91261M

912615

2

SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Te Pāngarau me te Tauanga, Kaupae 2, 2016

91261M Te whakahāngai tūāhua taurangi hei whakaoti rapanga

9.30i te ata Rāpare 24 Whiringa-ā-rangi 2016
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakahāngai tūāhua taurangi hei whakaoti rapanga.	Te whakahāngai tūāhua taurangi mā te whakaaro whaipānga hei whakaoti rapanga.	Te whakahāngai tūāhua taurangi mā te whakaaro waitara hōhonu hei whakaoti rapanga.

Tirohia mēnā 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.

Tirohia mēnā kei a koe te Puka Tikanga Tātai L2–MATHMF.

Whakaaturia ngā mahinga KATOA.

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, whakamahia te (ngā) whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Me whakaatu e koe ngā mahinga taurangi i tēnei pepa. Mā te whakamahi anake i ngā tikanga o te kimikimi ka tirotiro me te whakatika ka herea te ākonga ki te taumata Paetae.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–19 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI

MĀ TE KAIMĀKA ANAKE

(a) Whakarūnāhia $\left(\frac{3b}{c^2}\right)^{-4}$ ka tuhi ai i te otinga kia tōrunga ngā taupū.

(b) Tuhi $x^2 - 8x + 10$ kia pēnei te āhua $(x - p)^2 + q$.

(c) (i) Me whakaatu ko ngā otinga o te whārite $x^2 + x - 56 = 0$ he whā whakareatanga ake o ngā otinga o te whārite $4x^2 + x - 14 = 0$.

(ii) Kimihia te pānga i waenga i ngā otinga o te whārite $dx^2 + ex + f = 0$ me ngā otinga o te whārite $x^2 + ex + df = 0$, ina ko d, e, me f he tau tūturu.

QUESTION ONE

ASSESSOR'S USE ONLY

(a) Simplify $\left(\frac{3b}{c^2}\right)^{-4}$ leaving your answer with positive indices.

(b) Write $x^2 - 8x + 10$ in the form $(x - p)^2 + q$.

(c) (i) Show that the solutions of the equation $x^2 + x - 56 = 0$ are four times the solutions of the equation $4x^2 + x - 14 = 0$.

(ii) Find the relationship between the solutions of the equation $dx^2 + ex + f = 0$ and the solutions of the equation $x^2 + ex + df = 0$, where d, e, and f are real numbers.

(d) Ko te wharite pūrua o te āhua $ax^2 + bx + c = 0$ he whai otinga $-\frac{1}{2}$ me $\frac{2}{3}$.

Kimihia he huinga uara e tāea ana mō a, b, me c.

MĀ TE KAIMĀKA ANAKE

(e) Kimihia te (ngā) uara tau tōpū tōrunga mō k kia whai ai te whārite pūrua $2x^2 + 4kx + (2k^2 + 3k - 11) = 0$ i ngā otinga **whakahau tūturu**.

Parahautia tō tuhinga.

ASSESSOR'S USE ONLY

(d) A quadratic equation of the form $ax^2 + bx + c = 0$ has solutions $-\frac{1}{2}$ and $\frac{2}{3}$.

Find a possible set of values for a, b, and c.

(e) Find positive integer value(s) for k so that the quadratic equation $2x^2 + 4kx + (2k^2 + 3k - 11) = 0$ has **real rational** solutions.

Justify your answer.

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) Kimihia te *discriminant* o te whārite pūrua $x^2 = 10x + 3$.

(b) Whakarūnāhia $\dfrac{4\log\left(u^3\right)}{\log u}$.

(c) Ka hokona mai e Maria he waka hou mō te $24 990.

Ka heke te uara o te waka i ia tau mā te 12%.

Ka tāea te whakatauira te uara o te waka, $\$P$, t tau i muri i tana hokotanga mai, mā te pānga o te āhua $P = A(r)^t$.

E hia te roa ka haurua te uara o te waka?

QUESTION TWO

ASSESSOR'S USE ONLY

(a) Find the discriminant of the quadratic equation $x^2 = 10x + 3$.

(b) Simplify $\dfrac{4\log\left(u^3\right)}{\log u}$.

(c) Marie buys a new car for \$24 990.

The car's value decreases continuously by 12% each year.

The value of the car, \$$P$, t years after she first bought it, can be modelled by a function of the form $P = A(r)^t$.

How long will it take for the value of the car to halve?

MĀ TE KAIMĀKA ANAKE

(d) (i) Whakaotihia te whārite $\log_8 x = \frac{2}{3}$.

(ii) Whakaotihia te whārite $6(\log_8 x)^2 + 2\log_8 x - 4 = 0$.

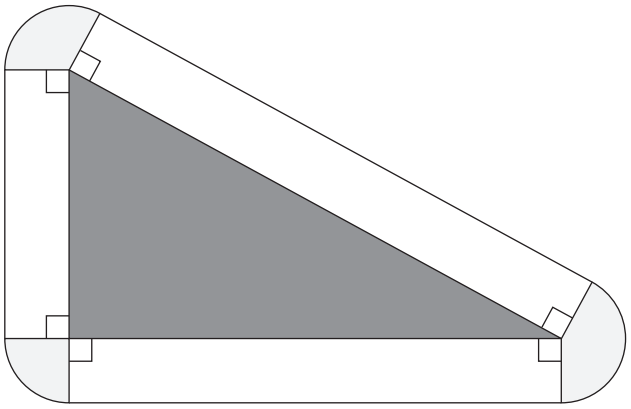
ASSESSOR'S USE ONLY

(d) (i) Solve the equation $\log_8 x = \frac{2}{3}$.

(ii) Solve the equation $6(\log_8 x)^2 + 2\log_8 x - 4 = 0$.

(e) E whakaatu ana te hoahoa i raro i tētahi māra tapatoru me tētahi ara e taiāwhio ana.

MĀ TE KAIMĀKA ANAKE



He taha ō te māra tapatoru me ngā roanga kei te ōwehenga 3:4:5.

He 1 m te whānui o te ara.

I ia kokona o te māra, he pewanga (wāhanga) te ara o tētahi porowhita me te pūtoro o te 1 m.

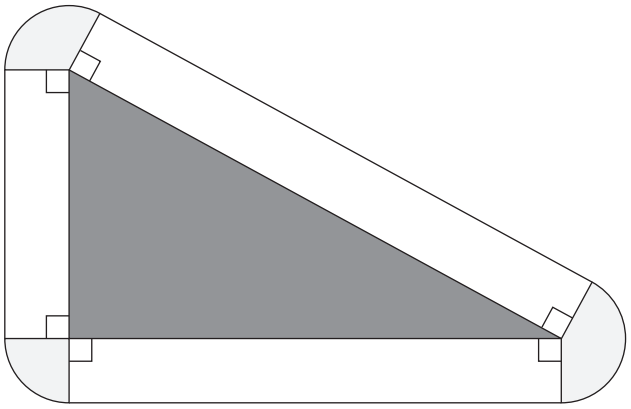
Ko te rerekētanga i waenga i te **rua whakareanga ake** o te horahanga **tapeke** o te ara me te horahanga o te māra he 2π m^2.

Kimihia te roa o te taha roa rawa o te māra.

(Horahanga o te porowhita = πr^2)

ASSESSOR'S USE ONLY

(e) The diagram below shows a triangular garden with a path around it.



The triangular garden has sides with lengths in the ratio 3:4:5.

The path is 1 m wide.

At each corner of the garden, the path is a sector (part) of a circle with a radius of 1 m.

The difference between **twice** the **total** area of the path and the area of the garden is 2π m^2.

Find the length of the longest side of the garden.

(Area of circle = πr^2)

TŪMAHI TUATORU

MĀ TE KAIMĀKA ANAKE

(a) Ki hea tapahi ai te kauwhata o $y = 12x^2 - x - 6$ i te tuaka x?

(b) Mō (t)ēhea uara o x ko $\log_x(216) = 3$?

(c) Hurinahatia te whārite e whai ake kia noho ko x te kaupapa: $\frac{4x}{5} = \frac{y(x+3)}{2}$.

Ka haere tonu te Tūmahi Tuatoru i te whārangi 14.

QUESTION THREE

ASSESSOR'S USE ONLY

(a) Where would the graph of $y = 12x^2 - x - 6$ cut the x-axis?

(b) For what value(s) of x does $\log_x(216) = 3$?

(c) Rearrange the following formula to make x the subject: $\frac{4x}{5} = \frac{y(x+3)}{2}$.

Question Three continues on page 15.

MĀ TE KAIMĀKA ANAKE

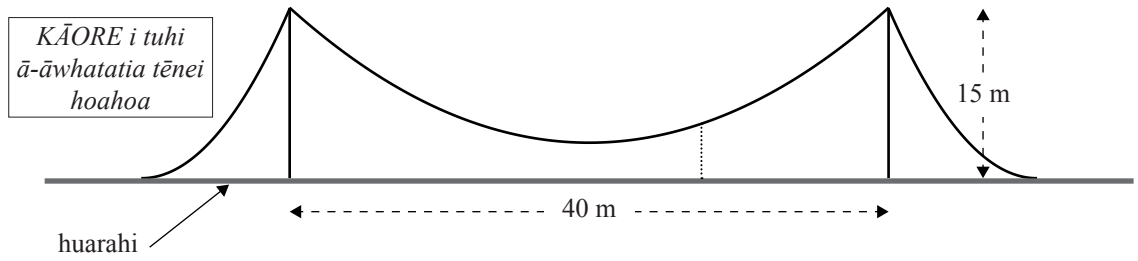
(d) Whakaotihia te whārite $9^{8n+6} = 27^{n^2-1} \times 3^{1-3n}$.

(e) He unahi te āhua o te taura o waenga o tētahi piriti hangarite, e ai ki te hoahoa i raro.

Ko ngā pourewa e toko ana i te taura he 15 m te teitei me te 40 m te tawhiti tētahi i tētahi.

I te pūwāhi o waenga i waenganui i ngā pourewa, ko te teitei o te taura i runga ake i te huarahi he 3 m.

Ka whakatūhia he pou poutū (kua tuhia ā-ira ki te hoahoa) ki te 10 m mai i te pokapū o te piriti, ā, ka pā atu ki te taura.



(i) Whakamahia te taurangi hei whakaatu he 6 m te teitei o te pou.

ASSESSOR'S USE ONLY

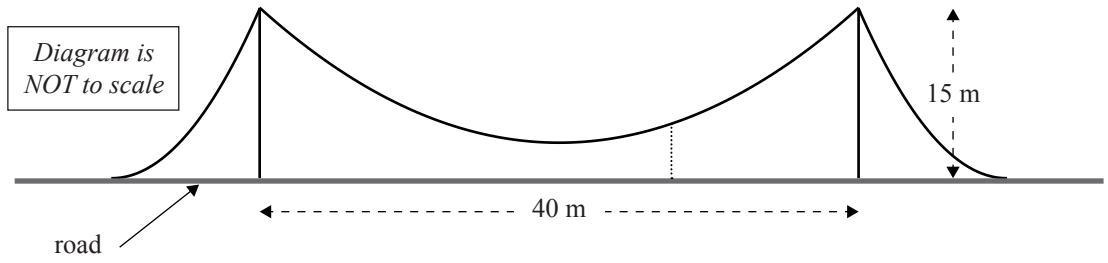
(d) Solve the equation $9^{8n+6} = 27^{n^2-1} \times 3^{1-3n}$.

(e) A symmetrical bridge has its central cable in the shape of a parabola, as shown in the diagram below.

The towers supporting the cable are each 15 m high and 40 m apart.

At the point midway between the towers, the height of the cable above the road is 3 m.

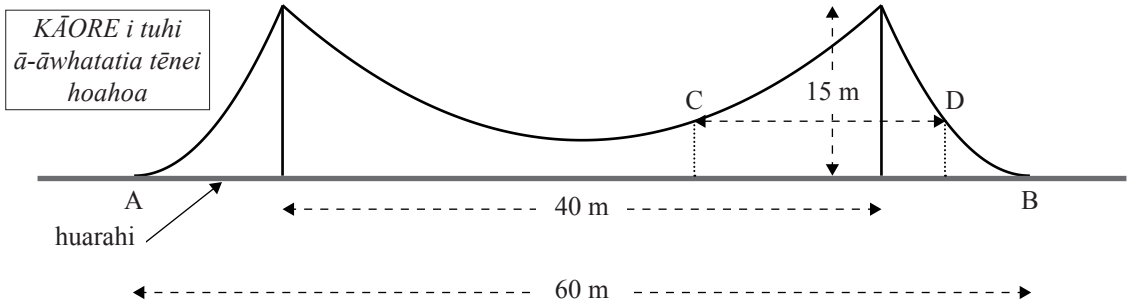
A vertical post (shown dotted in the diagram) is placed 10 m from the centre of the bridge and just touches the cable.



(i) Use algebra to show that the post is 6 m high.

(ii) E 60 m te roa AB o te piriti.

He unahi me te hangarite te āhua o ngā taura o waho, ā, ka pā ki te huarahi i ngā akitu A me B.



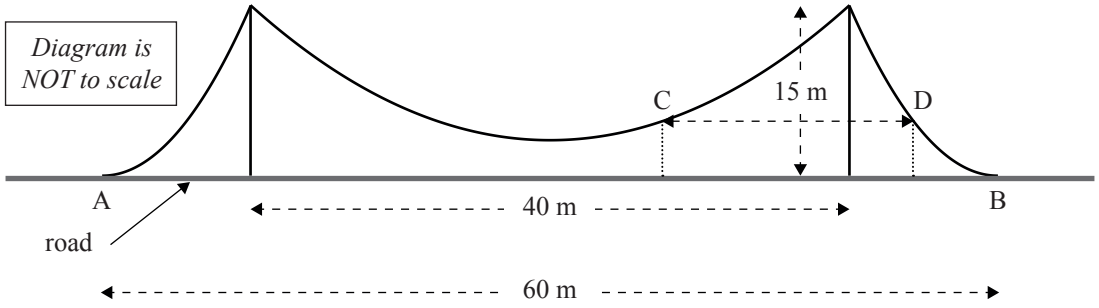
Kimihia te tawhiti, CD, i waenga i ngā unahi e rua i te 6 m te teitei i runga ake o te huarahi (e whakaaturia ana te tawhiti CD i roto i te hoahoa).

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(ii) The length of the bridge AB is 60 m.

The outside cables are also parabolic and symmetrical in shape, and touch the road at their vertices A and B.



Find the distance, CD, between the two parabolas at a height of 6 m above the road (the distance CD is shown in the diagram).

He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

MĀ TE KAIMĀKA ANAKE

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

English translation of the wording on the front cover

Level 2 Mathematics and Statistics, 2016

91261 Apply algebraic methods in solving problems

9.30 a.m. Thursday 24 November 2016
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.

Make sure that you have Formulae Sheet L2–MATHMF.

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 2–19 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.