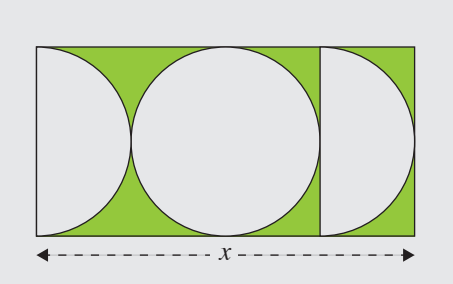
QUESTION TWO

(a) Solve $3x - 14 = \frac{5}{x}$.

(b) Simplify $\frac{\sqrt{9x^2 + 30x + 25}}{5x + 3x^2}$.

(c) Find the value of k for which the equation $\frac{x^2 - 2x}{4x - 1} = \frac{k - 1}{k + 1}$ has roots numerically equal but opposite signs (for example, 2 and –2).

(d) The logo for an IT company, *Doctor of Data*, is shown in the diagram to the right.



The green background of the logo is the shape of a rectangle with length x. The letters D, O, D are formed using semi-circles for both Ds and a circle for the O. Each has the same radius.

Area of a circle = πr^2.

(i) Find an expression in terms of x for the area of the circle in the middle of the logo (i.e. the letter 'O').

(ii) If the green background has an area of 10 cm^2, find the length of the rectangle.

QUESTION THREE

(a) Solve $x = \log_5 625$.

(b) Solve $9^{(2x+3)} = \left(\frac{1}{27}\right)^x$.

(c) If $\log_b x = 2$ and $\log_{3b} y = 2$, write y in terms of x.

Question Three continues on the next page.

(d) Consider the equation $3x^2 - 4kx + k^2 = 0$, where k is a constant.

Using the quadratic formula, find the fully simplified solutions to the quadratic equation in terms of k.

(e) The level of sound (intensity) is measured on a logarithmic scale using a unit called a decibel. The formula for the decibel level, d, is given by

$$d = 10\log_{10}\left(\frac{P}{P_0}\right)$$

where P is the intensity of the sound and P_0 is the weakest sound that the human ear can hear.

A cooling fan has a decibel level of 38 decibels. A heat pump has a decibel level of 30 decibels.

Show that the cooling fan sound intensity is more than six times that of the heat pump sound intensity.

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

QUESTION NUMBER

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

QUESTION NUMBER

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

QUESTION NUMBER