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91261M

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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, 2019

91261M Te whakahāngai tūāhua taurangi hei whakaoti rapanga

9.30 i te ata Rāpare 21 Whiringa-ā-rangi 2019
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 Pukapuka Tikanga Tātai L2–MATHMF.

Whakaaturia ngā mahinga KATOA.

Mēnā ka hiahia whārangi atu anō mō ō tuhinga, whakamahia te wāhi wātea kei muri o tēnei pukapuka.

Me whakaatu e koe ngā mahinga taurangi i tēnei pepa. Ko te tikanga, mā te whakamahi i ngā tikanga o te "kimikimi ka tirotiro i muri mai" me "te whakautu tika noa iho" ka herea te ākonga ki te taumata Paetae.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–23 kei roto i tēnei pukapuka, ā, 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

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI

(a) Whakaotia ia whārite e whai ake nei:

(i) $3x^2 - 6 = 7x$

(ii) $\frac{3}{x^2} + \frac{4}{x} = 5$

(b) Whakamahia ai tētahi rongoā hei whakaiti i te nui o te ngakototo i roto i te toto. Mō tētahi horopeta o ia rā o te rongoā, ko te rahinga ngakototo C i roto i te toto i te *t* marama mai i te horopeta tuatahi ka taea te whakatauira mā te pānga

$$C = 0.02t^2 - 0.6t + k,$$

ina ko *k* te rahinga ngakototo tuatahi, ā, whai mana anake te pānga mō ngā marama 15 tuatahi anake.

Ka whāngaia te rongoā ki tētahi tangata ko tana rahinga ngakototo tuatahi he 9.18.

E hia te roa e heke ai te rahinga ngakototo o te tangata ki te 5.05?

ASSESSOR'S USE ONLY

QUESTION ONE

(a) Solve each of the following equations:

(i) $3x^2 - 6 = 7x$

(ii) $\frac{3}{x^2} + \frac{4}{x} = 5$

(b) A drug is used to reduce the level of cholesterol in the blood. For a daily dose of the drug, the cholesterol level C in the blood t months after taking the first dose may be modelled by the function

$$C = 0.02t^2 - 0.6t + k,$$

where k is the initial cholesterol level and the function is valid for the first 15 months only.

A person with an initial cholesterol level of 9.18 is given the drug.

How long will it take the person's cholesterol level to reduce to 5.05?

(c) Ka taea te pūrau $p(x) = (2m - 1)x^2 + (m + 1)x + (m - 4)$ te tuhi hei **pūrua tautika**.

Kimihia te (ngā) uara o m.

(d) Mā te whakatauwehe, kimihia tētahi kīanga e ai ki a p mō te rerekētanga i waenga i ngā pūtāke o te whārite $(px)^2 + 4px - 12 = 0$.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(c) The polynomial $p(x) = (2m - 1)x^2 + (m + 1)x + (m - 4)$ can be written as a **perfect square**.

Find the value(s) of m.

(d) By factorising, find an expression in terms of p for the difference between the roots of the equation $(px)^2 + 4px - 12 = 0$.

(e) Whakamahia te taurangi ki te whakaatu ko te kauwhata o te pānga $y = (x - a)(x - b) - c^2$, ina ko $c \neq 0$, ka whiti i te tuaka-x i ngā pūwāhi wehe kē e rua.

MĀ TE KAIMĀKA ANAKE

(e) Use algebra to show that the graph of the function $y = (x - a)(x - b) - c^2$, where $c \neq 0$, crosses the x-axis at two distinct points.

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MĀ TE KAIMĀKA ANAKE

TŪMAHI TUARUA

(a) Whakarūnā katoatia, ka tuhi ai i ngā otinga kia tōrunga ngā taupū:

(i) $(9a^2b^{-4})^{0.5}$

(ii) $\left(\frac{2a}{3b^4}\right)^{-2}$

(b) Tuhia $\frac{2c+1}{c^2-9} + \frac{c-2}{c^2-4c+3}$ hei hautanga kotahi ki tōna āhua rūnā rawa atu.

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QUESTION TWO

(a) Simplify fully, leaving your answers with positive indices:

(i) $(9a^2b^{-4})^{0.5}$

(ii) $\left(\frac{2a}{3b^4}\right)^{-2}$

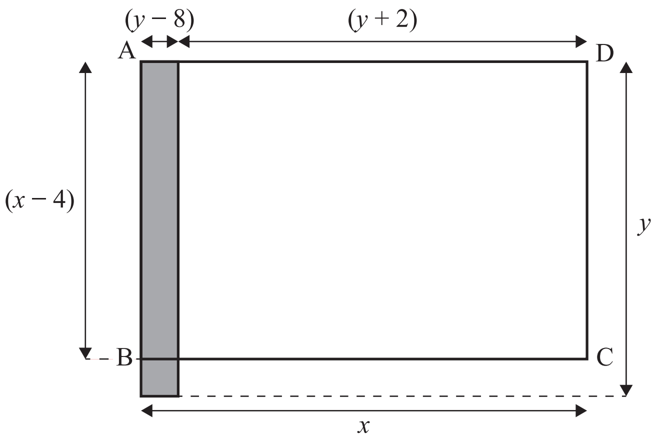
(b) Write $\frac{2c+1}{c^2-9}+\frac{c-2}{c^2-4c+3}$ as a single fraction in its simplest form.

MĀ TE KAIMĀKA ANAKE

(c) Whakatauwehe katoatia $fm - 6gn + 3fn - 2gm$.

(d) E wehea ana te hanga i raro ki ngā tapawhā hāngai. Kua tuhia ngā roa katoa ki te cm.

Kua whakaahuahia tēnei rārangi, mai tērā i whakamahia i roto i te whakamātautau.



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

Ko te horahanga o te tapawhā hāngai kua kaurukutia he 9 cm^2.

Kimihia te horahanga o te tapawhā hāngai ABCD.

ASSESSOR'S USE ONLY

(c) Factorise fully $fm - 6gn + 3fn - 2gm$.

(d) The shape below is divided into rectangles. All measurements are in cm.

This diagram has been corrected from that used in the examination.

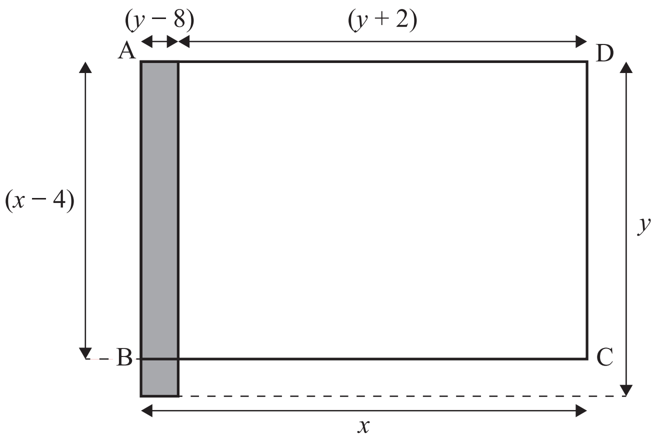


Diagram is NOT to scale

The shaded rectangle has an area of 9 cm^2.

Find the area of the rectangle ABCD.

(e) Ko tētahi pūtake o te whārite $x^2 + px + q = 0$ ko te n whakarea ki tērā atu, ina ko $n \neq 0$.

Me whakaatu ko $qn^2 + (2q - p^2)n + q = 0$.

MĀ TE KAIMĀKA ANAKE

(e) One root of the equation $x^2 + px + q = 0$ is n times the other, where $n \neq 0$.

Show that $qn^2 + (2q - p^2)n + q = 0$.

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MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATORU

(a) Whiriwhiria te uara o m mēnā ko $\log_5 m - 3 = 0$

(b) Me tuhi hei taupū kōaro kotahi: $\log 6 - 2\log y$

(c) Whakarūnā katoatia $\dfrac{3^{2n-1} + 3^{2n+1}}{3^{2n} - 9^{n-2}}$

ASSESSOR'S USE ONLY

QUESTION THREE

(a) Find the value of m if $\log_5 m - 3 = 0$

(b) Write as a single logarithm: $\log 6 - 2\log y$

(c) Fully simplify $\dfrac{3^{2n-1} + 3^{2n+1}}{3^{2n} - 9^{n-2}}$

MĀ TE KAIMĀKA ANAKE

(d) (i) Kei te tino piki haere te maha o ngā tāngata N e pāngia ana e tētahi huaketo kapo i te pāpātanga aumou o te 5.3% i ia wiki whai muri i te whakataunga tuatahi o te huaketo.

Mēnā ko N_0 te maha o ngā tāngata kua whakatauhia kei te pāngia e te huaketo, i ngā wiki e t whai muri i te whakataunga tuatahi i te huaketo, ka taea a N te whakatauira mā te pānga $N = N_0\,(1.053)^t$.

E hia te roa ka tōtoru te maha o ngā tāngata ka whakatauhia kei te pāngia e te huaketo ki te maha o ngā tāngata i whakatauhia i te tuatahi?

(ii) Ka tino piki rawa atu anō te maha o ngā tāngata N e pāngia ana e tētahi huaketo kē i te pāpātanga aumou o te r % i ia wiki. 2500 ngā tāngata i whakatauhia i te tuatahi kua pāngia e tēnei huaketo. Whai muri i te 10 wiki, ko te maha o ngā tāngata e pāngia ana e tēnei huaketo kua piki ki te 4250.

Whiriwhiria a r, ko te whakaaro kei te hāngai tonu te momo tauira kei te wāhanga (i).

Ka haere tonu te Tūmahi 3 i te whārangi 18 ➤

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(d) (i) The number of people N suffering from a contagious virus increases exponentially at a constant rate of 5.3% each week after the virus was initially diagnosed.

If N_0 is the number of people initially diagnosed with the virus, then t weeks after the virus was initially diagnosed, N can be modelled by the function $N = N_0\,(1.053)^t$.

How long will it take for the number of people diagnosed with the virus to be three times the number initially diagnosed?

(ii) The number of people N suffering from a different virus also increases exponentially at a constant rate of r % each week. 2500 people were initially diagnosed with this virus. After 10 weeks, the number of people suffering from this virus had increased to 4250.

Find r, assuming the form of model in part (i) still applies.

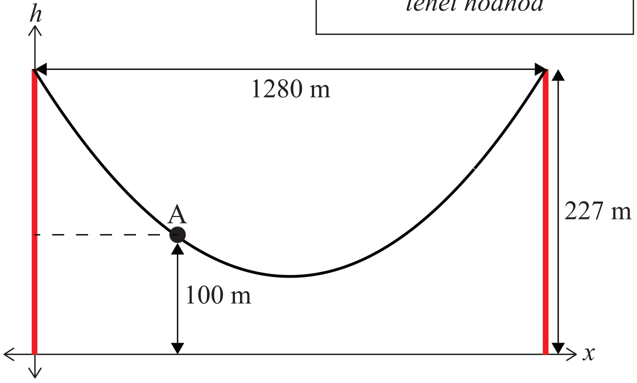
Question 3 continues on page 19 ➤

(e) E rua ngā pourewa o te Golden Gate Bridge i San Francisco.

Ko te teitei h ā-mita o ngā taura whakatārewa i runga ake i te pae wai toharite, i te tawhiti huapae o te x mita mai i te take o te pourewa mauī, ka taea te whakatauira mā te pānga $h = k(x - 640)^2 + 67$.

I te wāhi weherua i waenga i ngā pourewa e rua, e 67 mita ngā taura whakatārewa i runga ake i te pae wai toharite. Ko te tawhiti i waenga i ngā pourewa he 1280 mita, ā, ko ngā pourewa he 227 mita te teitei, ka inea mai i te pae wai toharite.

KĀORE i tuhi ā-āwhatatia tēnei hoahoa



Rich Niewiroski Jr (https://commons.wikimedia.org/wiki/File:GoldenGateBridge-001.jpg), CC BY 2.5.

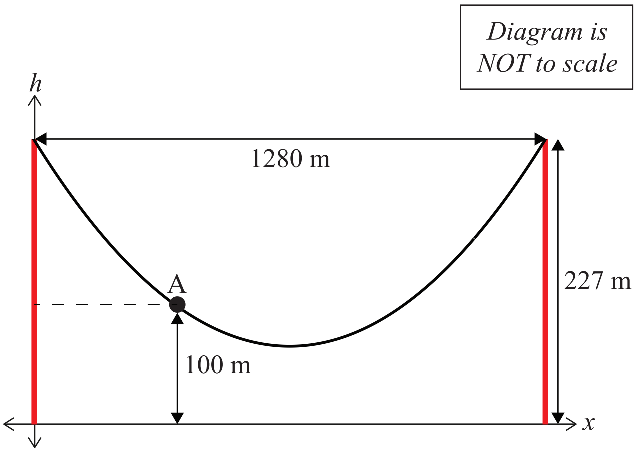
Ka whakatūhia tētahi inehau (e whakaaturia ana ko A i te hoahoa i te taha mauī o runga) i runga o te taura hei ine i te tere o te hau i te teitei o te 100 mita i runga ake o te pae wai toharite.

Whiriwhiria te tawhiti huapae o te inehau mai i te pourewa mauī.

(e) The Golden Gate Bridge in San Francisco has two towers.

The height h in metres of the suspension cables above the mean water level, at a horizontal distance x metres from the base of the left tower, can be modelled by the function $h = k(x - 640)^2 + 67$.

At the mid-point between the two towers, the suspension cables are 67 metres above the mean water level. The distance between the towers is 1280 metres and the towers are 227 metres tall, measured from the mean water level.



Rich Niewiroski Jr (https://commons.wikimedia.org/wiki/File:GoldenGateBridge-001.jpg), CC BY 2.5.

An anemometer (shown as A in the left-hand diagram above) to measure wind speed is placed on a cable at a height of 100 metres above the mean water level.

Find the horizontal distance of the anemometer from the left tower.

ASSESSOR'S USE ONLY

MĀ TE KAIMĀKA ANAKE

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

TAU TŪMAHI

MĀ TE KAIMĀKA ANAKE

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

QUESTION NUMBER

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English translation of the wording on the front cover

Level 2 Mathematics and Statistics, 2019

91261 Apply algebraic methods in solving problems

9.30 a.m. Thursday 21 November 2019
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 Booklet L2–MATHMF.

Show ALL working.

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

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 2–23 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.