91028M

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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!

Tohua tēnei pouaka mēnā kāore he tuhituhi i roto i tēnei pukapuka

Te Pāngarau me te Tauanga, Kaupae 1, 2020

91028M Te tūhura i ngā pānga i waenganui i ngā papatau, ngā whārite me ngā kauwhata

9.30 i te ata Rāmere 20 Whiringa-ā-rangi 2020
Ngā whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te tūhura i ngā pānga i waenganui i ngā papatau, ngā whārite me ngā kauwhata.	Te tūhura i ngā pānga i waenganui i ngā papatau, ngā whārite me ngā kauwhata mā te whakaaro whaipānga.	Te tūhura i ngā pānga i waenganui i ngā papatau, ngā whārite me ngā kauwhata mā te whakaaro waitara hōhonu.

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.

Whakaaturia ngā mahinga KATOA.

He tukutuku kei ētahi whārangi. He wāhi mahinga tēnei māu mō te tātuhi kauwhata, hoahoa rānei, te hanga papatau, te tuhi whārite, te tuhi rānei i tō tuhinga

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

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2-35 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.

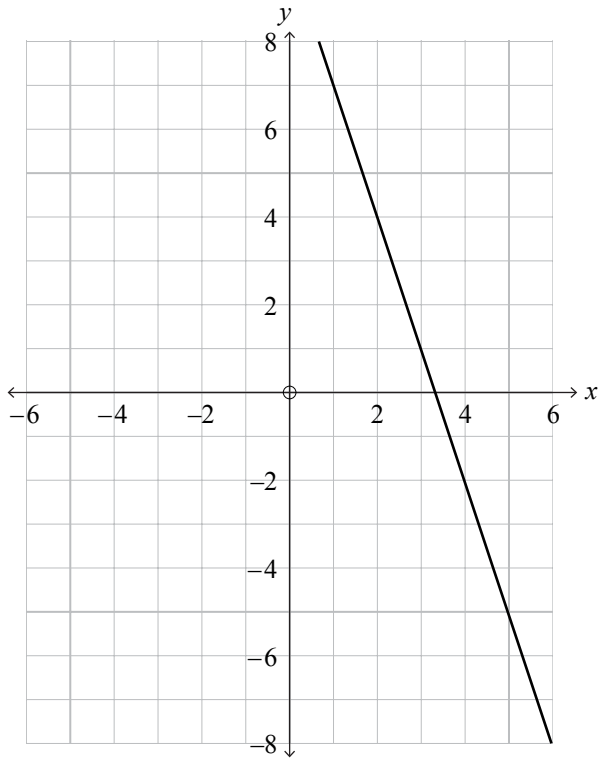
TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI

MĀ TE KAIMĀKA ANAKE

(a) Tuhia te whārite mō te kauwhata e whakaaturia ana i raro nei.



Whārite: _____

(b) Kei te whakarite ētahi hoa tokotoru – a Anaru, Bahman, me Cael – ki te penapena moni. He rerekē te mahere penapena a tēnā, a tēnā. Kei te hiahia rātou ki te whakataurite e hia te nui ka penapenatia e rātou i roto i te 9 tau nei.

Kāore e tangohia e ngā hoa nei he moni mai i ā rātou mahere penapena i roto i taua wā.

(i) Ka raua e Anaru he rahinga moni ki te pūtea pēke i te tīmatanga o tana mahere penapena. Ka whiwhi huamoni pūrua ia mai i tēnei rahinga i te mutunga o ia tau.

Ka taea te mahere a Anaru te whakaatu mā te $S = 50 \times 1.3^t$

ina ko S te rahinga o ngā penapena (ā-tara $)

ko te t te maha o ngā tau mai i te tīmatanga o te mahere penapena.

E hia te nui o te moni i raua atu e Anaru ki tana mahere penapena i te tīmatanga?

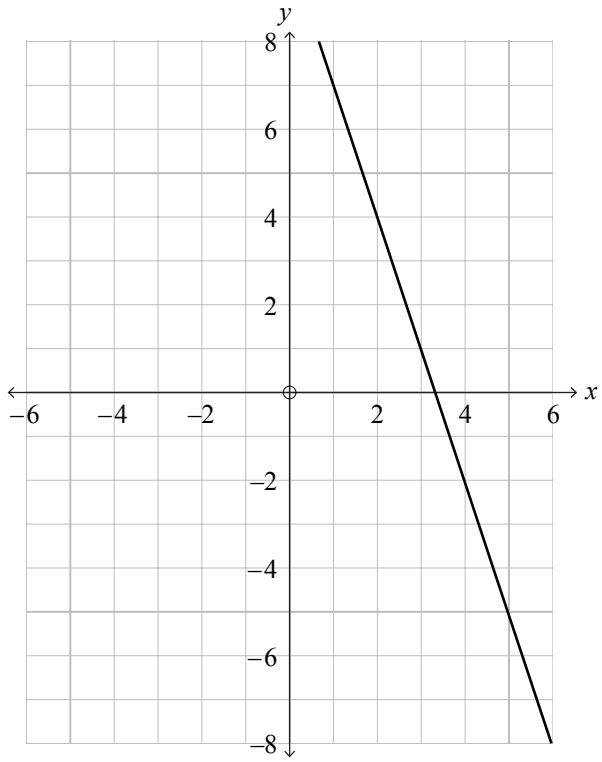
_____

_____

QUESTION ONE

ASSESSOR'S USE ONLY

(a) Give the equation of the graph shown below.



Equation: _____

(b) Three friends – Anaru, Bahman, and Cael – are about to start saving. Each friend has a different savings plan. They want to compare how much they will save over the next 9 years.

None of the friends will withdraw any money from their savings plans at any stage.

(i) Anaru puts an amount of money into a bank account at the start of his savings plan. His money will gain compound interest on this amount at the end of each year.

Anaru's plan can be represented by $S = 50 \times 1.3^t$

where S is the amount of savings (in dollars $)

and t is the number of years since the savings plan started.

How much money did Anaru put into his saving plan at the start?

_____

_____

(ii) Kāore a Bahman i te hiahia ki te whakamahi i tētahi pēke, nō reira ko tana mahere he putu i āna moni ki tētahi pouaka hū huna. Ka raua e ia he $50 ki te pouaka hū i te tīmatanga o tana mahere penapena. Kāore a Bahman e whiwhi huamoni, engari ka raua e ia he $40 ki te pouaka hū i te mutunga o ia tau.

Tuhia te whārite e whakaatu ana i te mahere penapena a Bahman.

(iii) E whakaaturia ana ngā taipitopito o te mahere penapena a Cael i te tūtohi i raro.

He $100 tonu kei roto i te pūtea pēke a Cael ina tīmata ngā hoa ki te whakataurite.

Mutunga o te tau (*t*)	**Rahinga penapena tapeke $ (*S*)**
1	110
2	121
3	133.10
4	
5	
6	
7	
8	
9	

Tuhia te whārite e whakaatu ana i te mahere penapena a Cael.

ASSESSOR'S USE ONLY

(ii) Bahman does not want to use a bank, and instead plans to keep his money in a well-hidden shoebox. He puts $50 into the shoebox at the start of his savings plan. Bahman will not receive any interest, but he will put an extra $40 into the shoebox at the end of each year.

Write the equation that represents Bahman's savings plan.

(iii) The details of Cael's savings plan are shown in the table below.

Cael already has $100 in his bank account when the friends start their comparisons.

End of year (t)	**Total savings amount in $ (S)**
1	110
2	121
3	133.10
4	
5	
6	
7	
8	
9	

Write the equation that represents Cael's savings plan.

(iv) Ka tīmata anō tētahi atu hoa, a Deli, ki te penapena ki tētahi pūtea pēke. E whakaatu ana te kauwhata kei te whārangi whai ake i te mahere penapena a Deli.

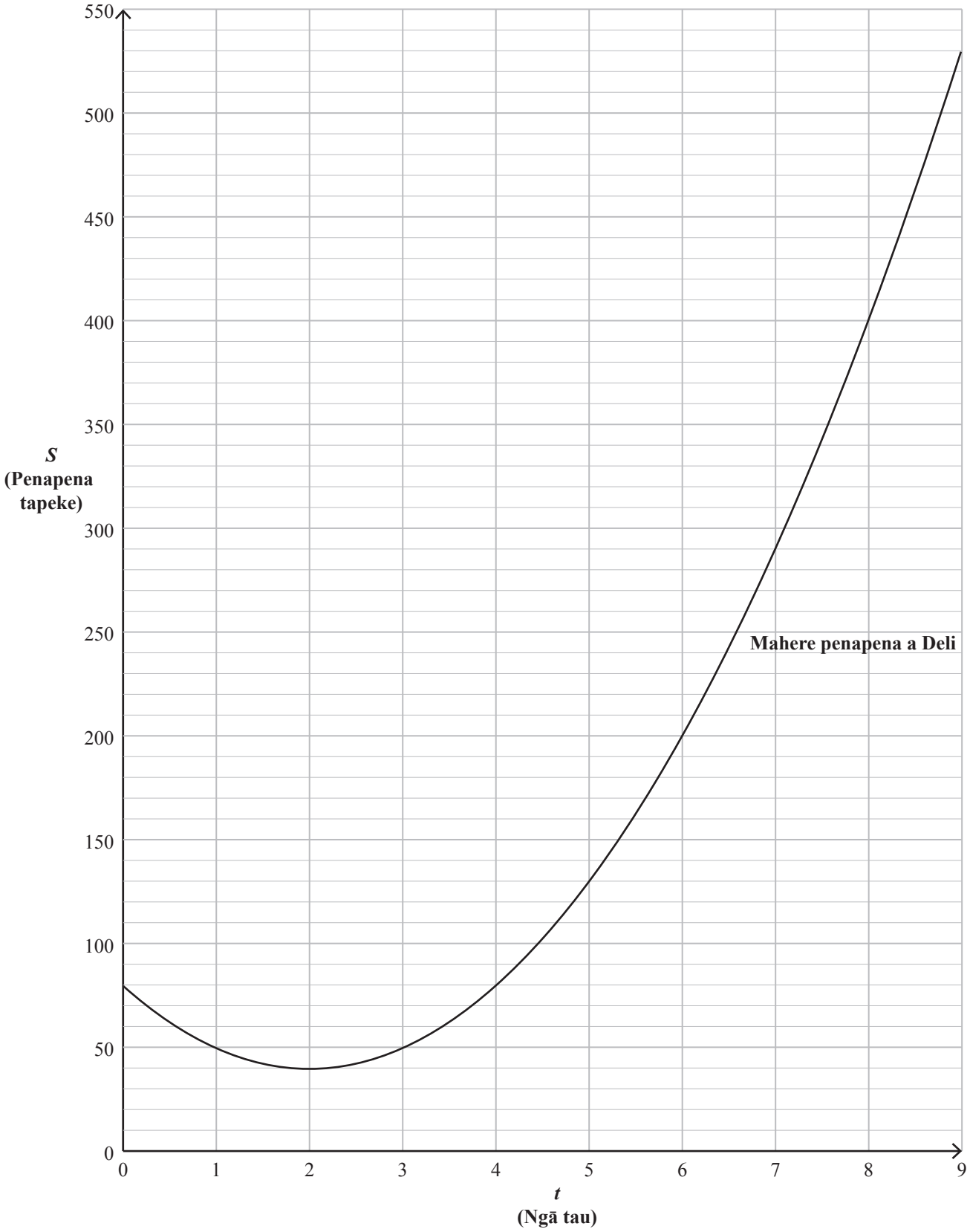
Ko te whārite mō te mahere penapena a Deli he $S = 10(t - 2)^2 + 40$.

Mā te whakamahi papatau, ngā whārite, ME ngā kauwhata, whakatauritea ngā rahinga kua penapenatia e Anaru, Cael me Deli (arā, ko ngā hoa anake kei te whakamahi i tētahi pēke hei penapena) i ngā tūmomo wāhanga o te 9 tau.

(Me kī he kauwhata motukore ngā kauwhata katoa o tēnei tūmahi.)

MĀ TE KAIMĀKA ANAKE

MĀ TE KAIMĀKA ANAKE



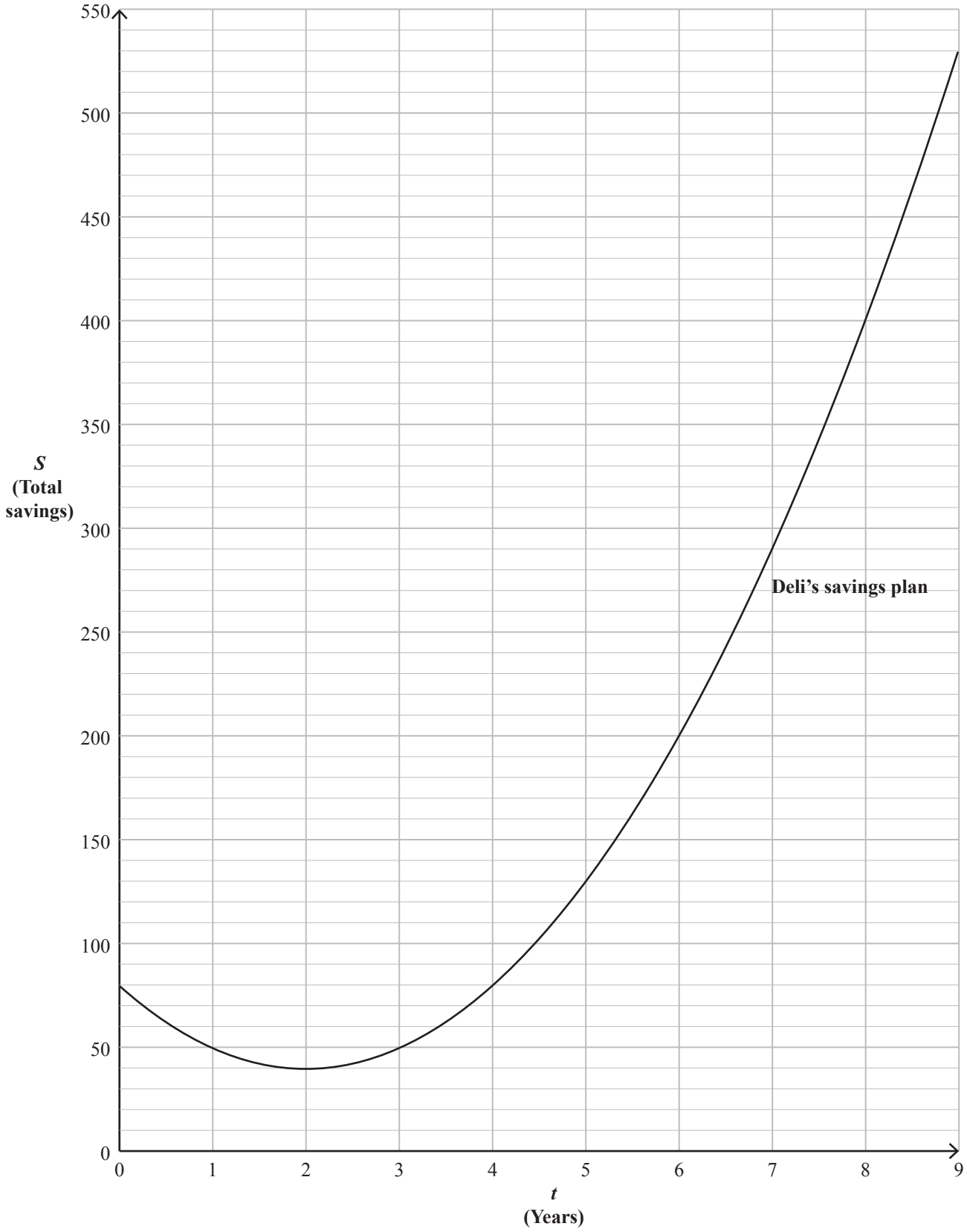
ASSESSOR'S USE ONLY

(iv) A fourth friend, Deli, also decides to start saving into a bank account. The graph on the next page shows Deli's savings plan.

The equation for Deli's savings plan is $S = 10(t - 2)^2 + 40$.

Using tables, equations, AND graphs, compare the amounts saved by Anaru, Cael, and Deli (i.e. only the friends who are using a bank to save) at various stages during the 9 years.

(All graphs in this question can be considered to be continuous graphs.)

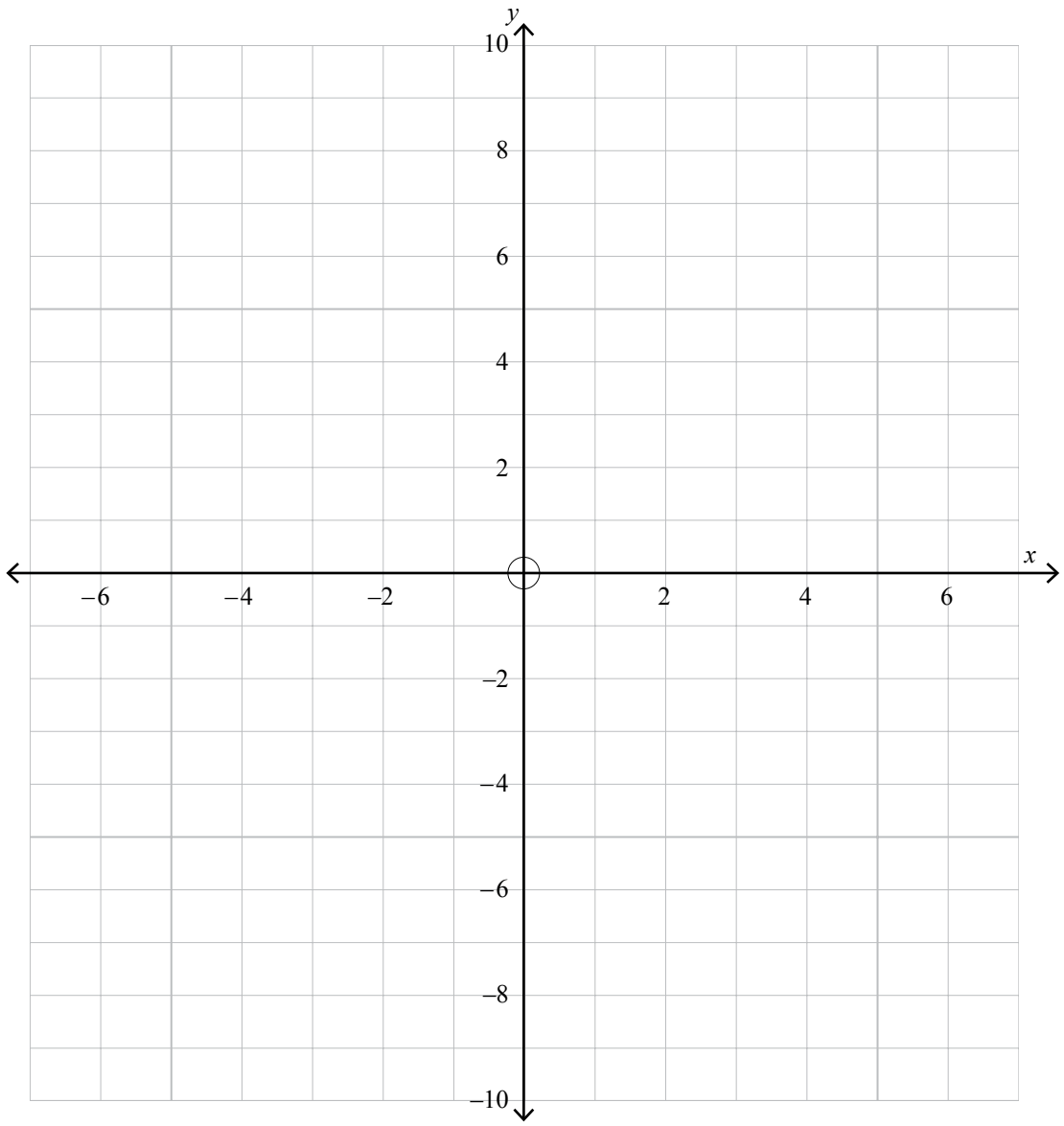


ASSESSOR'S USE ONLY

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) Mā te whakamahi i ngā tuaka kei raro, tuhia te kauwhata o $y = x^2 + 2x - 8$.

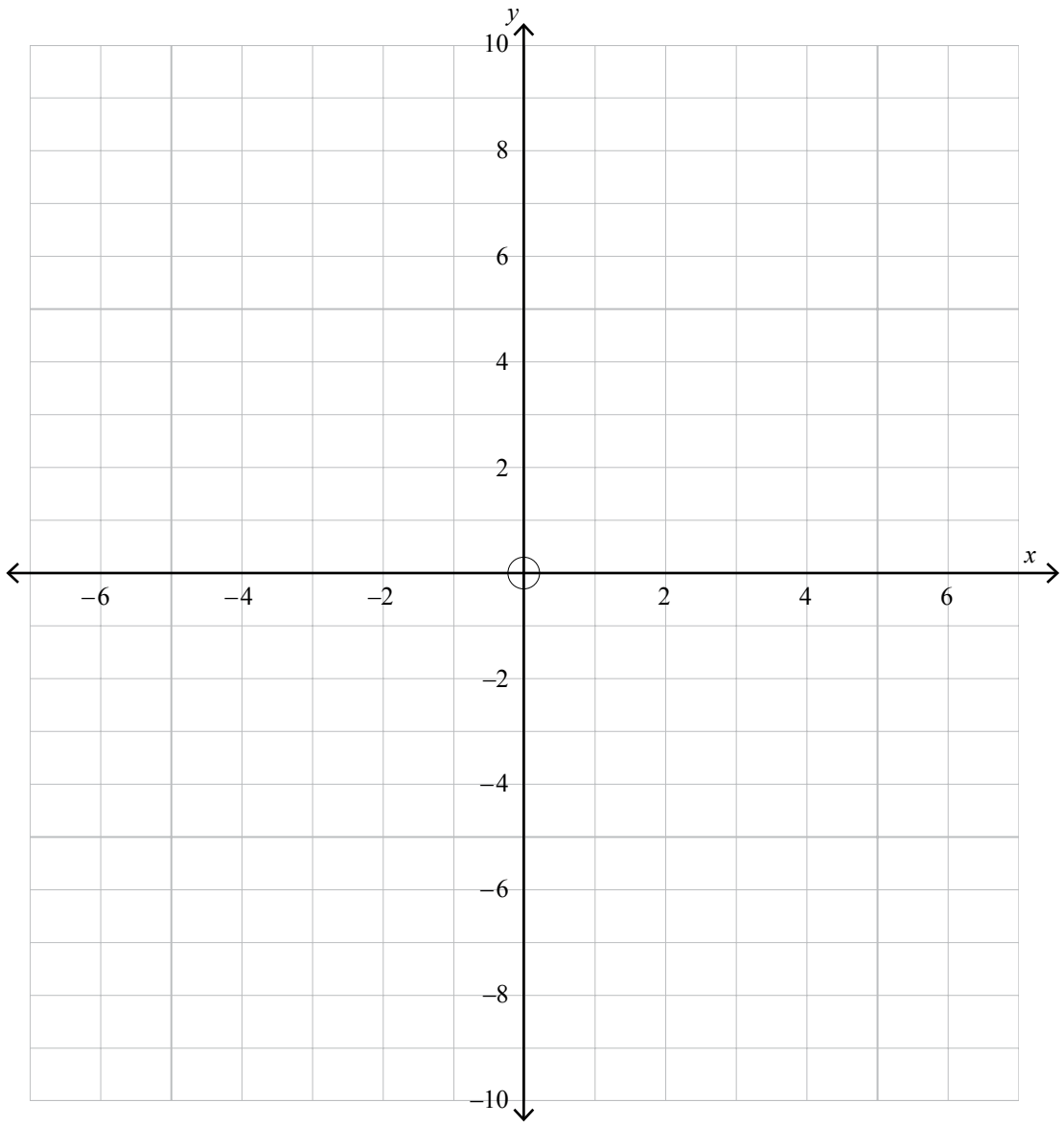


Ki te hiahia koe ki te tā anō i tēnei kauwhata, whakamahia te tukutuku kei te whārangi 28.

QUESTION TWO

ASSESSOR'S USE ONLY

(a) Using the axes below, sketch the graph of $y = x^2 + 2x - 8$.



If you need to redraw this graph, use the grid on page 29.

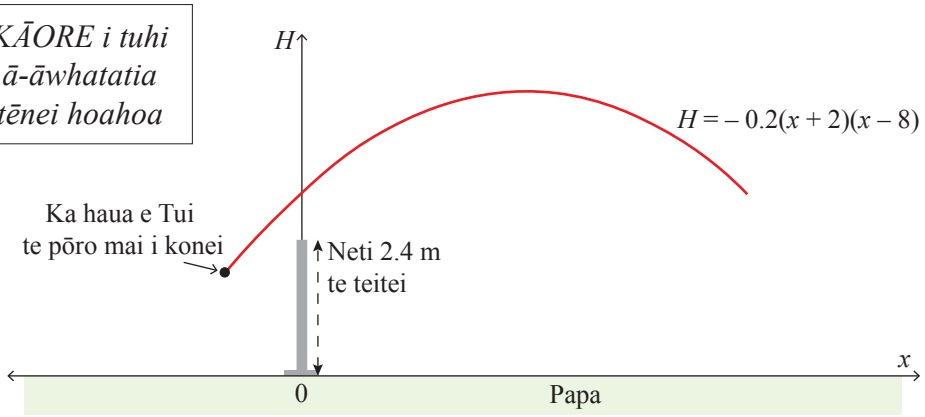
MĀ TE KAIMĀKA ANAKE

(b) (i) Kei roto a Tui i te kapa poirewa o tōna kura. Kei te parakitihi ia i tana patu i te pōro ki tērā taha o te neti, e ai ki te hoahoa i raro. Ko te teitei o runga o te neti he 2.4 mita i runga ake o te papa.

Ka taea te whakatauira te ara o te pōro mā te $H = -0.2(x + 2)(x - 8)$

ina ko x te tawhiti huapae mai i te neti, ā, ko H te tawhiti poutū mai i te papa.

KĀORE i tuhi ā-āwhatatia tēnei hoahoa



E hia te teitei atu anō o te pōro mai i runga o te neti i te whakawhitinga atu i te neti?

(ii) E māharahara ana a Tui ka "āraia" e ngā hoariri ana hahau i te neti, arā, ka peke atu rātou ki te ārai i tana hahau kia kore ai e whiti i te neti (e ai ki te pikitia).

Me pēhea te whakarerekē i te whārite o te ara o te pōro, $H = -0.2(x + 2)(x - 8)$, e whai pānga ai mēnā ka āraia tana hahau i te neti, kāore rānei?

Homai kia rua ngā huatau i te iti rawa e hāngai ana ki ngā pūtake ā-kauwhata.

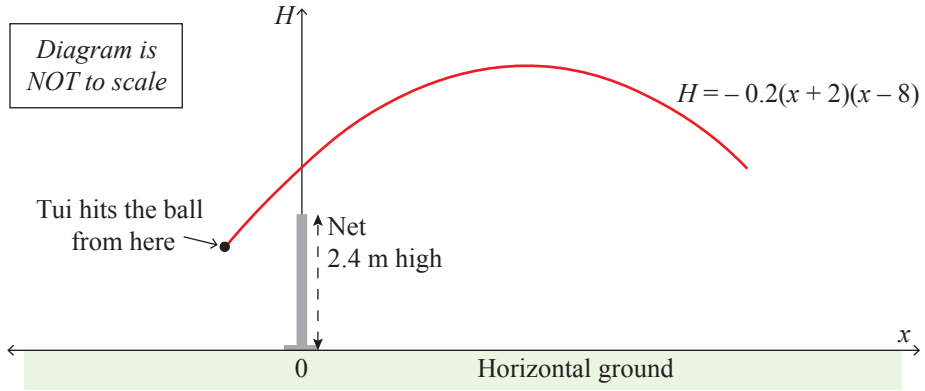
Whakaahua: https://www.nj.com/highschoolsports/2019/08/girls-volleyball-returning-stat-leaders-for-2019.html

ASSESSOR'S USE ONLY

(b) (i) Tui is in her school volleyball team. She is practising hitting the ball over the net, as shown in the diagram below. The height of the top of the net is 2.4 metres above the horizontal ground.

The equation of the path of the ball can be given by $H = -0.2(x + 2)(x - 8)$

where x is the horizontal distance from the net and H is the vertical distance above the ground.



How much higher than the top of the net will the ball be as it passes over it?

(ii) Tui is concerned that the opposition players will "block" her shots at the net, i.e. jump up and stop her shot from coming over the net (as shown in the picture).

How could altering the equation of the path of the ball, $H = -0.2(x + 2)(x - 8)$, have an effect on whether or not her shot is being blocked at the net?

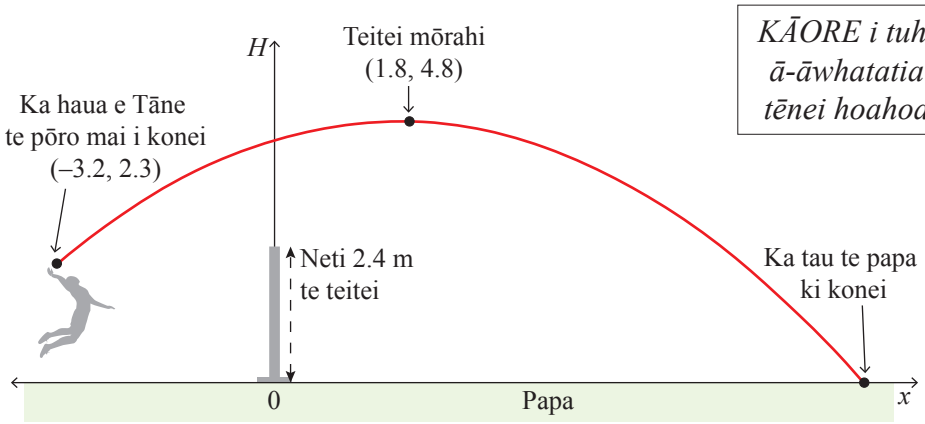
Provide at least two suggestions that are based on graphical reasons.

Photo: https://www.nj.com/highschoolsports/2019/08/girls-volleyball-returning-stat-leaders-for-2019.html

(c) (i) Kei te parakitihi a Tāne i ana pūkenga poirewa mā te maka i te pōro ki tua o te neti.

He 3.2 mita te tawhiti huapae o Tāne mai i te neti, ā, ka hahautia e ia te pōro mai i tētahi teitei poutū o te 2.3 mita.

Ka rere te pōro mā tētahi āhua tino unahi, ka whiti atu i te neti, ka tae atu ki te teitei mōrahi o te 4.8 mita ina tae atu ki te tawhiti huapae o te 1.8 mita i tērā taha o te neti.



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

Whiriwhiria te whārite o te ara i rere ai te pōro i te wehenga i te ringa o Tāne ka whiti i te neti, e ai ki te hoahoa i runga ake, ina ko x te tawhiti huapae mai i te neti, ā, ko H te tawhiti poutū mai i te papa.

Kei te papa te tuaka-x, ka ōrite te tuaka-H ki te rārangi o te neti.

Parahautia tō tuhinga ki ngā whiriwhiringa whānui, mārama hoki.

MĀ TE KAIMĀKA ANAKE

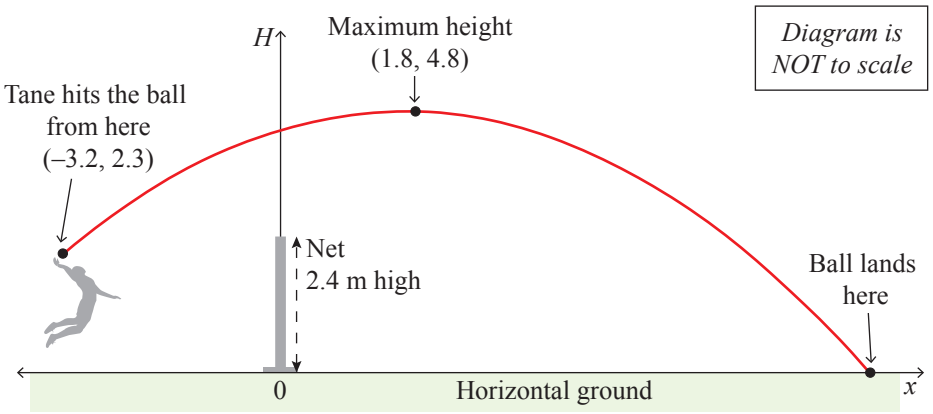
Ngā ataata: https://www.istockphoto.com/nz/vector/volleyball-men-silhouettes-gm165691738-11469557

ASSESSOR'S USE ONLY

(c) (i) Tane is practising his volleyball skills by throwing the ball over the net.

Tane is at a horizontal distance of 3.2 metres from the net, and he hits the ball from a vertical height of 2.3 metres.

The ball travels in a perfect parabola shape, over the net, reaching a maximum height of 4.8 metres when it is at a horizontal distance of 1.8 metres on the other side of the net.



Find the equation of the path travelled by the volleyball as it leaves Tane's hand and heads over the net, as shown in the diagram above, where x is the horizontal distance from the net and H is the vertical distance above the ground.

The x-axis will be at ground level, and the H-axis will be in line with the net.

Justify your answer with full and clear working.

Silhouettes: https://www.istockphoto.com/nz/vector/volleyball-men-silhouettes-gm165691738-11469557

(ii) Ka haere ake a Ruru ki a Tāne, ka tū ia ki tērā taha o te neti.
Ka haua e Tāne te pōro ki tērā taha o te neti ki a Ruru.
Ko te whārite o te ara i rere ai tēnei pōro ko
$H = -0.25(x - 2.1)^2 + 3.9$.

Ka rere atu a Ruru ki te pōro i mua i te taunga ki te papa, engari auare ake.

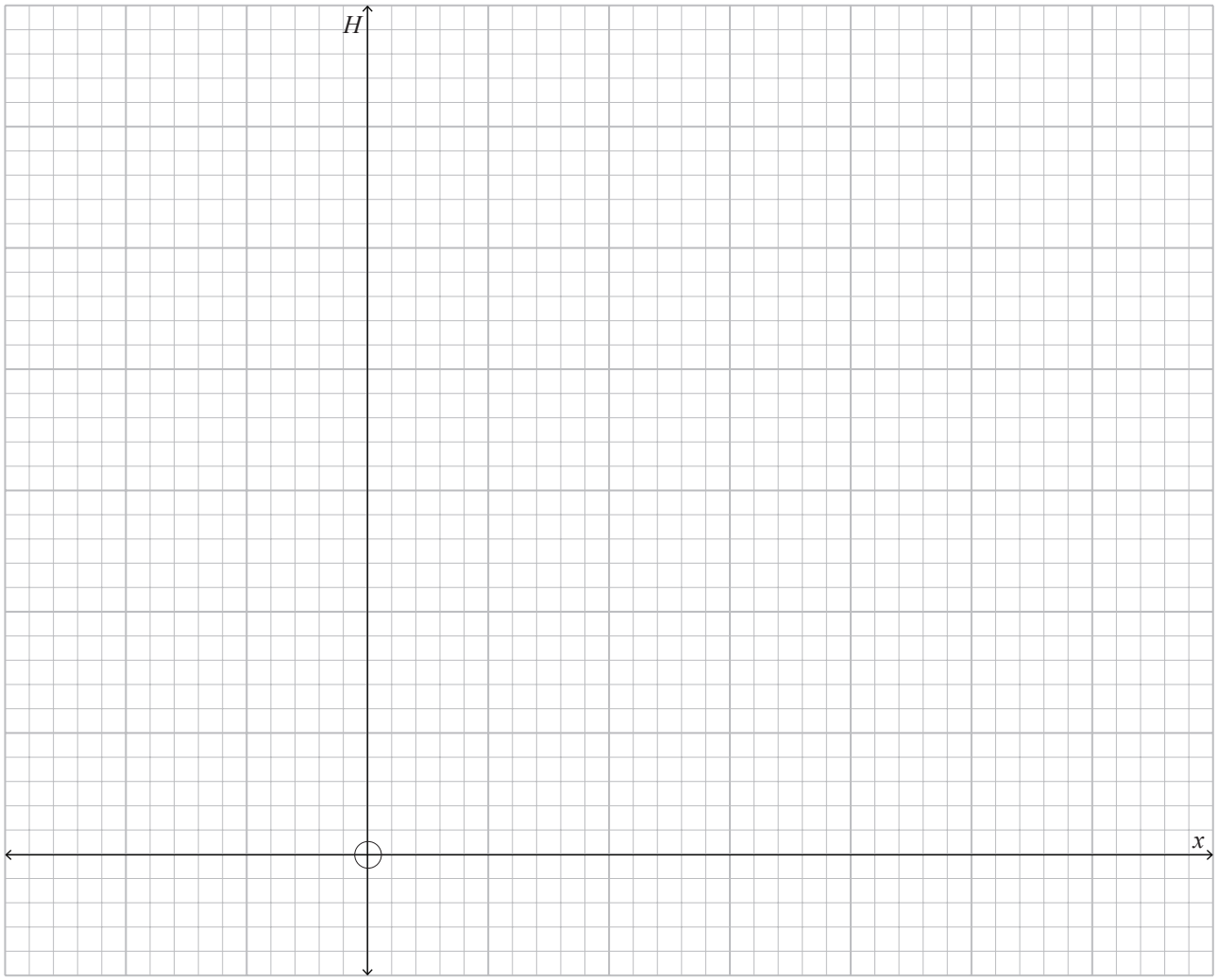
Whakamahia ngā whārite, ngā kauwhata RĀNEI, whiriwhiria e hia te tawhiti mai i te neti e tau ai te pōro ki te papa.

Parahautia tō tuhinga ki ngā whiriwhiringa whānui, mārama hoki.

Ka hiahia pea koe ki te whakamahi i te pepa kauwhata kei tērā taha.

MĀ TE KAIMĀKA ANAKE

Whakaahua: https://www.staradvertiser.com/2019/03/07/photo-gallery/uh-mens-volleyball-hawaii-vs-king/



MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(ii) Ruru joins Tane, standing on the opposite side of the net.
Tane sends the ball over the net towards Ruru.
The equation of the path travelled by this volleyball is $H = -0.25(x - 2.1)^2 + 3.9$.

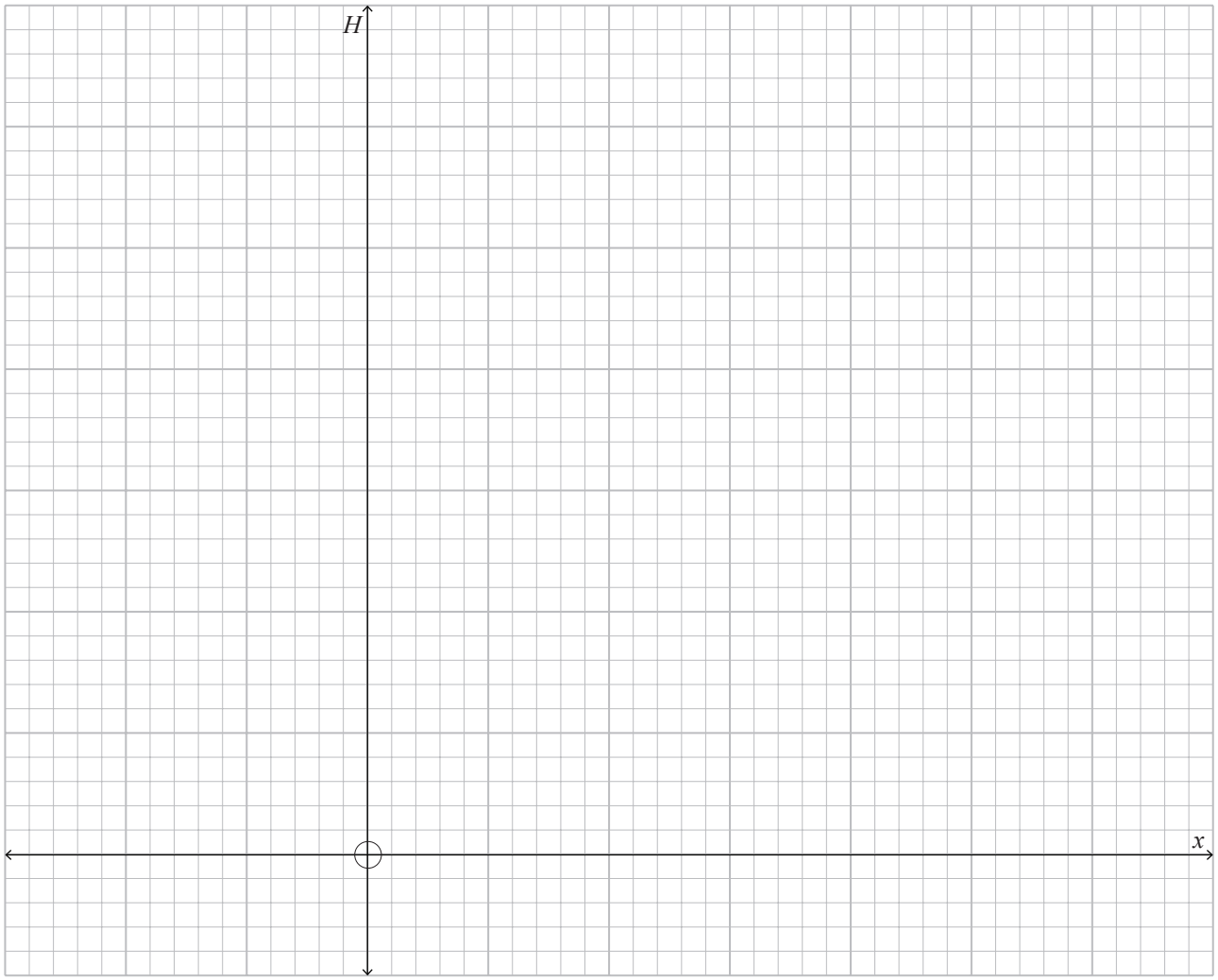
Ruru dives to reach the ball before it hits the ground, but misses the ball.

Using equations OR graphs, find how far away from the net the ball will first hit the ground.

Justify your answer with full and clear working.

You may choose to use the graph paper provided opposite.

Photo: https://www.staradvertiser.com/2019/03/07/photo-gallery/uh-mens-volleyball-hawaii-vs-king/

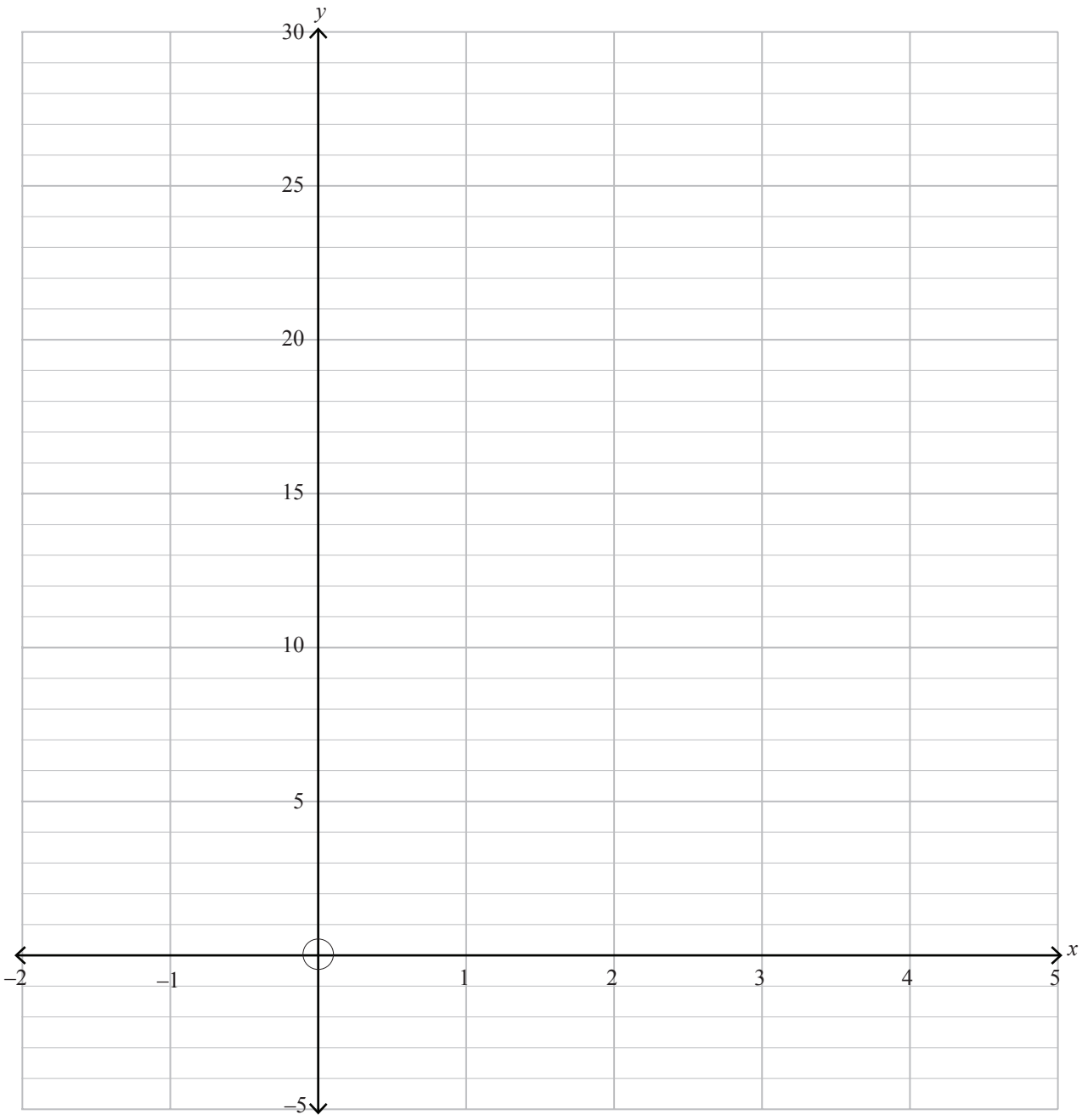


ASSESSOR'S USE ONLY

TŪMAHI TUATORU

MĀ TE KAIMĀKA ANAKE

(a) Mā te whakamahi i ngā tuaka i raro, tuhia te kauwhata o $y = 3^{(x-1)}$.

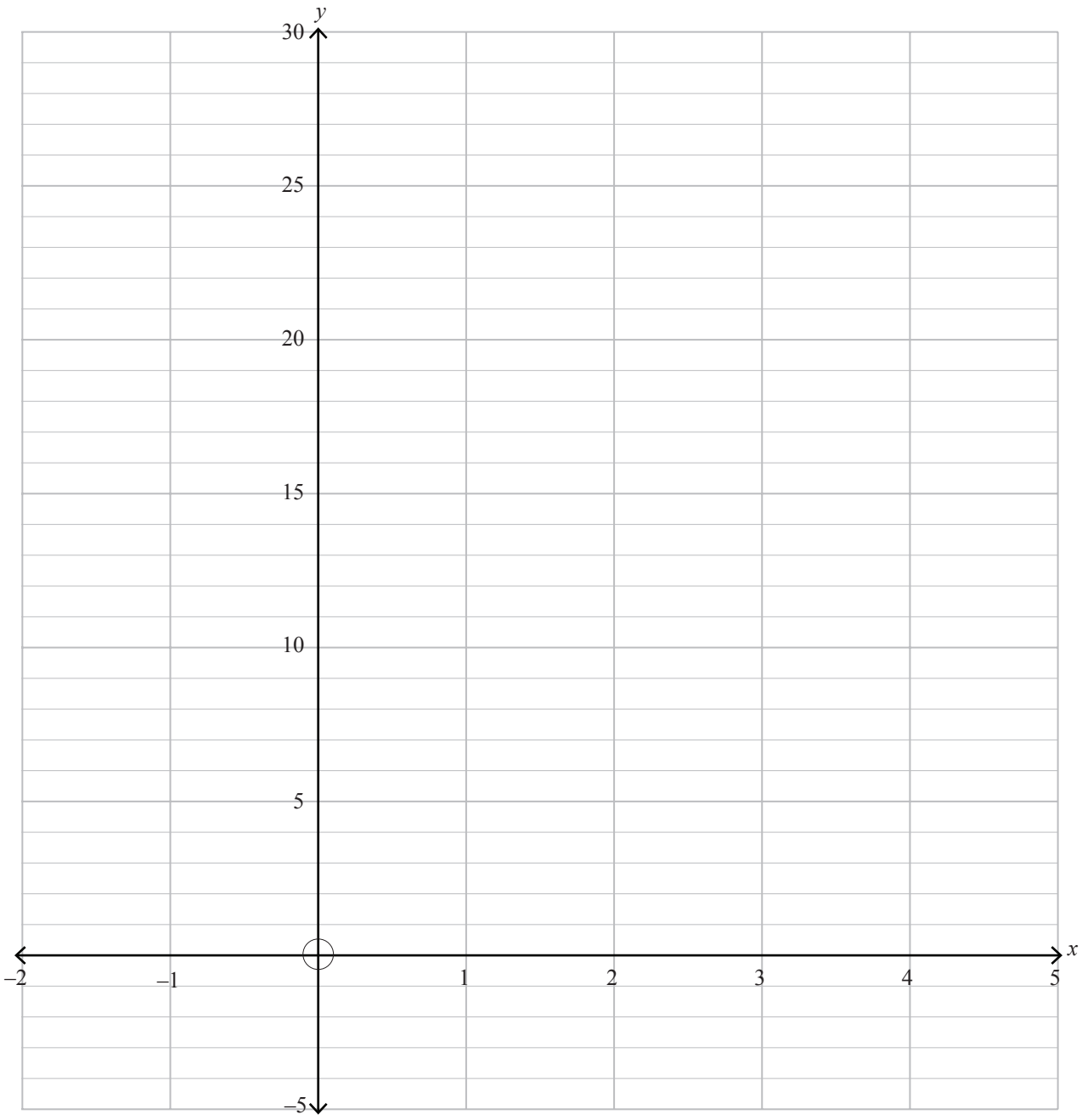


Ki te hiahia koe ki te tuhi anō i tēnei kauwhata, me whakamahi te tukutuku kei te whārangi 30.

QUESTION THREE

ASSESSOR'S USE ONLY

(a) Using the axes below, sketch the graph of $y = 3^{(x-1)}$.



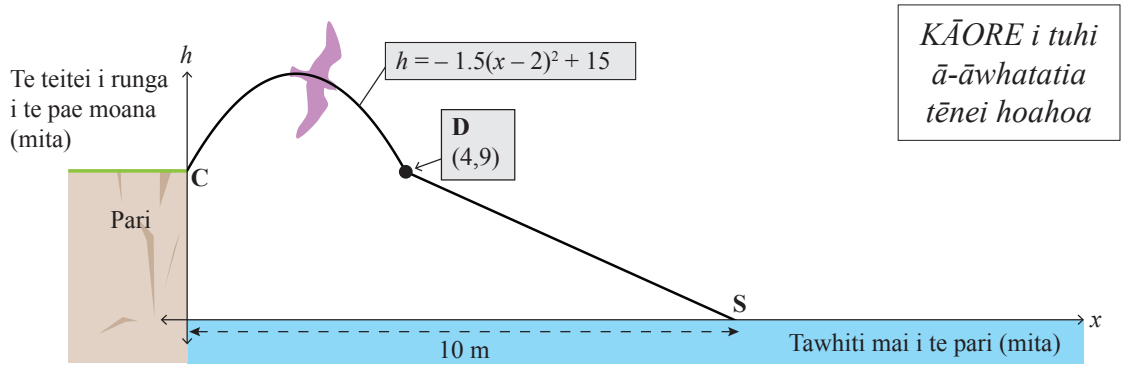
If you need to redraw this graph, use the grid on page 31.

MĀ TE KAIMĀKA ANAKE

(b) E whakaaturia ana te ara rerenga o tētahi manu moana ki te kauwhata i raro. Ka rere atu te manu mai i te pari i te pūwāhi C.

Ka whai te manu i tētahi ara e ai ki te ānau me te whārite $h = -1.5(x - 2)^2 + 15$, ina ko x te tawhiti huapae ā-mita mai i te pari, ā, ko h te tawhiti poutū ā-mita i runga ake o te pae moana.

Ka huri te ahunga o te manu i te pūwāhi D, ka topa whakararo ka whai i tētahi ara torotika, kia tau ki te pae moana i te pūwāhi S. 10 mita te pūwāhi S mai i te pūtake o te pari.



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

(i) He aha te teitei poutū rawa i eke ai te manu ki runga ake o te pae moana?

(ii) Kimihia te whārite o te ara o te manu ina whai haere ana i te wāhanga topa whakararo torotika, rārangi D ki S.

(iii) Ka rere atu tētahi atu manu moana mai i te pari. Ka whai i tētahi ara rerenga ā-unahi ōrite.

Me pēhea te whakaatu i te ara rerenga kē o tēnei manu tuarua ki te whārite, ina whakatauritea ki te whārite o te ara rerenga o te manu tuatahi?

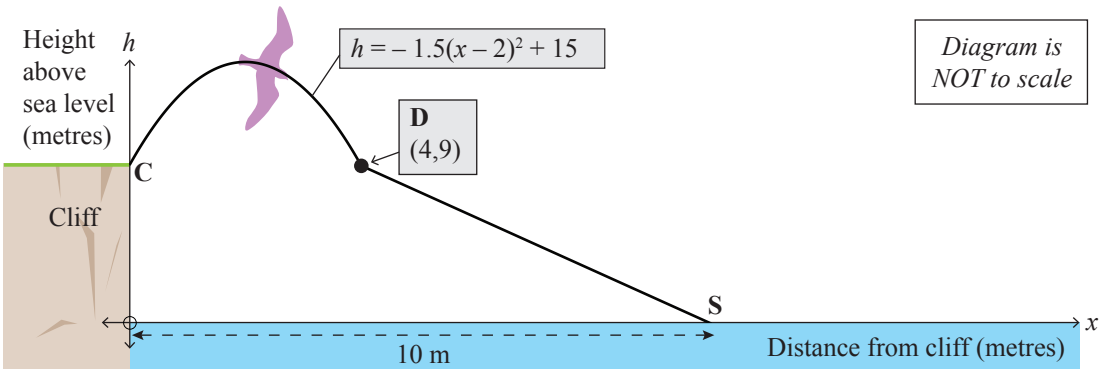
Homai kia rua ngā huatau i te iti rawa e hāngai ana ki ngā pūtake ā-kauwhata.

ASSESSOR'S USE ONLY

(b) A seabird's flight path is shown in the graph below. The bird takes off from the cliff at point C.

The bird initially follows a path described by the curve with equation $h = -1.5(x - 2)^2 + 15$, where x is the horizontal distance in metres from the cliff and h is the vertical distance in metres above sea level.

The bird changes direction at point D, going into a diving motion that follows a straight-line path, until it hits sea level at point S. Point S is 10 metres from the base of the cliff.



(i) What is the greatest vertical height that the bird reaches above sea level?

(ii) Find the equation of the bird's flight path when it follows the straight-line diving section, line D to S.

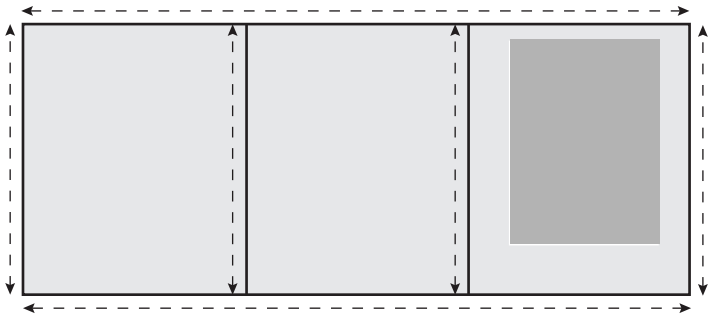
(iii) Another seabird takes off from the cliff. It follows a similar parabola-shaped flight path.

How might the different flight path of this second bird be shown in its equation, compared to the equation of the first bird's flight path?

Provide at least two suggestions that are based on graphical reasons.

(c) Kei te hiahia tētahi kaipāmu ki te waihanga i ngā pārae tapawhā-hāngai e toru, e ōrite ana te horahanga, i te taha tētahi ki tētahi. 120 mita te nui o ngā taiepa mō tēnei kaupapa, ā, kei te hiahia ia ki te kimi i te whakaritenga e tino whai hua ai te horahanga tapeke o ngā pārae.

E whakaaturia ana te whakaritenga e hiahiatia ana i raro.



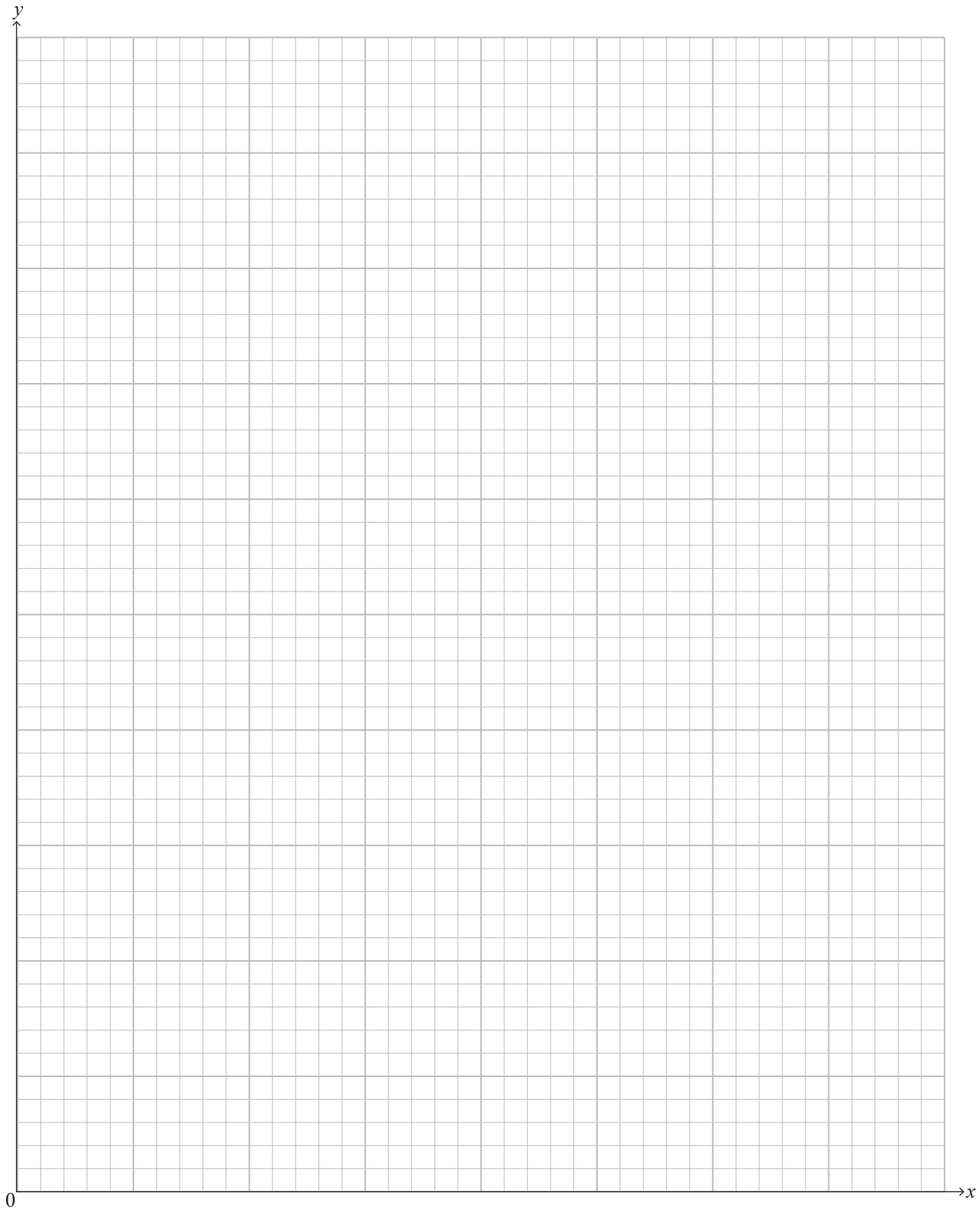
KĀORE i tuhi ā-āwhatatia tēnei hoahoa

Whakamahia ngā papatau, ngā whārite ME ngā kauwhata hei tūhura i te pātahitanga i waenga i te horahanga tapeke o ngā pārae me ngā roa o ngā tūmomo taiepa ka taea e ia te whakamahi.

MĀ TE KAIMĀKA ANAKE

Atahanga: macrovector, www.freepik.com

MĀ TE KAIMĀKA ANAKE



ASSESSOR'S USE ONLY

(c) A farmer wants to set up three rectangular fields, of equal area, side by side. He has a total of 120 metres of fencing for this project, and he wants to find the set-up that maximises the total area of the fields.

The required set-up is shown below.

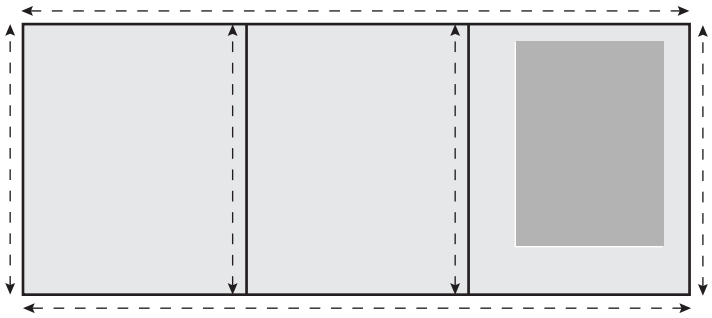
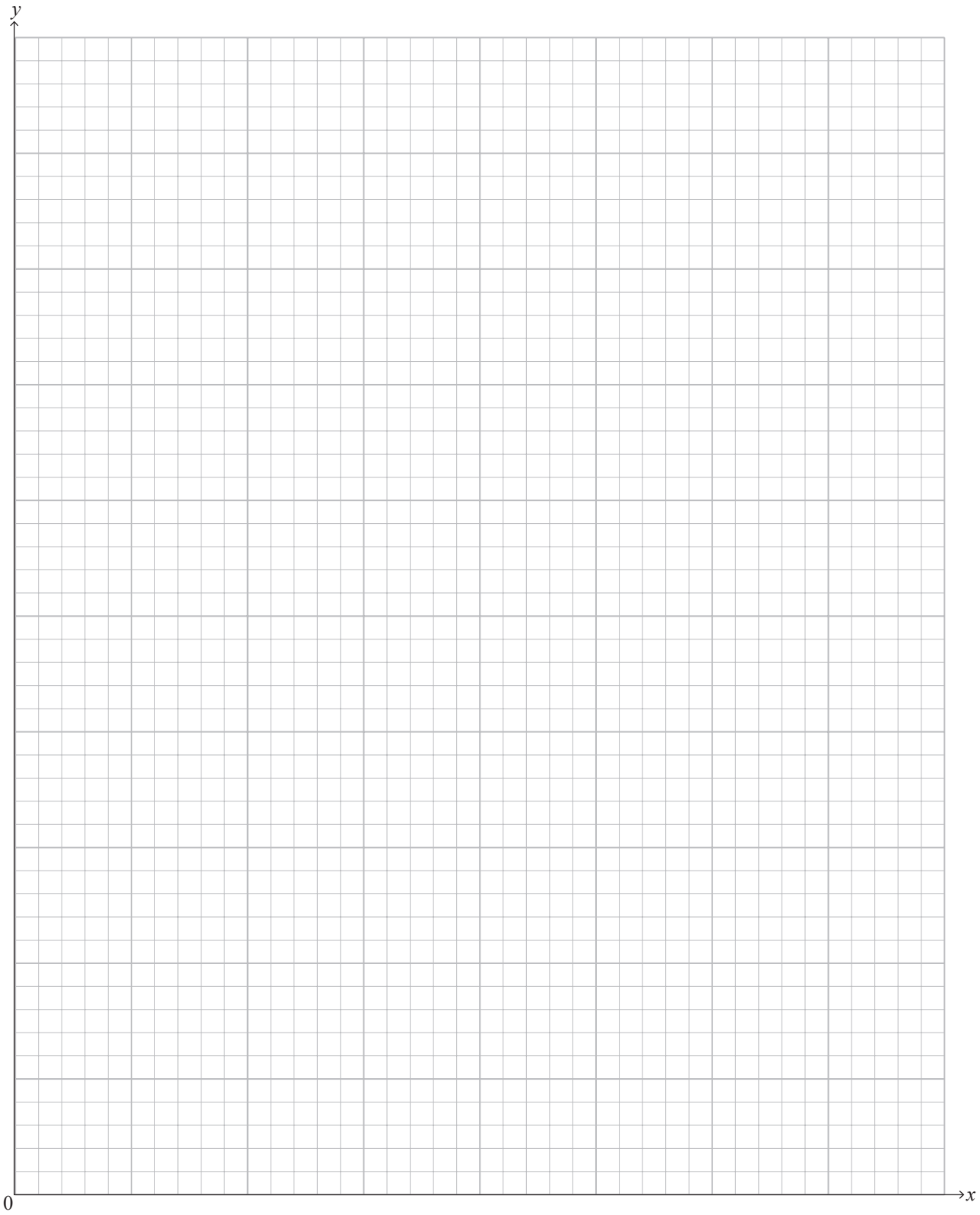


Diagram is NOT to scale

Use tables, equations, AND graphs to investigate the relationship between the total area of the fields and the lengths of the various fences he could use.

Image: macrovector, www.freepik.com

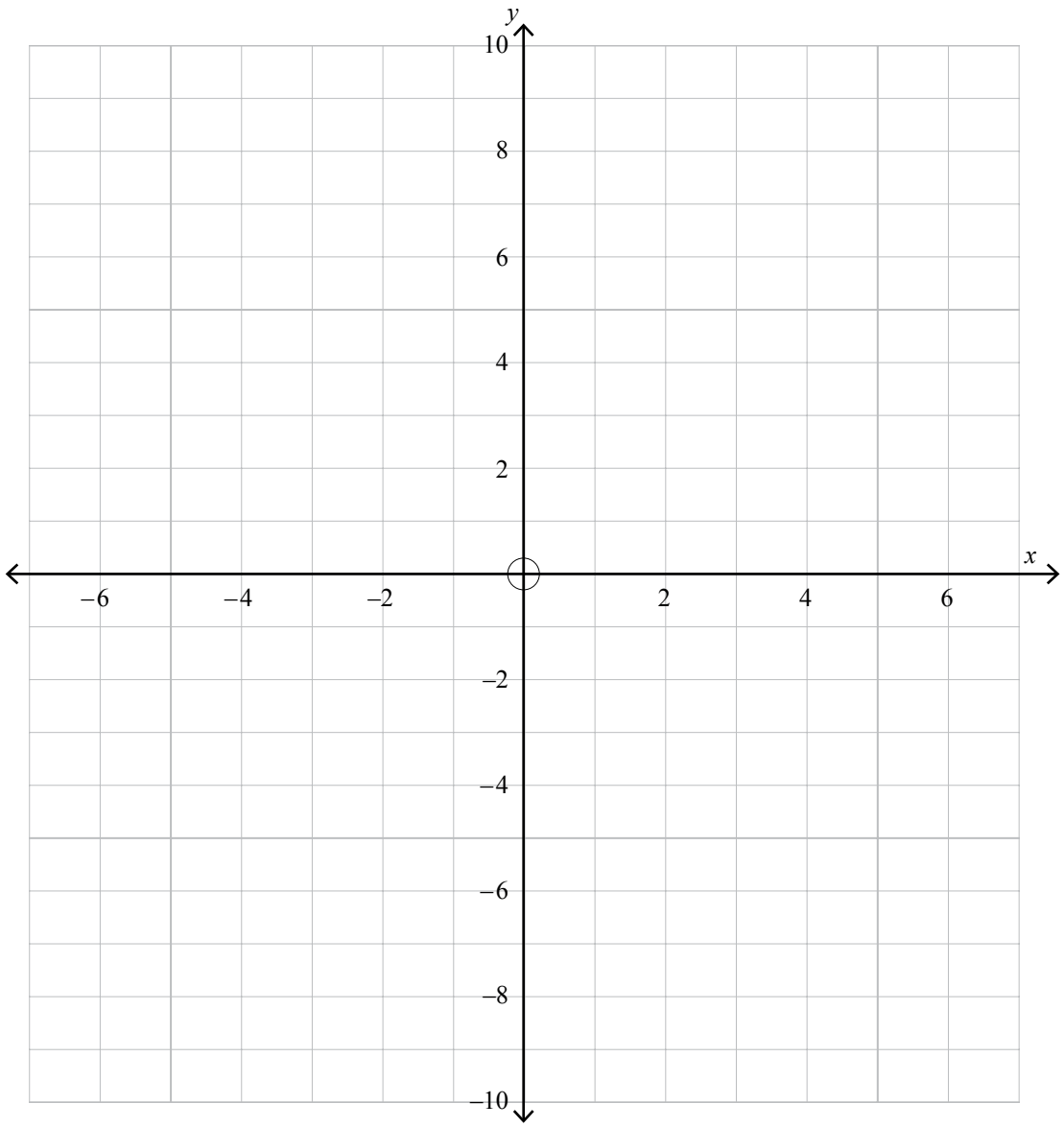
ASSESSOR'S USE ONLY



NGĀ TUKUTUKU TĀPIRI

MĀ TE KAIMĀKA ANAKE

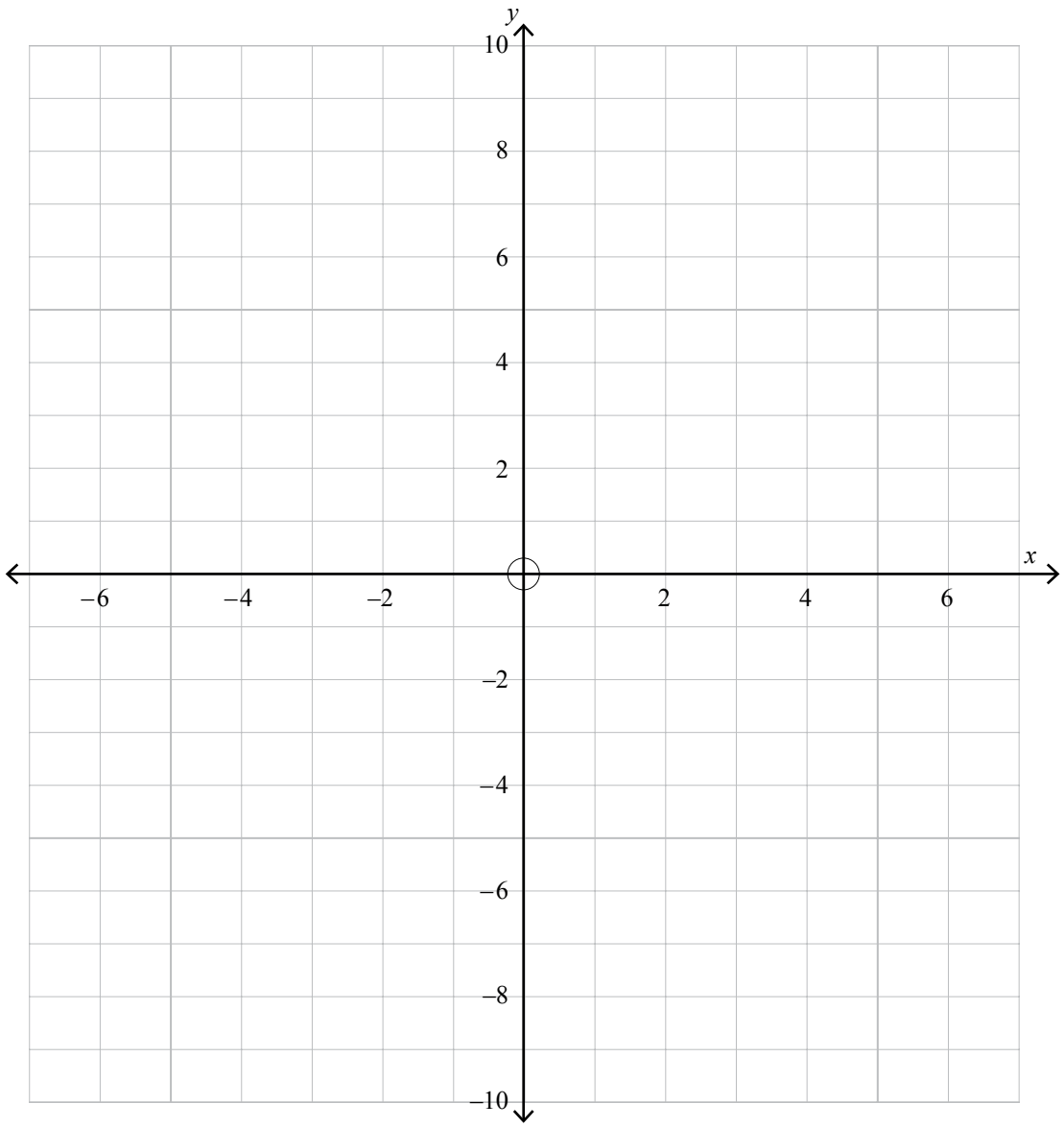
Ki te hiahia koe ki te tātuhi anō i tō urupare ki te Tūmahi Tuarua (a), whakamahia te tukutuku i raro nei. Kia mārama tonu tō tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.



SPARE GRIDS

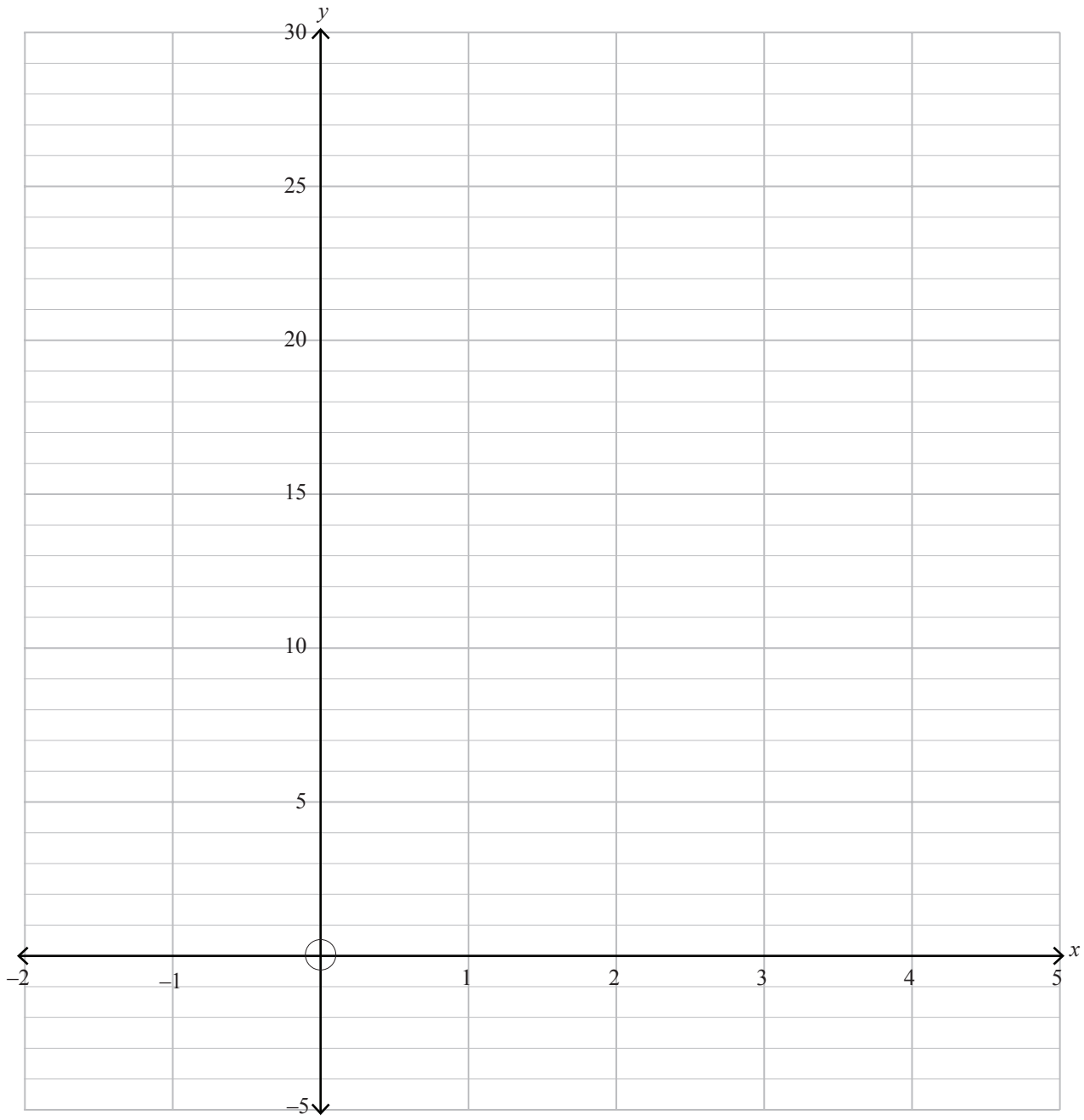
ASSESSOR'S USE ONLY

If you need to redo Question Two (a), use the grid below. Make sure you make it clear which answer you want marked.



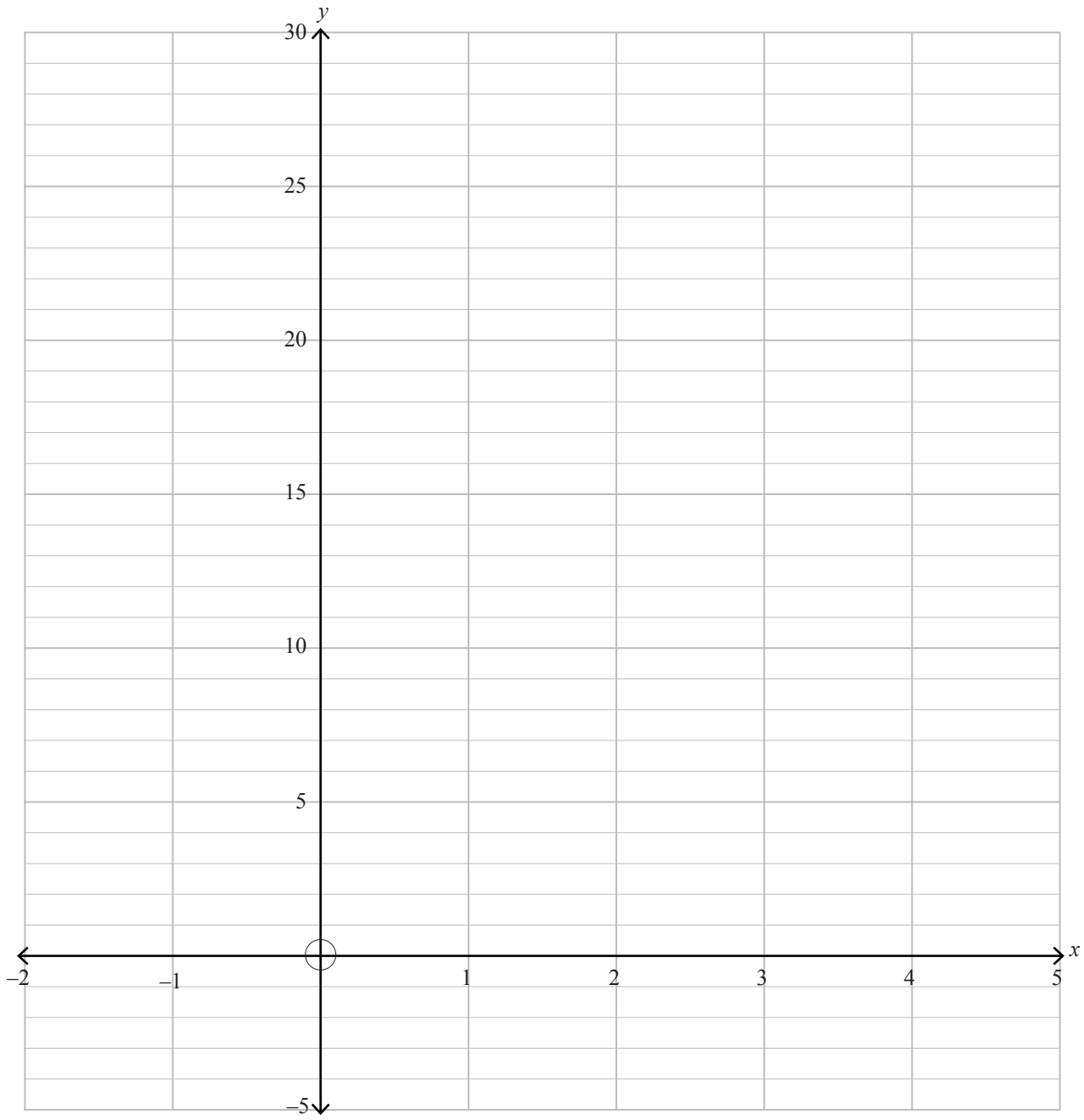
Ki te hiahia koe ki te tātuhi anō i tō urupare ki te Tūmahi Toru (a), whakamahia te tukutuku i raro nei. Kia mārama tonu tō tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.

MĀ TE KAIMĀKA ANAKE



If you need to redo Question Three (a), use the grid below. Make sure you make it clear which answer you want marked.

ASSESSOR'S USE ONLY



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

ASSESSOR'S USE ONLY

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

ASSESSOR'S USE ONLY

English translation of the wording on the front cover

Level 1 Mathematics and Statistics 2020

91028 Investigate relationships between tables, equations and graphs

9.30 a.m. Friday 20 November 2020
Credits: Four

91028M

Achievement	Achievement with Merit	Achievement with Excellence
Investigate relationships between tables, equations and graphs.	Investigate relationships between tables, equations and graphs, using relational thinking.	Investigate relationships between tables, equations and graphs, using extended abstract thinking.

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.

Grids are provided on some pages. This is working space for the drawing of a graph or a diagram, constructing a table, writing an equation, or writing your answer

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 2–35 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.