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See back cover for an English translation of this cover.

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Tuhia he (☒) ki te pouaka mēnā kāore koe i tuhi kōrero ki tēnei puka

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NZQA

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Te Pāngarau me te Tauanga, Kaupae 2, 2024

91261M Te whakamahi tikanga taurangi i te whakaoti rapanga

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te whakamahi tikanga taurangi i te whakaoti rapanga.	Te whakamahi tikanga taurangi i te whakaoti rapanga, mā te whai i te whakaaro ā-pānga.	Te whakamahi tikanga taurangi i te whakaoti rapanga, mā te whai i te whakaaro waitara e whānui ana.

Tirohia kia kitea ai e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOA kei roto i tēnei pukapuka.

Whakaaturia ngā whiriwhiringa KATOA.

Tirohia kia kitea ai kei a koe te Pepa Ture Tātai L2–MATHMF.

Ki te hiahia wāhi atu anō koe mō ō tuhinga, whakamahia ngā whārangi kei muri o tēnei pukapuka.

Tirohia kia kitea ai e tika ana te raupapa o ngā whārangi 2–19, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki tētahi wāhi e kitea ai te kauruku whakahāngai (✂✂✂). Ka poroa taua wāhanga ka mākahia ana te pukapuka.

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TE TŪMAHI TUATAHI

(a) Tuhia te whārite $x^2 + 8x - 5$ kia pēnei kē te āhua $(x + p)^2 - q$.

(b) Whiriwhiria te tātaritanga o te whārite pūrua o $3x^2 + 2 = 5x$.

(c) Tuhia te $\frac{1}{t} + \frac{(t-5)}{t^2} - \frac{1}{3t}$ hei hautanga kotahi.

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) E whakaataria ana tētahi pūrau pūtoru ki te whārite o $f(x) = 3x^3 + ax^2 + bx + c$, arā, he tau pūmau te a, te b, me te c.

E toru ngā pūtake o te kauwhata o te pūrau, ā, ka whakawhiti i te tuaka-x i -2, $\frac{1}{3}$, me te 4.

Mā te whakamahi i tō mōhio ki ngā pūtake, whiriwhiria te uara o ngā tau pūmau.

(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) Whakaaturia te taea o te whārite nei, $\dfrac{\left(x^{\frac{3}{2}}+x^{\frac{1}{2}}\right)\left(x^{\frac{1}{2}}-x^{\frac{-1}{2}}\right)}{\left(x^{\frac{3}{2}}-x^{\frac{1}{2}}\right)^2}$ te whakarūnā kia pēnei $\dfrac{x+1}{x(x-1)}$.

(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 $\dfrac{x+1}{x(x-1)}$.

TE TŪMAHI TUARUA

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

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

(c) Whiriwhiria te uara o k e rite ai ngā tau o te pūtake, engari e rerekē ai ngā tohu mō te whārite o $\frac{x^2-2x}{4x-1}=\frac{k-1}{k+1}$ (hei tauira, te 2 me te -2).

QUESTION TWO

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

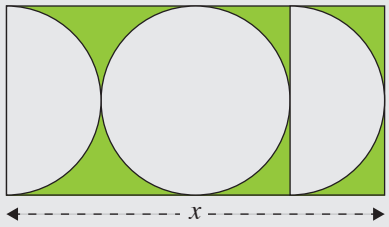
(b) Simplify $\frac{\sqrt{9x^2 + 30x + 25}}{5x + 3x^2}$.

(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) E whakaaturia ana i te hoahoa i te taha matau nei te waitohu o tētahi kamupene hangarau mōhiohio, o *Doctor of Data*.

He tapawhā roa te āhua o te horamuri kākāriki o te waitohu, ā, ko x te roa. E āhuatia ana te pū D, te O, me te D ki ngā porowhita haurua mō ngā pū D e rua, me tētahi porowhita mō te pū O. E ōrite ana te pūtoro o tēnā, o tēnā.

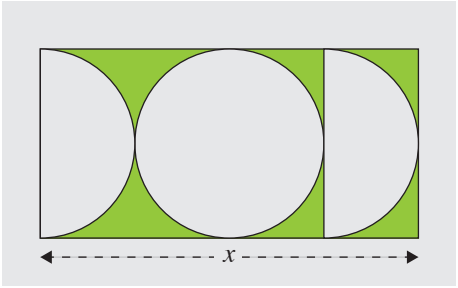
Ko te horahanga o tētahi porowhita = πr^2.



(i) Whiriwhiria he kīanga e ai ki te x mō te horahanga o te porowhita kei waenga pū o te waitohu (arā, te pū 'O').

(ii) Mēnā ko te 10 cm^2 te horahanga o te horamuri kākāriki, whiriwhiria te roa o te tapawhā roa.

(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.

TE TŪMAHI TUATORU

(a) Whakaotia te $x = \log_5 625$.

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

(c) Mēnā e pēnei ana: $\log_b x = 2$, ā, e pēnei ana hoki: $\log_{3b} y = 2$, tuhia te y e ai ki te x.

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.

(d) Whakaarotia te whārite o $3x^2 - 4kx + k^2 = 0$, arā, he tau pūmau te k.

Mā te whakamahi i te ture tātai pūrua, whiriwhiria ngā otinga, kua whakarūnā katoatia, o te whārite pūrua e ai ki te k.

E rere tonu ana te Tūmahi Tuatoru i te whārangi e whai ake ana.

(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.

Question Three continues on the next page.

(e) Ka inea te taumata o te oro (te kaha) ki tētahi āwhata pūkōaro mā te whakamahi i tētahi waeine e kīia nei he wae pāoro. Ko te ture tātai mō te taumata wae pāoro, mō d, e whakaataria ana ki te whārite o

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

arā, ko P te kaha o te oro, ā, ko P_0 te oro māriri katoa e taea ana e te taringa o te tangata te rongo.

Ko te 38 te taumata wae pāoro o te kōwhiuwhiu whakamātao. Ko te 30 te taumata wae pāoro o te pūrere whakamahana.

Whakaaturia e ono whakareanga te kaha ake o te oro o te kōwhiuwhiu whakamātao, tēnā i te kaha o te oro o te pūrere whakamahana.

(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.

He whārangi anō ki te hiahiatia.
Tuhia te tau tūmahi mēnā e hāngai ana.

TE TAU TŪMAHI

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

QUESTION NUMBER

English translation of the wording on the front cover

Level 2 Mathematics and Statistics 2024

91261M Apply algebraic methods in solving problems

Credits: Four

91261M

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–MATHMF.

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 2–19 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.