See back cover for an English translation of this cover

1

91028M

910285

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 koe i tuhituhi i roto i tēnei pukapuka

Te Pāngarau me te Tauanga, Kaupae 1, 2021

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

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 tūhonohono.	Te tūhura i ngā pānga i waenganui i ngā papatau, ngā whārite me ngā kauwhata mā te whakaaro waitara.

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.

Tuhia ō mahinga KATOA.

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

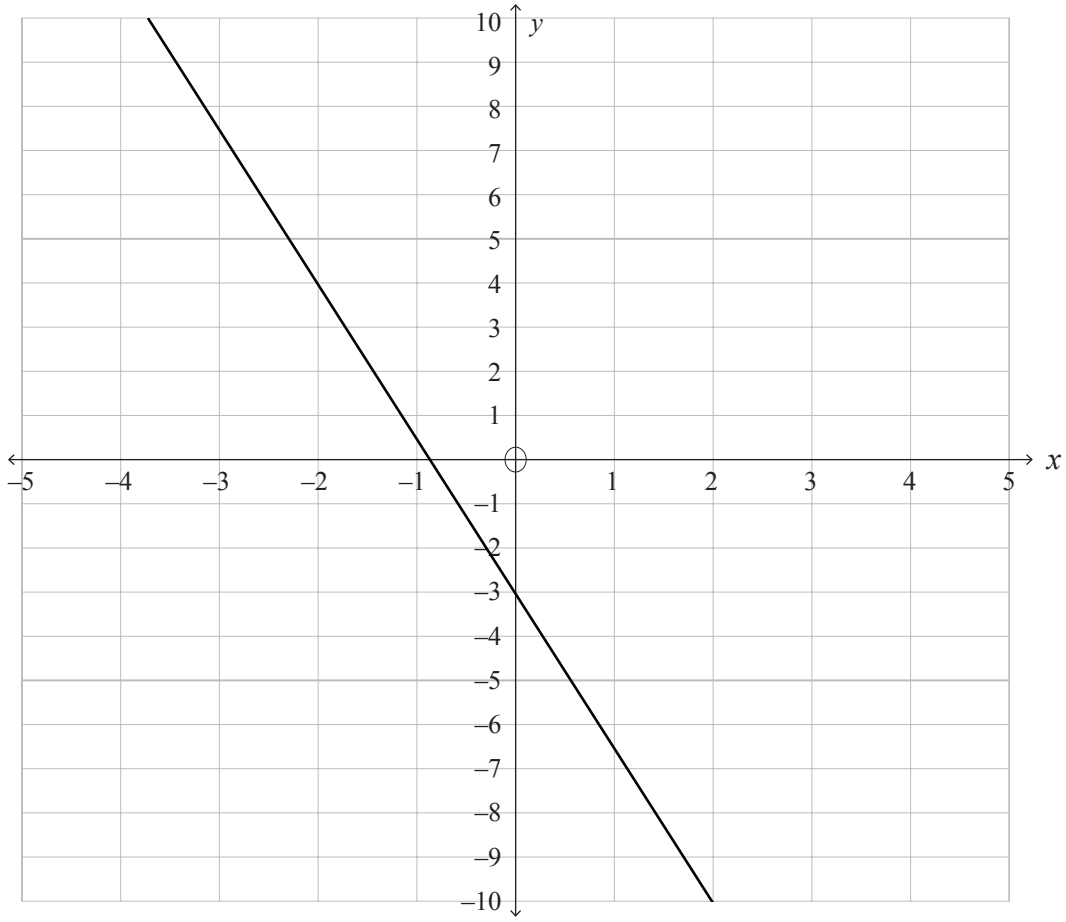
Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–39 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki roto i tētahi wāhi kauruku whakahāngai (⁘). Ka tapahia pea tēnei wāhi ina mākahia te pukapuka.

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

TŪMAHI TUATAHI

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

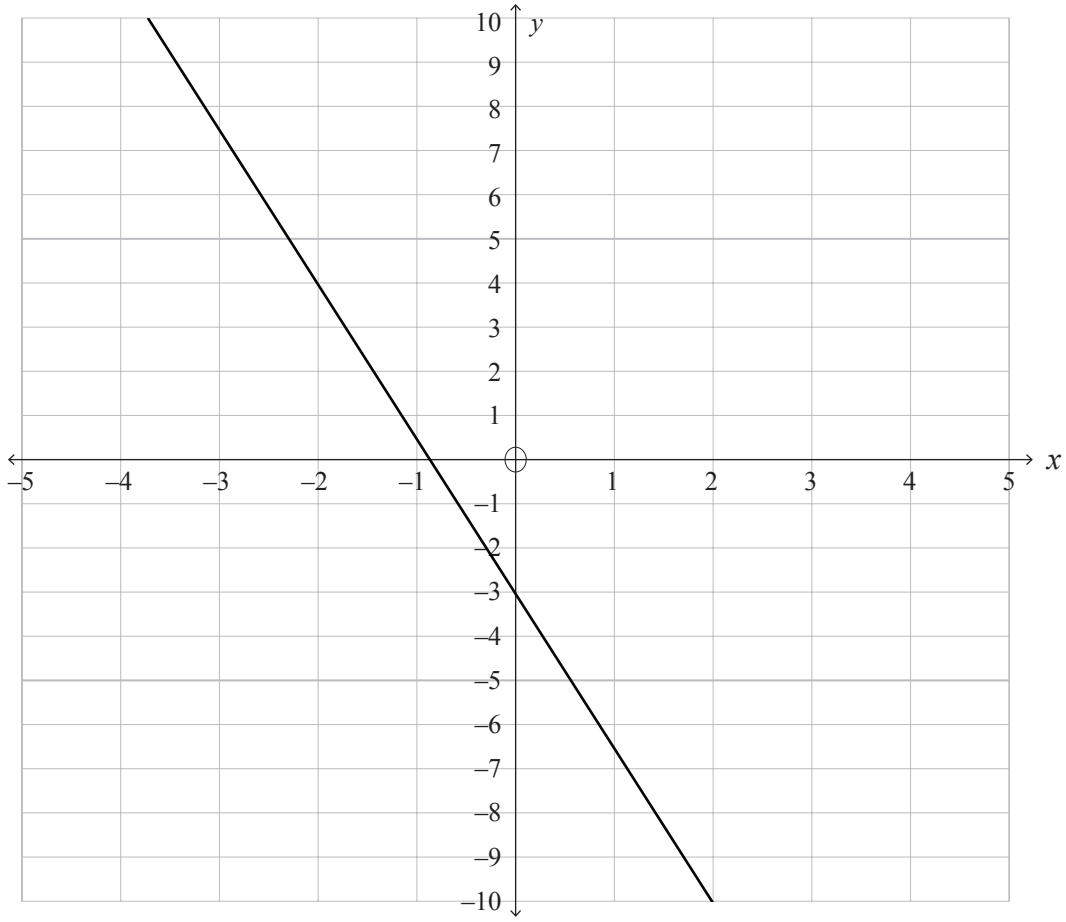


Whārite: _____

(ii) Whiriwhiria te whārite o te rārangi hou mēnā ka nekehia te kauwhata e whakaaturia ana kei te whārangi 2 ki ngā wae 20 ki runga me ngā wae 10 ki te mauī, ka whakarūnā i tō tuhinga ki tērā e tino taea ana.

QUESTION ONE

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



Equation: _____

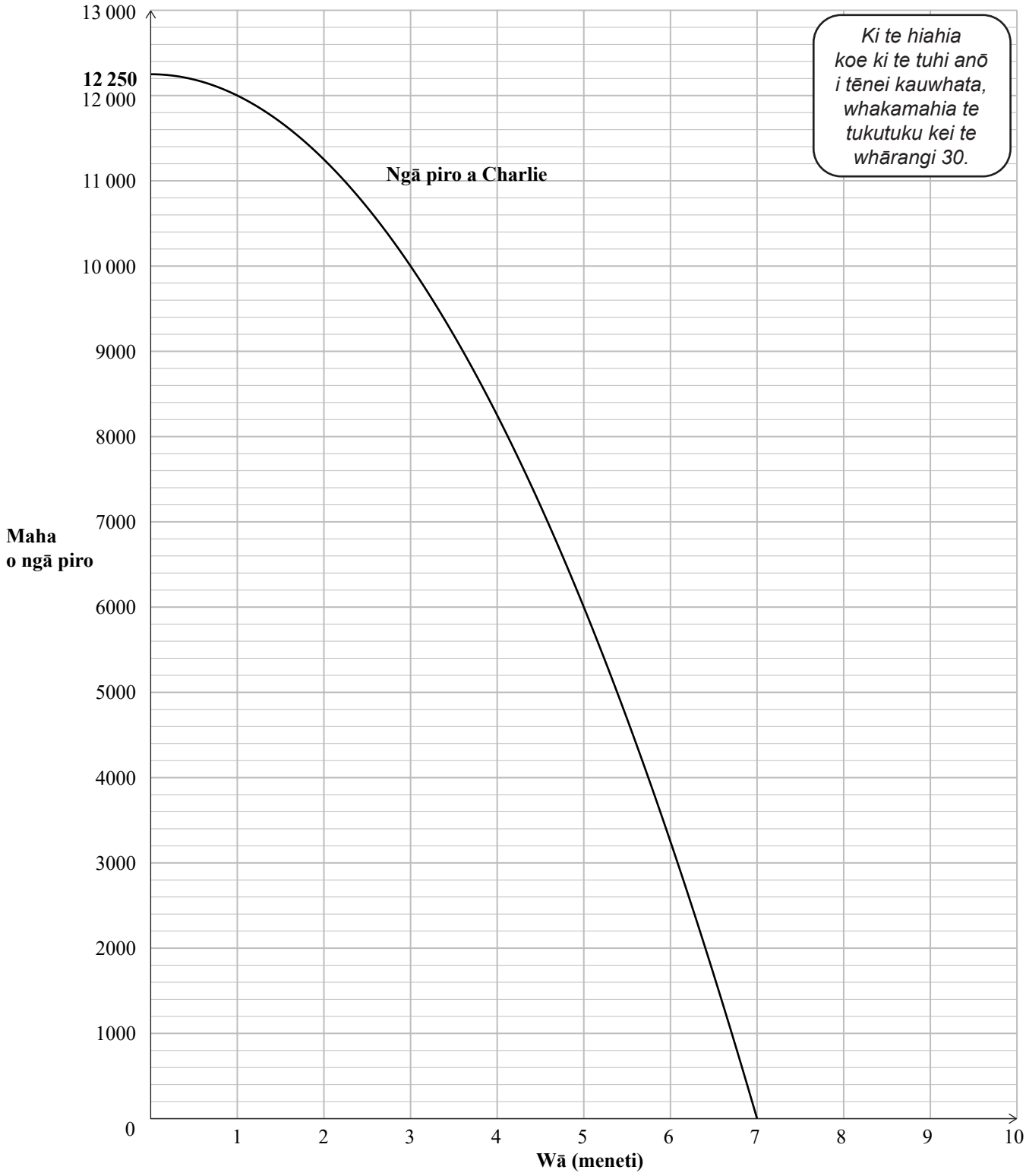
(ii) Find the equation of the new line if the graph shown on page 4 is translated 20 units up and 10 units to the left, simplifying your answer as far as possible.

(b) Kei te tākaro a Anne, Ben me Charlie i tētahi kēmu rorohiko e pā ana ki ngā kaurehe whawhai. He iwa meneti te roa o ia kēmu. Ka tīmata rātau katoa ki te purei i te wā kotahi.

I tētahi kēmu:

- Ka tīmata a Anne me te 4 000 piro. I a ia e purei ana, he 500 piro ka ngaro i a ia i ia meneti.
- Ka tīmata a Ben me te 12 000 piro. Ka ngaro te haurua o ana piro i ia meneti.
- Ka tīmata a Charlie me te 12 250 piro. Ka ngaro katoa ana piro i muri i te whitu meneti, me te auau e whai ana i tētahi tauira whārite pūrua, e ai ki te kauwhata i raro.

Mēnā ka ngaro katoa ngā piro a tētahi kaitākaro i mua i te ekenga o te iwa meneti, ka whakawāteahia mai ia i te kēmu. Ka ngaro haere tonu ngā piro a ngā kaitākaro.



(i) Whakaotihia te tūtohi e whai ake nei.

Wā (meneti)	Maha o ngā piro e toe ana mā Anne	Maha o ngā piro e toe ana mā Ben	Maha o ngā piro e toe ana mā Charlie
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			

(ii) Mā te whakamahi i ngā tuaka kua whakaritea ki te whārangi 6, tātuhia ngā kauwhata e whakaatu ana i te maha o ngā piro mai i ngā kēmu kua pureitia e Anne rāua ko Ben.

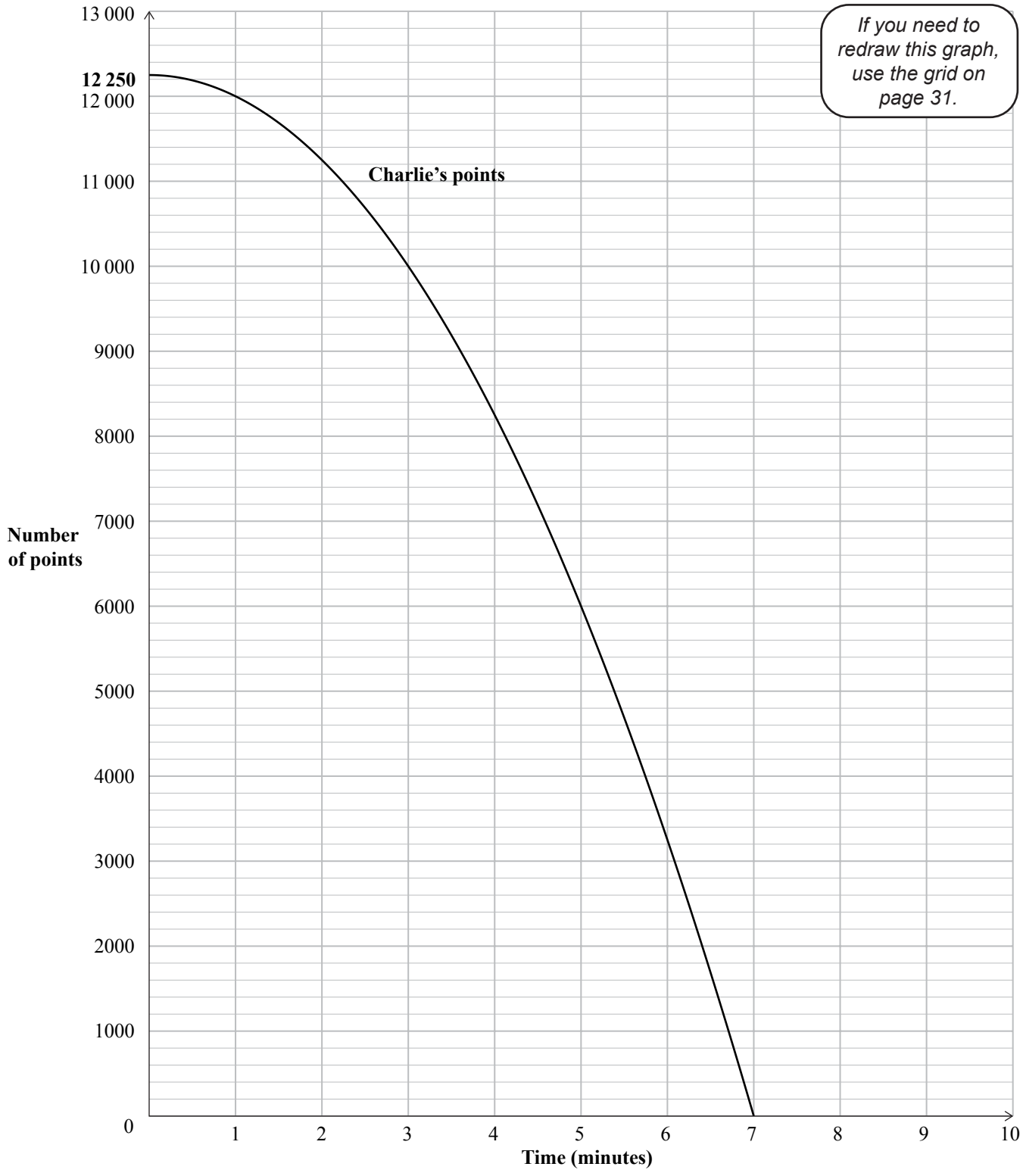
(iii) Whiriwhiria te whārite o tēnā tauira, o tēnā tauira mō te maha o ngā piro mai i ngā kēmu e pureitia ana e Anne, Ben me Charlie.

(b) Anne, Ben, and Charlie are playing a computer game that involves fighting monsters. Each game lasts for nine minutes. They all start playing the game at the same time.

In one game:

- Anne starts with 4 000 points. As she plays, she loses 500 points every minute.
- Ben starts with 12 000 points. He loses half his points every minute.
- Charlie starts with 12 250 points. He loses all of his points after seven minutes, with the rate following a quadratic pattern, as shown on the graph below.

If a player loses all of their points before the nine minutes are up, they are removed from the game. The players lose their points continuously.



(i) Complete the table below.

Time (minutes)	Number of points remaining for Anne	Number of points remaining for Ben	Number of points remaining for Charlie
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			

(ii) Using the axes provided on page 8, draw the graphs representing the number of points from the games played by Anne and Ben.

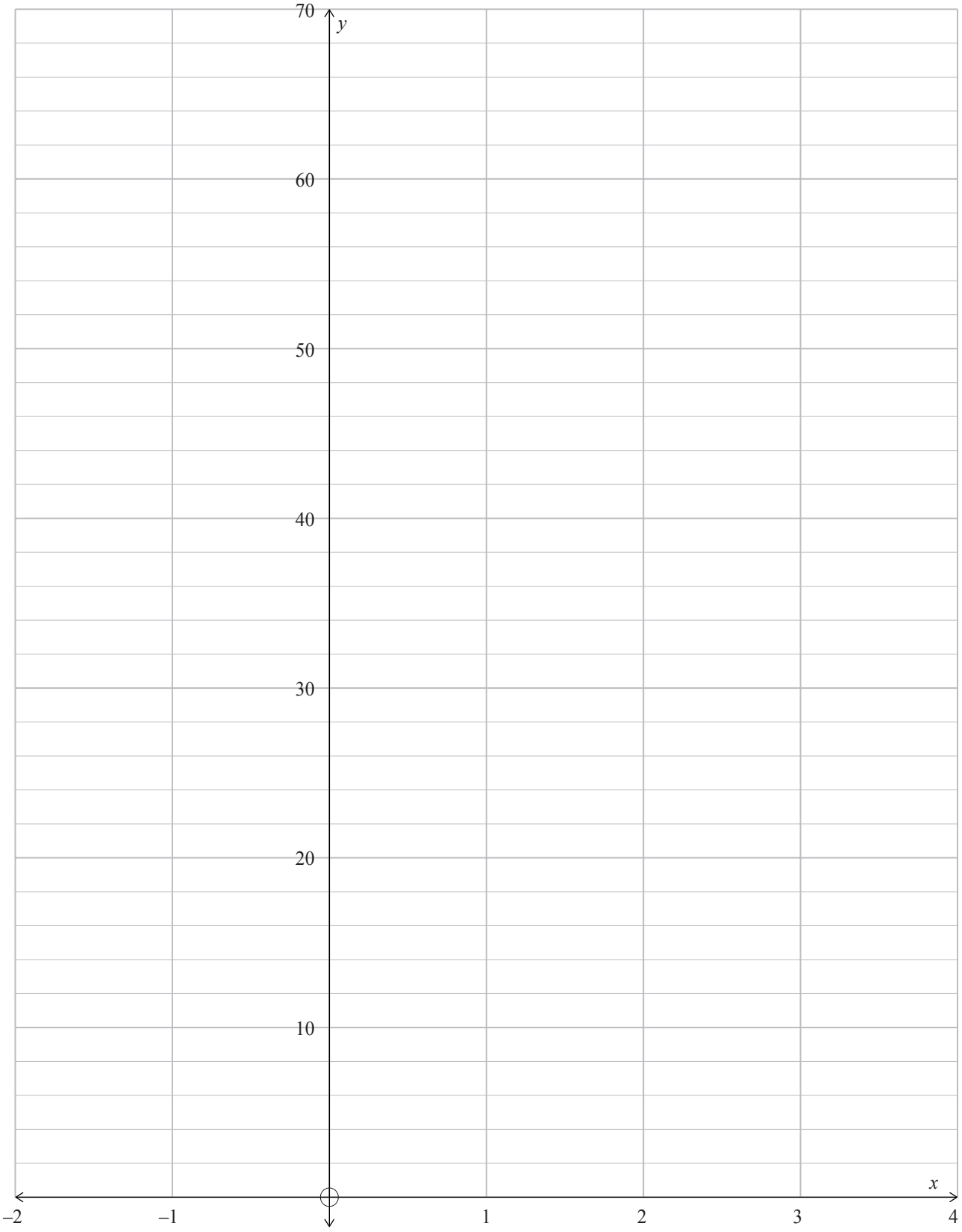
(iii) Find the equation of each of the models for the number of points from the games played by Anne, Ben, and Charlie.

(iv) Whakatauritea ngā piro a tēnā kaitākaro, a tēnā kaitākaro i te roanga o tēnei kēmu, ā, ko wai ka purei i te kēmu mō te wā roa rawa.

(iv) Compare each player's points over the course of this game, including who will play the game for the longest time.

TŪMAHI TUARUA

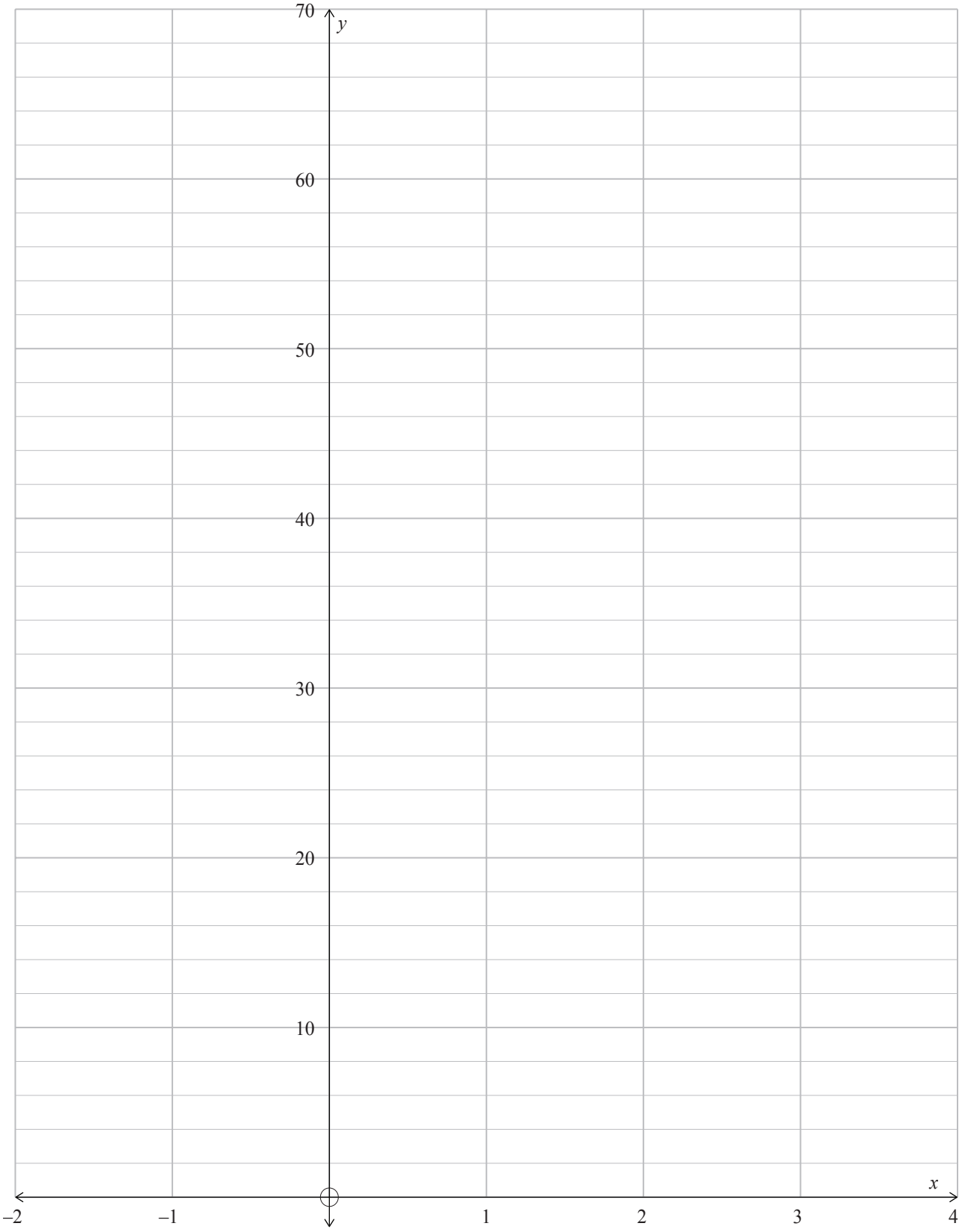
(a) Mā te whakamahi i ngā tuaka i raro, tuhia te kauwhata o $y = 2^{x+2}$



Ki te hiahia koe ki te tuhi anō i tēnei kauwhata, whakamahia te tukutuku i te whārangi 32.

QUESTION TWO

(a) Using the axes below, sketch the graph of $y = 2^{x+2}$



If you need to redraw this graph, use the grid on page 33.

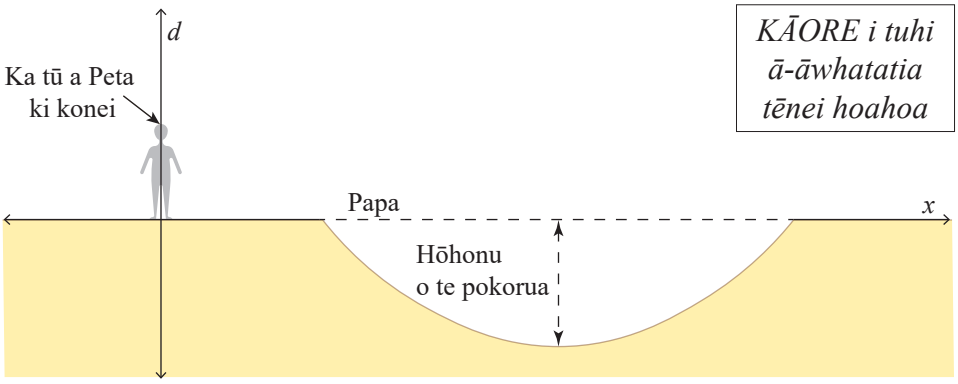
(b) I Hot Water Beach, ka karia e ngā tāngata ngā pokorua i ngā kirikiri kia tae atu ai ki te wai mahana. Ka kī ngā pokorua ki te wai, ā, ka takoto ngā tāngata ki rō wai mahana.

Mātāpuna: https://www.newzealand.com/int/plan/business/cathedral-cove-and-hot-water-beach-express/

(i) I karia e te whānau o Peta tētahi pokorua ka taea te whakatauira mā te whārite $d = 0.8(x - 1)(x - 4)$

ina ko d te hōhonu ā-mita o te pokorua i raro i te papa

ā, ko x te tawhiti huapae ka inea mai i te wāhi e tū ana a Peta.



KĀORE i tuhi ā-āwhatatia tēnei hoahoa

E hia te tawhiti i raro i te papa o te wāhi hōhonu rawa o te pokorua?

(ii) Ko te whakaaro o te kuia o Peta he mōrea pea te pokorua. Ka tahuri te whānau o Peta ki te kari i tētahi pokorua hou hei whakarata i tō rātau kuia. He unahi anō te āhua o te pokorua hou.

Homai kia rua ngā tikanga i te iti rawa e taea ana te whārite taketake o te pokorua i (i) te whakarerekē kia haumaru ake te pokorua hou.

Whakaahuahia ka pēhea te whakaawe a tēnā rerekētanga, a tēnā rerekētanga i te āhua o te pokorua.

(iii) Ka karia e te whānau o Sheila tana pokorua me tētahi rōnaki whakararo kia pai ai te reti a tā rātau kurī ki roto i te wai mahana. Ka inea e rātau te hōhonu i ngā wāhi maha, ā, ka tuhia ki te tūtohi i raro.

Tawhiti huapae mai i a Sheila (mita)	**Hōhonu o te pokorua i raro i te papa (mita)**
0	1
1	0.5
2	0.25
3	0.125

He aha te whārite o te tauira e ū ana ki ngā otinga e whakaaturia ana ki te tūtohi i runga ake?

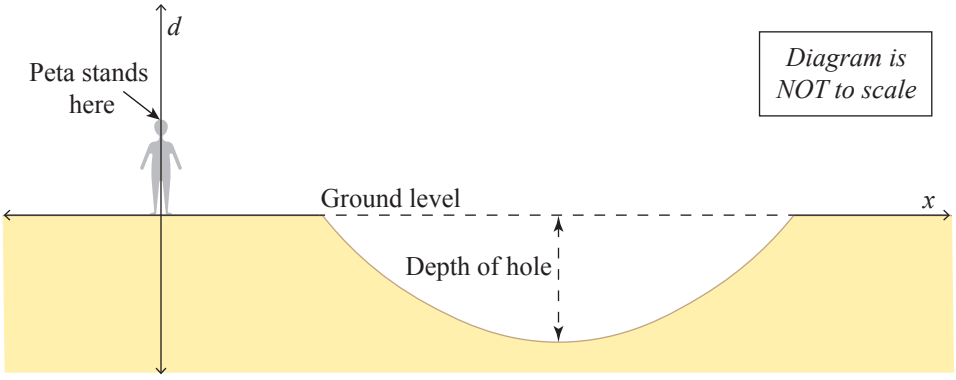
(b) At Hot Water Beach, people dig holes in the sand to reach warm water. The holes fill with water and people lie in the warm water.

Source: https://www.newzealand.com/int/plan/business/cathedral-cove-and-hot-water-beach-express/

(i) Peta's family dug a hole that can be modelled by the equation $d = 0.8(x - 1)(x - 4)$

where d is the depth of the hole in metres below ground level

and x is the horizontal distance measured from where Peta is standing.



How far below ground level is the deepest point of the hole?

(ii) Peta's grandmother thinks the hole is possibly dangerous. Peta's family decide to dig a new hole to try to calm their grandmother. The new hole will still be in the shape of a parabola.

Suggest at least two ways in which the original equation of the hole in (i) could be altered to make a new, safer hole.

Describe how each of the changes would affect the hole's shape.

(iii) Sheila's family dig their hole with a gentle slope downwards so their dog can slide into the warm water. They measure the depth in several places, which are recorded in the table below.

Horizontal distance from Sheila (metres)	**Depth of the hole below ground level (metres)**
0	1
1	0.5
2	0.25
3	0.125

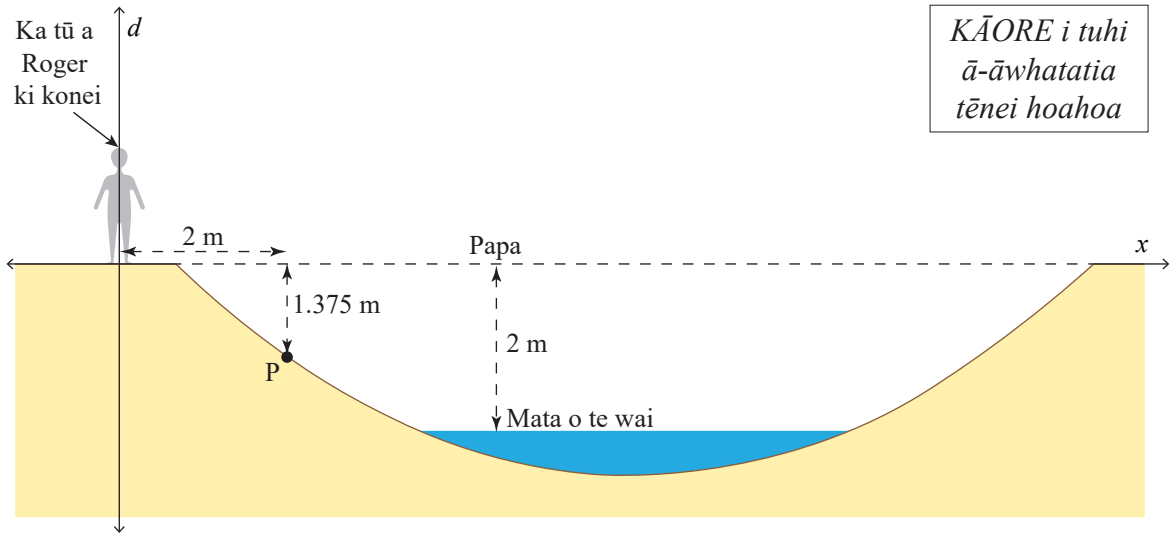
What is the equation of the model that fits the results shown in the table above?

(iv) I karia e te whānau o Roger tētahi pokorua ka taea te whakatauira mā tētahi whārite pūrua, e ai ki te hoahoa i raro.

Ko te wāhi tino hōhonu rawa o te pokorua he 2.5 mita, i te tawhiti huapae o te 5 mita mai i a Roger.

He 1.375 mita te hōhonu o te pokorua i tētahi tawhiti huapae o te 2 mita mai i a Roger (pūwāhi P kei te hoahoa).

Ka rere te wai mahana ki te pokorua. Ko te mata o te wai he 2 mita i raro i taumata o te papa.

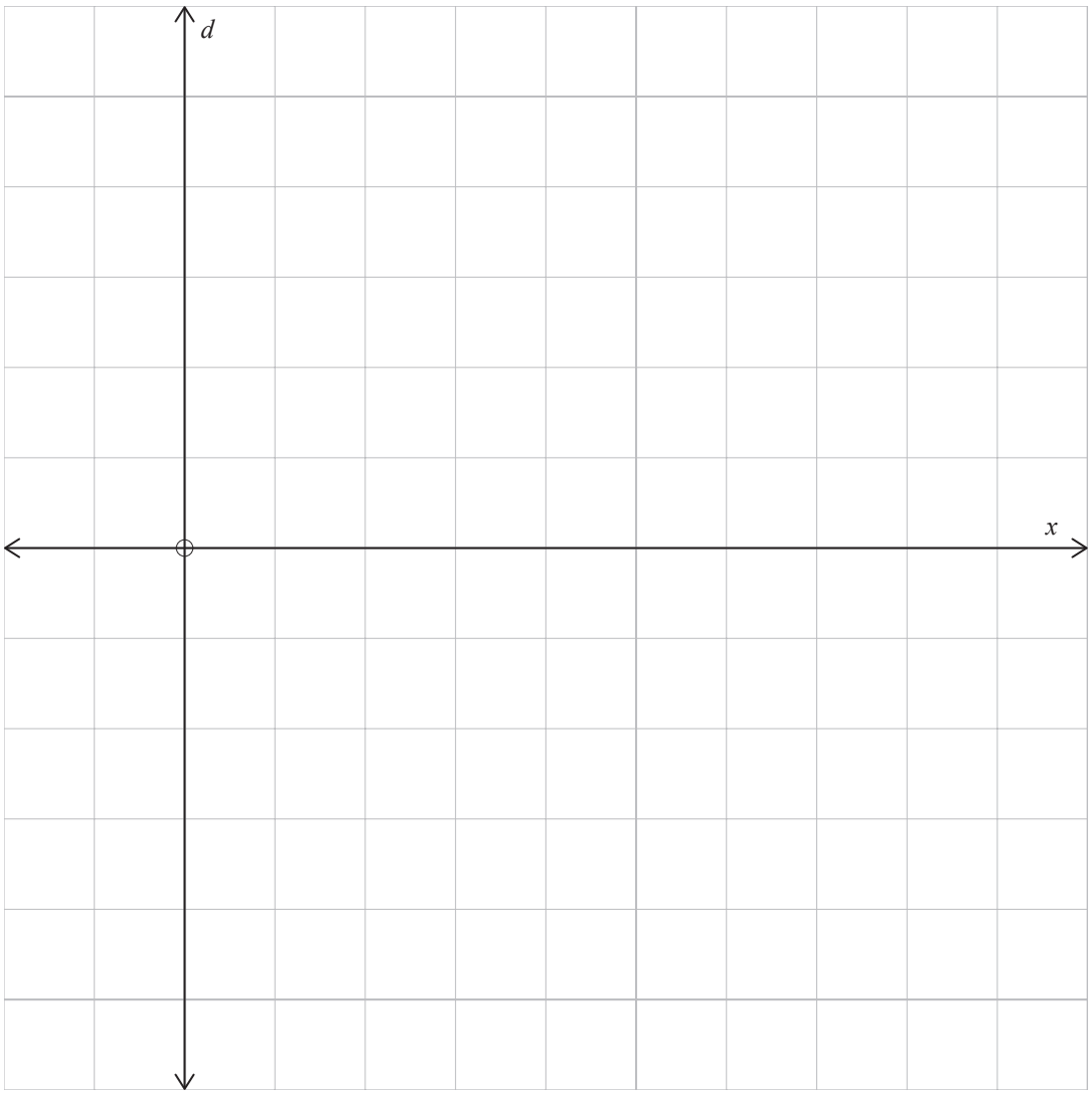


KĀORE i tuhi ā-āwhatatia tēnei hoahoa

Mā te whakamahi i ngā whārite, ngā kauwhata **RĀNEI**, whiriwhiria e hia te whānui o te pokorua o Roger i te **mata o te wai**.

Parahautia tō tuhinga ki ngā whiriwhiringa whānui, mārama hoki.

Ka hiahia pea koe ki te whakamahi i te pepa kauwhata ki te whārangi 19.

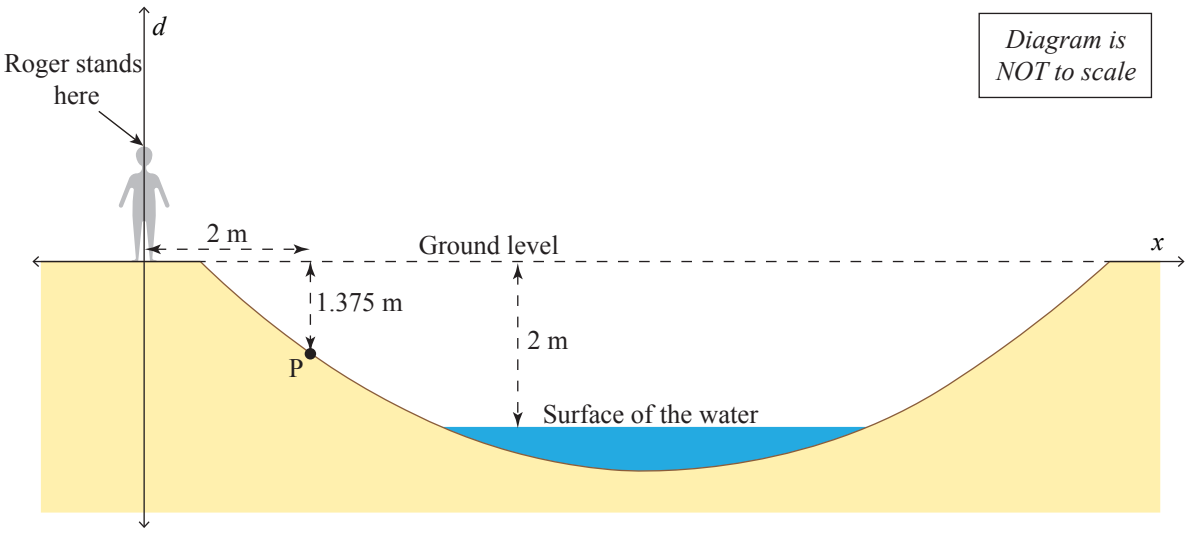

d
x

(iv) Roger's family dug a hole that can be modelled by a quadratic equation, as shown in the diagram below.

The hole's greatest depth is 2.5 metres, at a horizontal distance of 5 metres from Roger.

The hole is 1.375 metres deep at a horizontal distance of 2 metres from Roger (point P on the diagram).

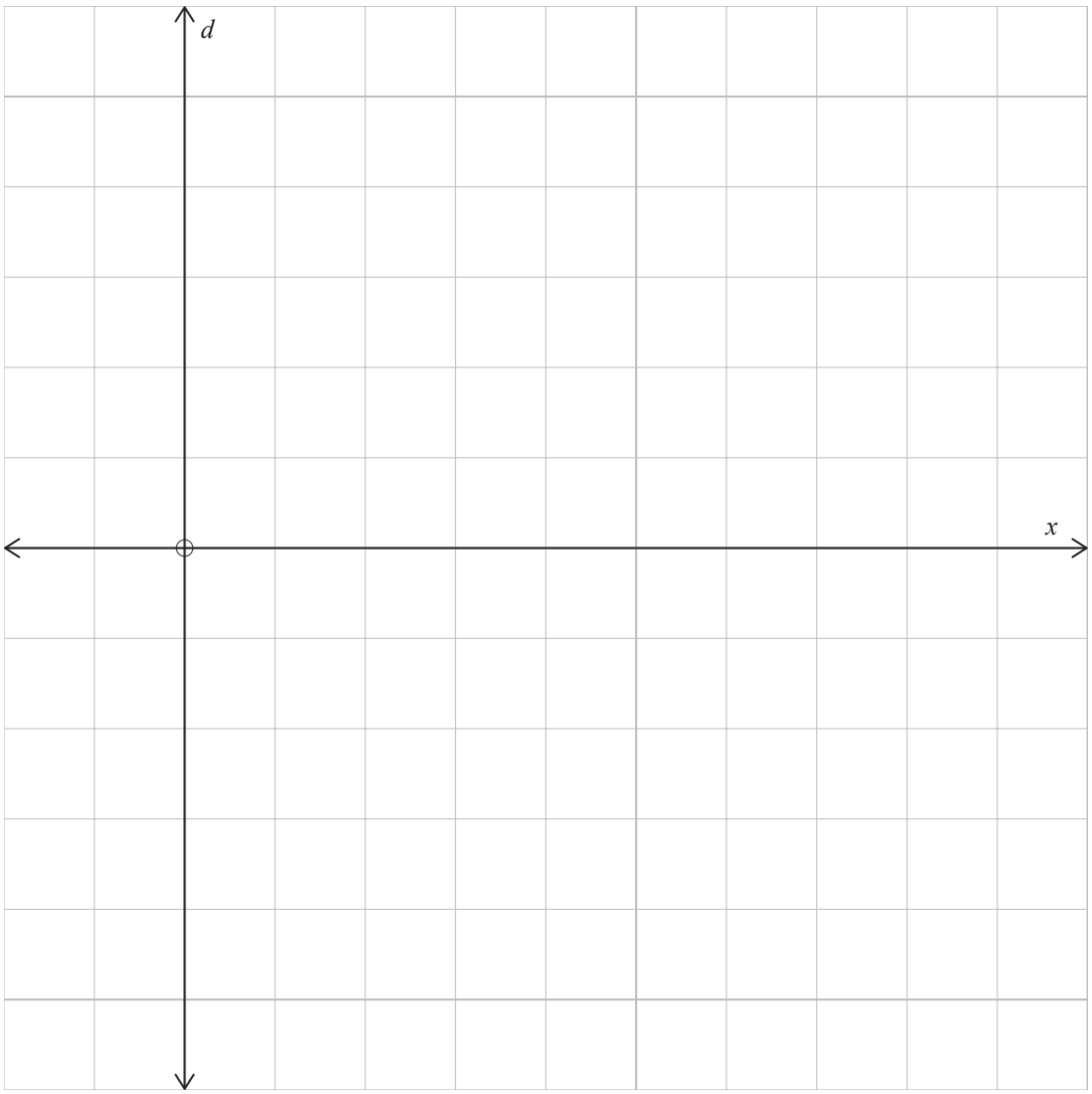
Warm water flows into the hole. The surface of the water is 2 metres below ground level.



Using equations **OR** graphs, find how wide Roger's hole is at the **surface of the water**.

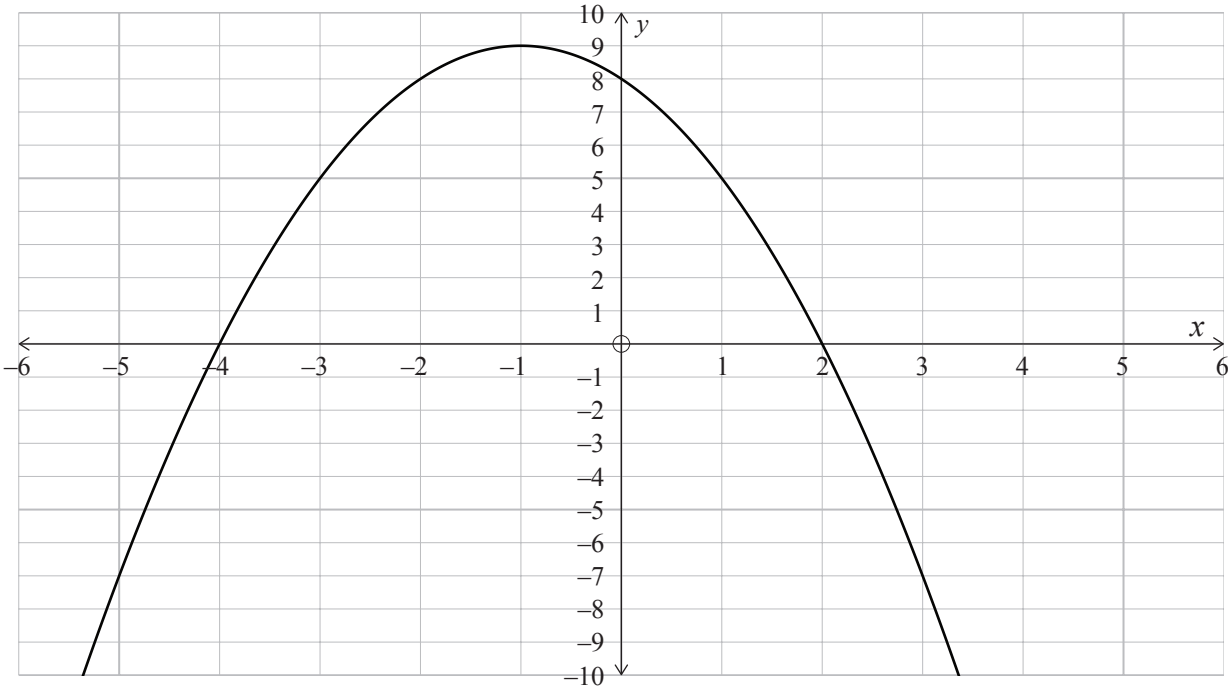
Justify your answer with full and clear working.

You may choose to use the graph paper on page 21.


d
x

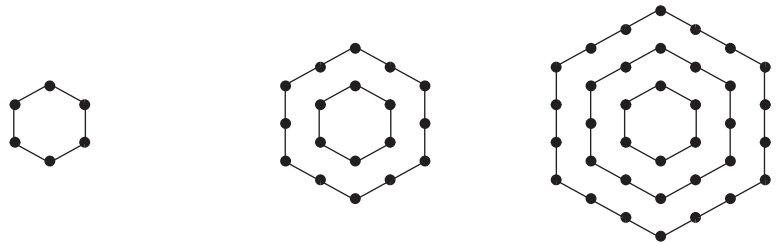
TŪMAHI TUATORU

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



Whārite: _____

(b) I te tātuhi a Zak i ētahi tauira i roto i tana pukapuka, he tātuhi ira kātahi ka tūhonohono haere kia puta ai ngā tapaono.



Tauira 1 **Tauira 2** **Tauira 3**

(i) Whakaotihia te tūtohi e whai ake nei kia puta ai te tapeke o ngā ira i whakamahia i ia tauira.

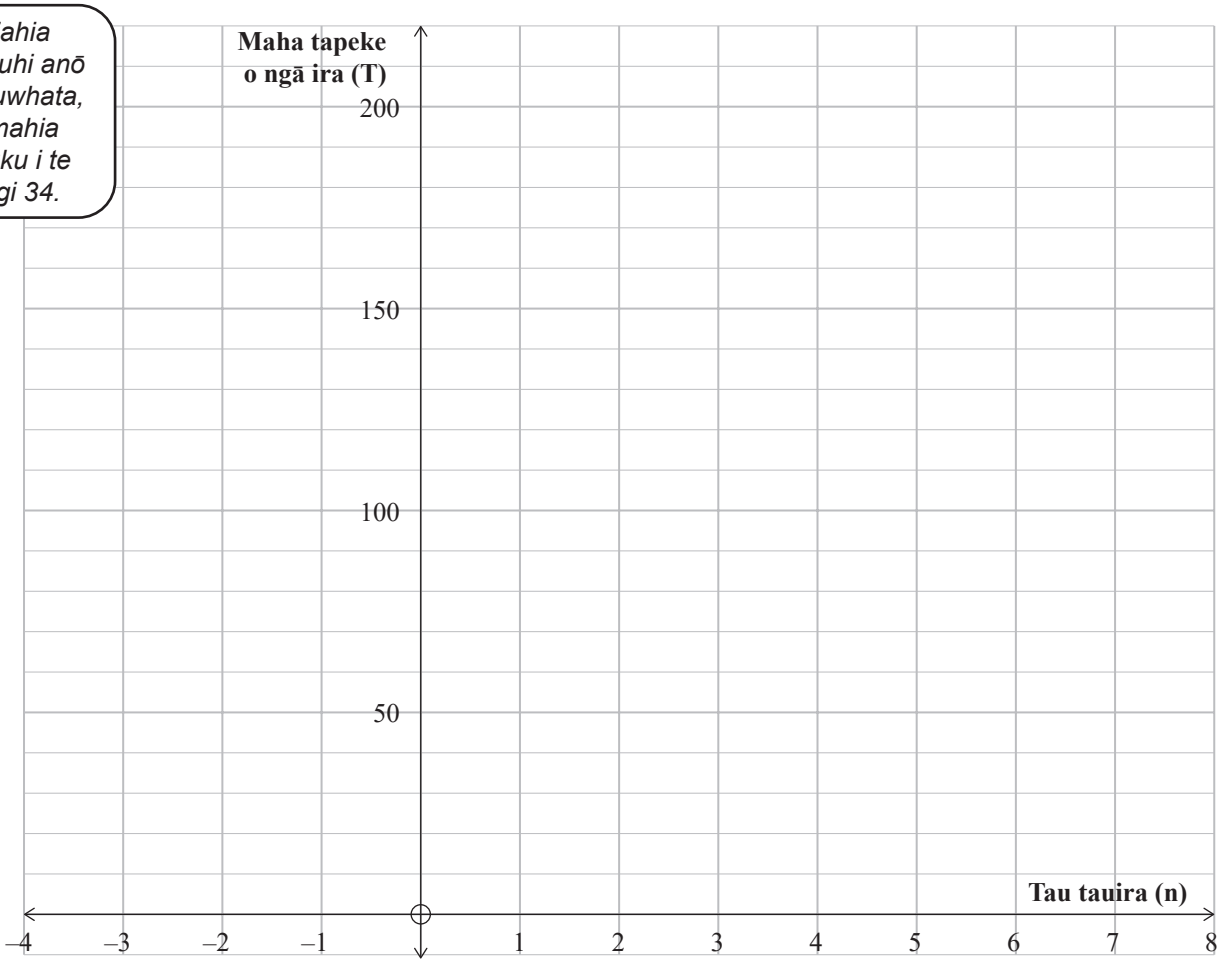
Tau tauira (n)	Maha tapeke o ngā ira (T)
1	6
2	18
3	36
4	
5	

(ii) Whiriwhiria tētahi whārite e whakaatu ana i te tapeke o ngā ira kei tētahi tauira.

Parahautia tō whakautu.

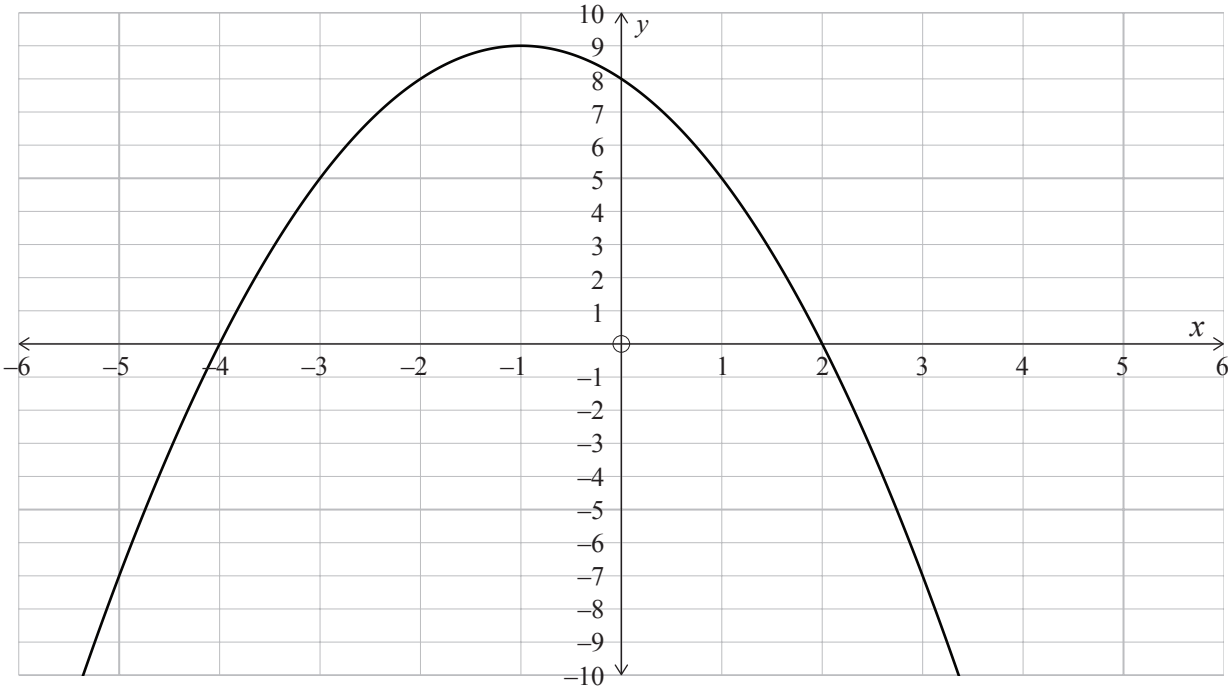
(iii) Whakamahia ngā tuaka i raro hei tātuhi i te kauwhata e tino whakaatu ana i ngā pātahitanga i waenga i te 'Tau tauira' me 'Te tapeke o ngā ira'.

Ki te hiahia koe ki te tuhi anō i tēnei kauwhata, whakamahia te tukutuku i te whārangi 34.



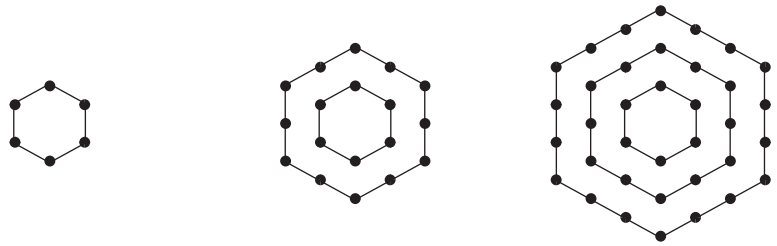
QUESTION THREE

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



Equation: _____

(b) Zak was drawing some patterns in his book, drawing dots and then connecting them to form hexagons.



Pattern 1 **Pattern 2** **Pattern 3**

(i) Complete the table below to give the total number of dots used in each pattern.

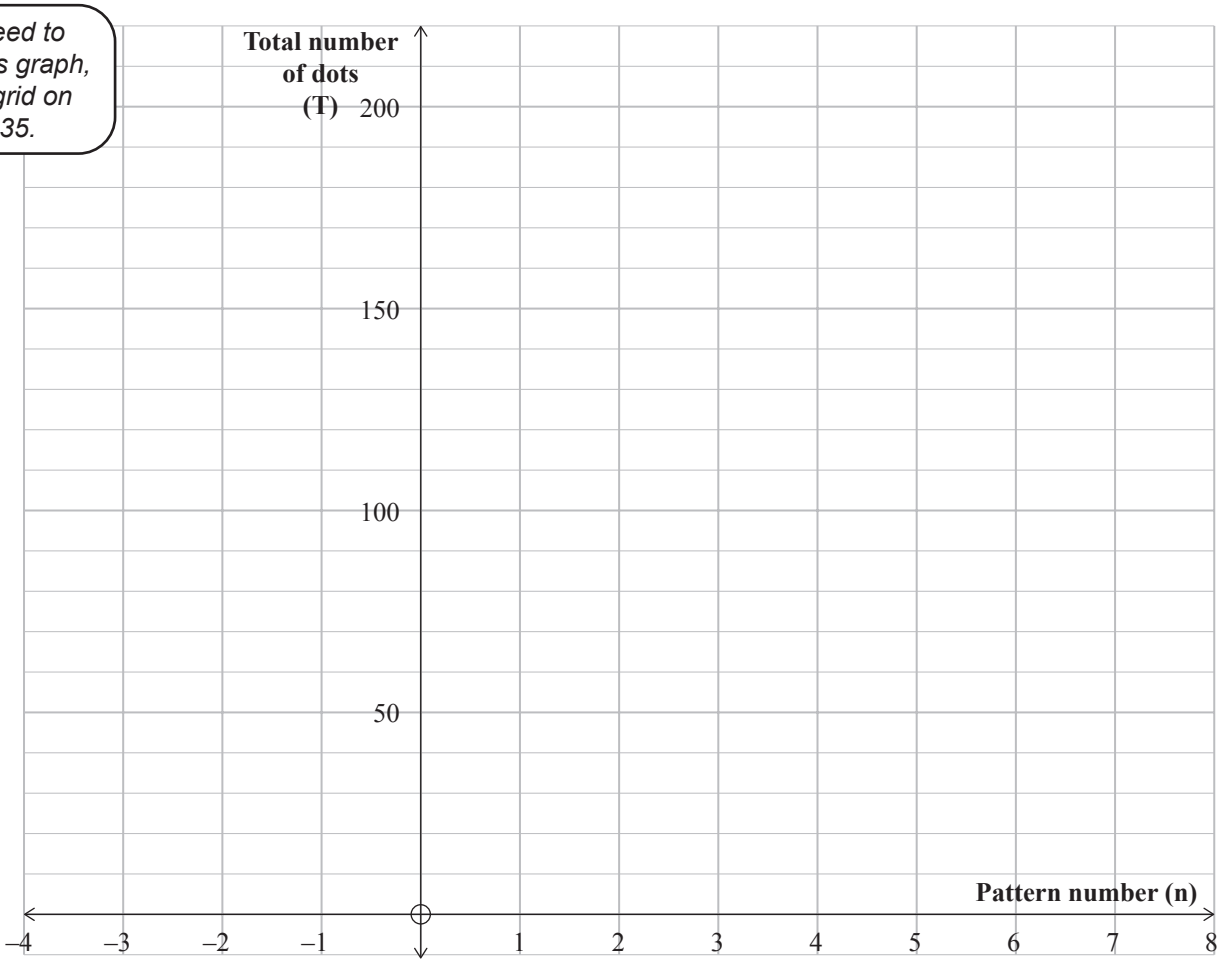
Pattern number (n)	Total number of dots (T)
1	6
2	18
3	36
4	
5	

(ii) Find an equation that represents the total number of dots in any given pattern.

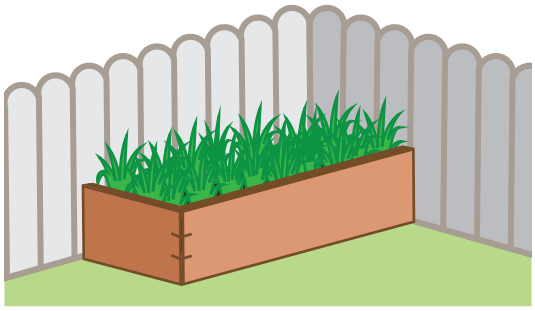
Justify your answer.

(iii) Use the axes below to draw the graph that best represents the relationship between 'Pattern number' and 'Total number of dots'.

If you need to redraw this graph, use the grid on page 35.

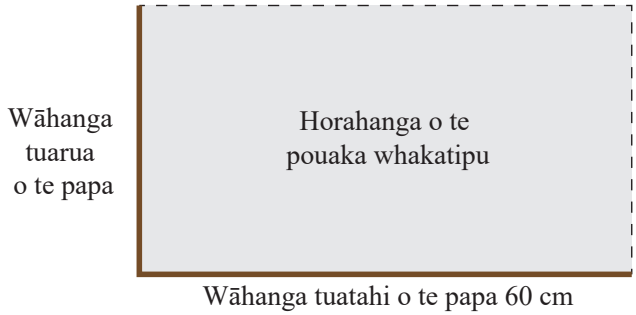


(c) Ka whakahokia mai e Lizzy he papa 60 cm te roa.



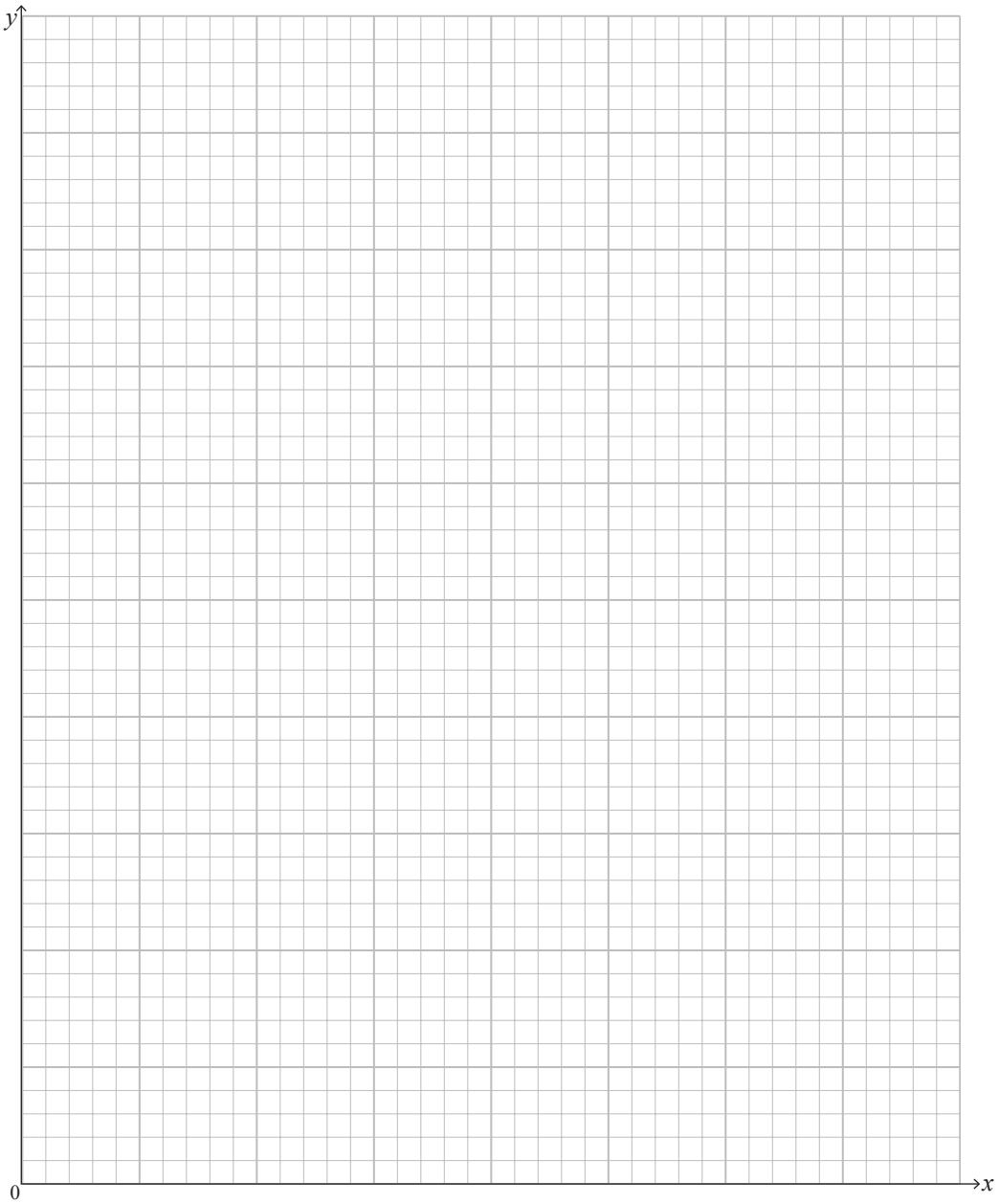
Ka whakarite ia ki te tapahi i te papa ki ngā wāhanga e rua hei hanga i tētahi pouaka whakatipu tapawhā-hāngai iti kei te kokonga o tana māra, ki te taha tonu o te taiapa (nō reira me hanga ia i ngā taha e rua anake).

E whakaaturia ana te whakaritenga e hiahiatia ana i raro.



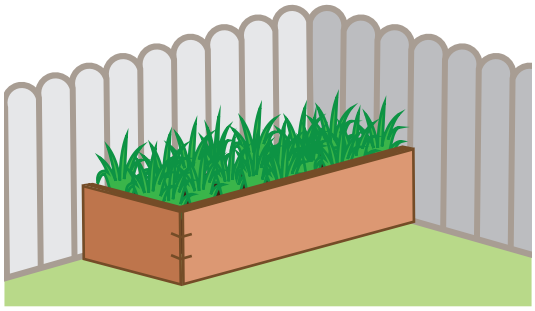
Whakamahia ngā tūtohi, ngā whārite **me** ngā kauwhata hei tūhura i te hononga i waenga i ngā roa o ngā wāhanga e rua me te horahanga o te pouaka whakatipu.

Homai kia TORU i te iti rawa ngā tākupu e whai ana i tō tūhuratanga.

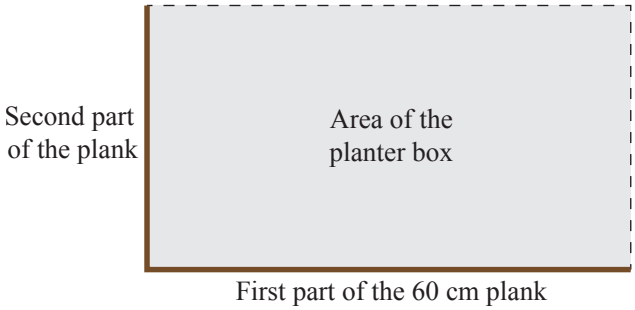

y
0
x

(c) Lizzy has brought home a 60 cm-long plank of wood.

She plans to cut this plank into two parts to make a small rectangular planter box in the corner of her garden, up against the existing fence (so she needs to make only two sides).

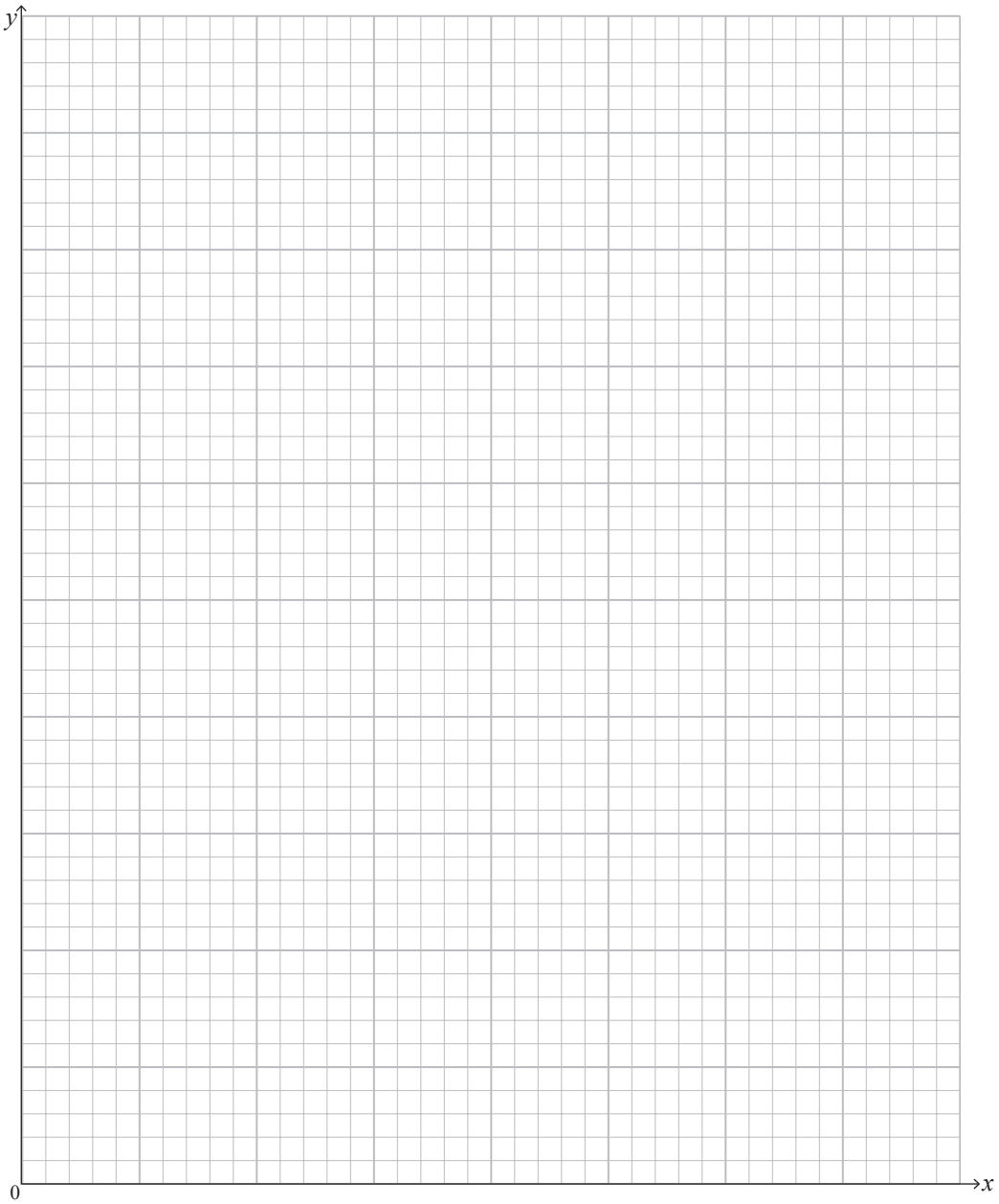


The required set-up is shown below.



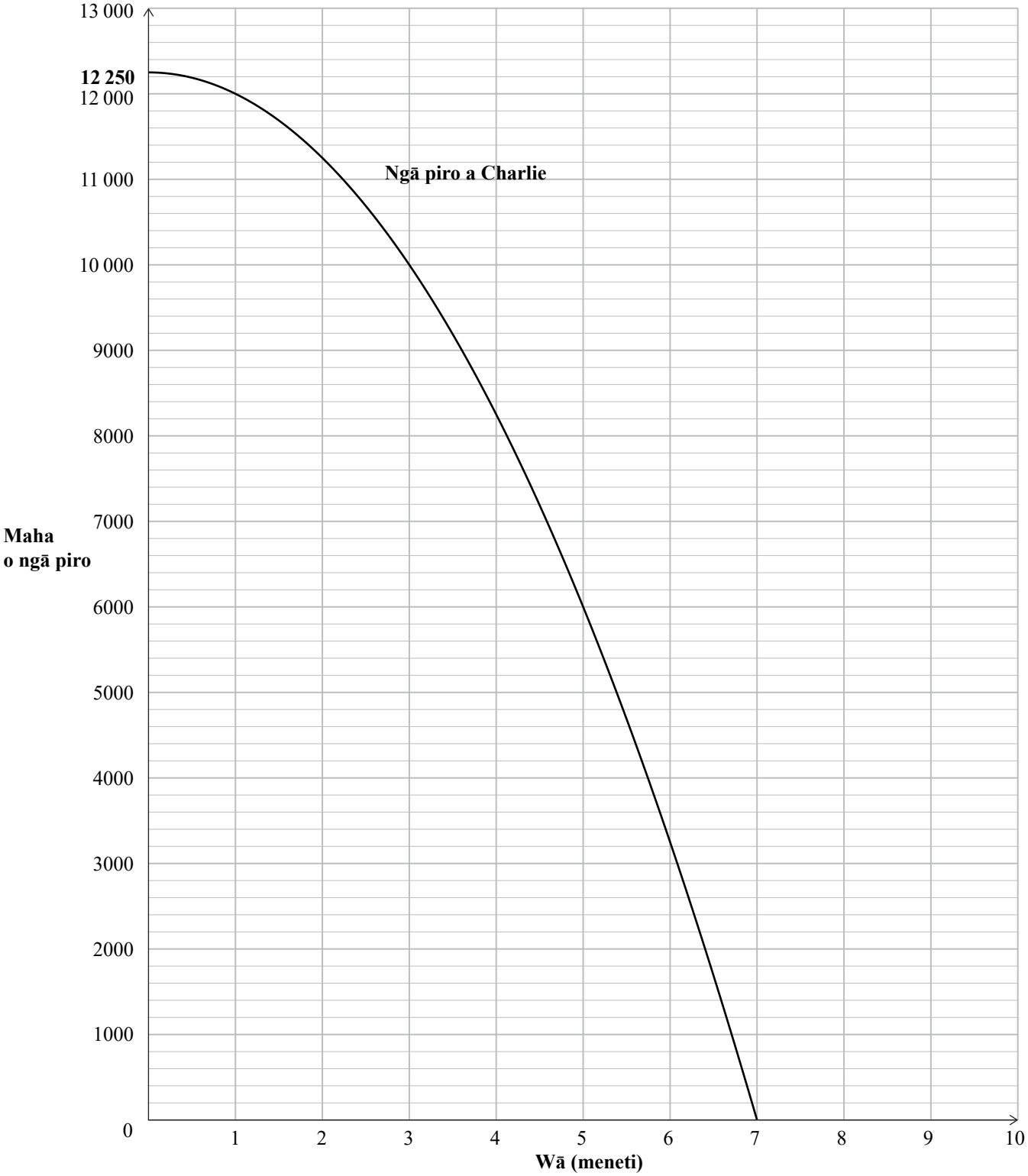
Use tables, equations, **and** graphs to investigate the relationship between the lengths of the two parts and the area of the planter box.

Provide at least THREE comments that follow from your investigation.


y
0
x

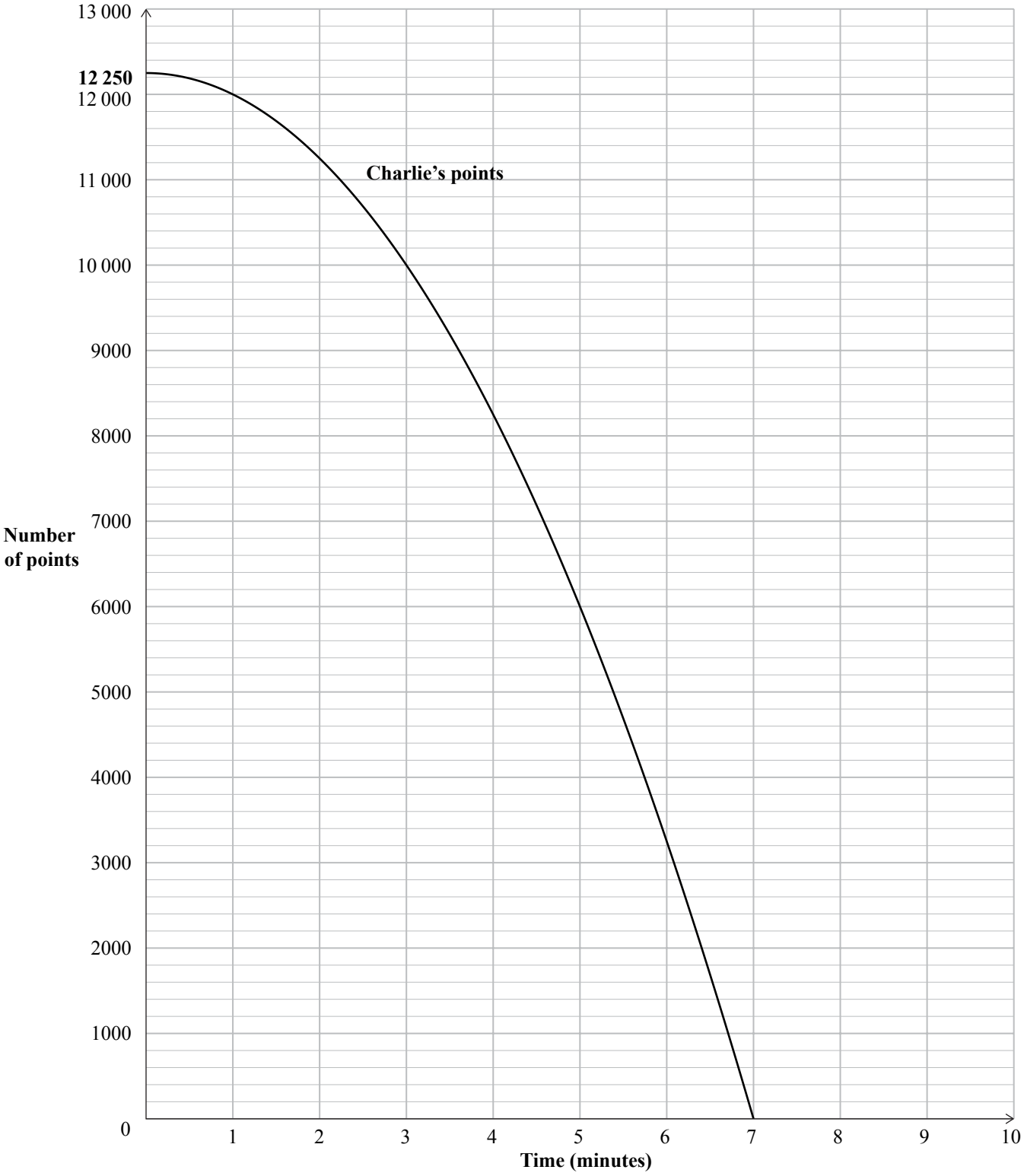
NGĀ TUKUTUKU TĀPIRI

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

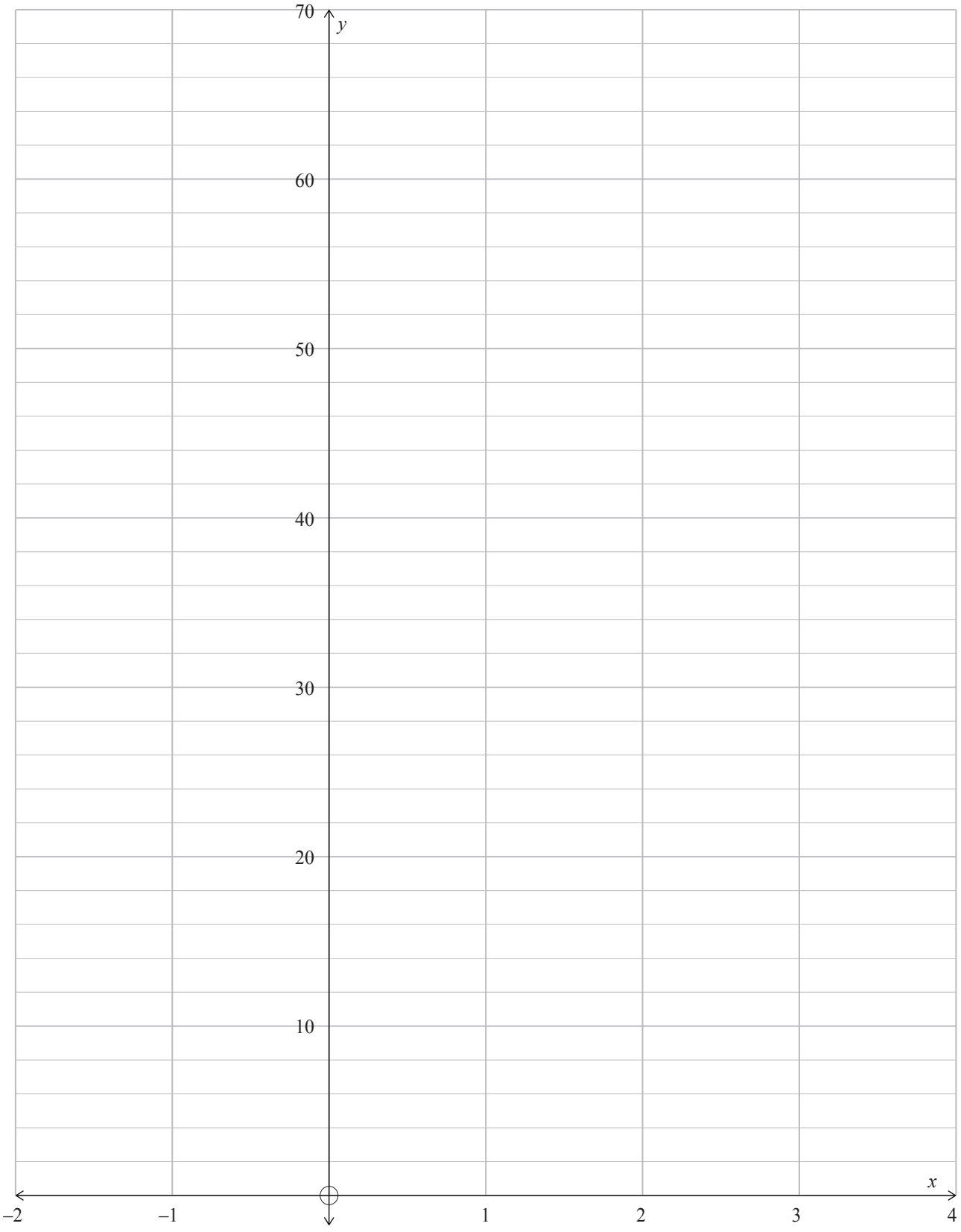


SPARE GRIDS

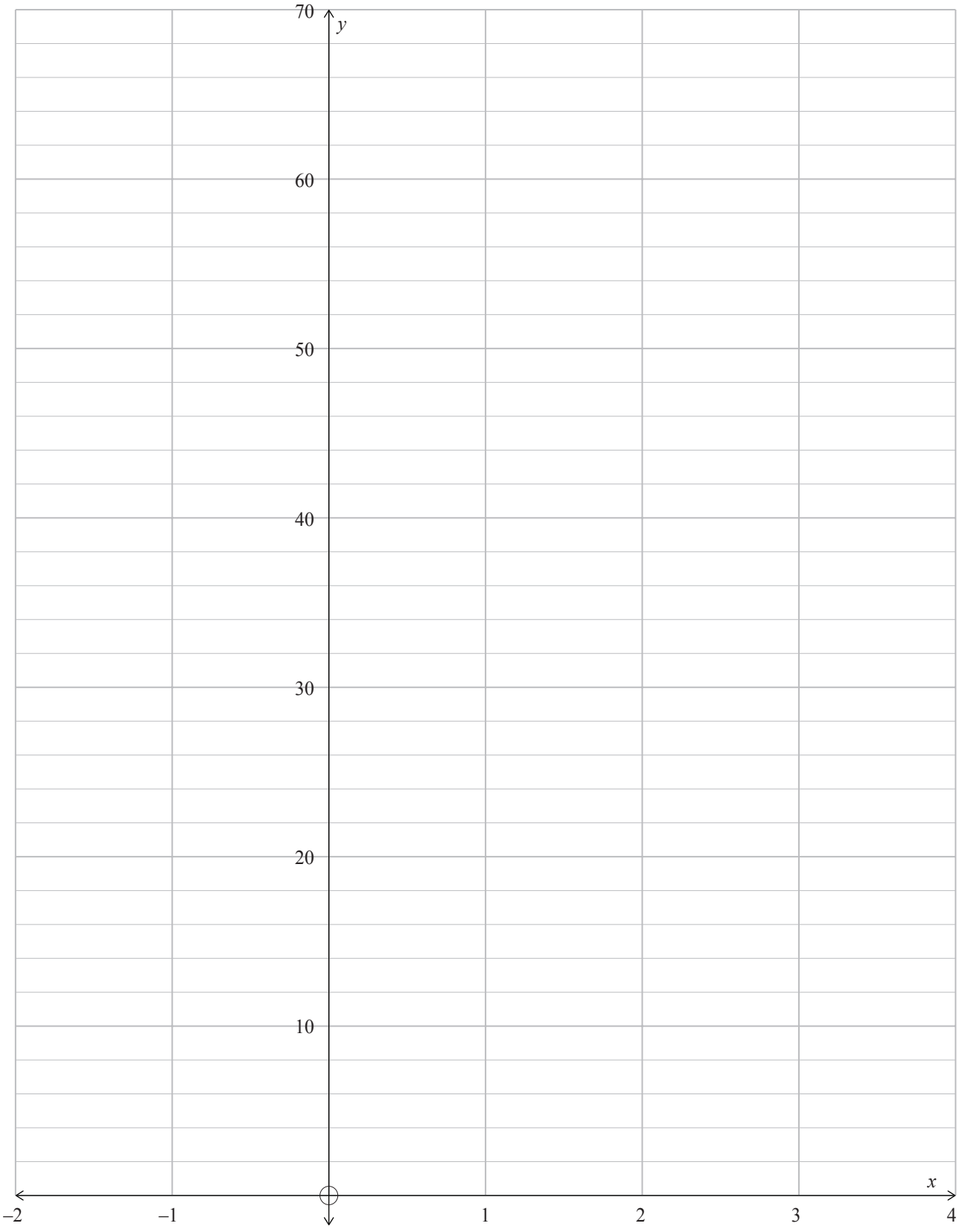
If you need to redo Question One (b), use the grid below. You should make it clear which answer you want marked.



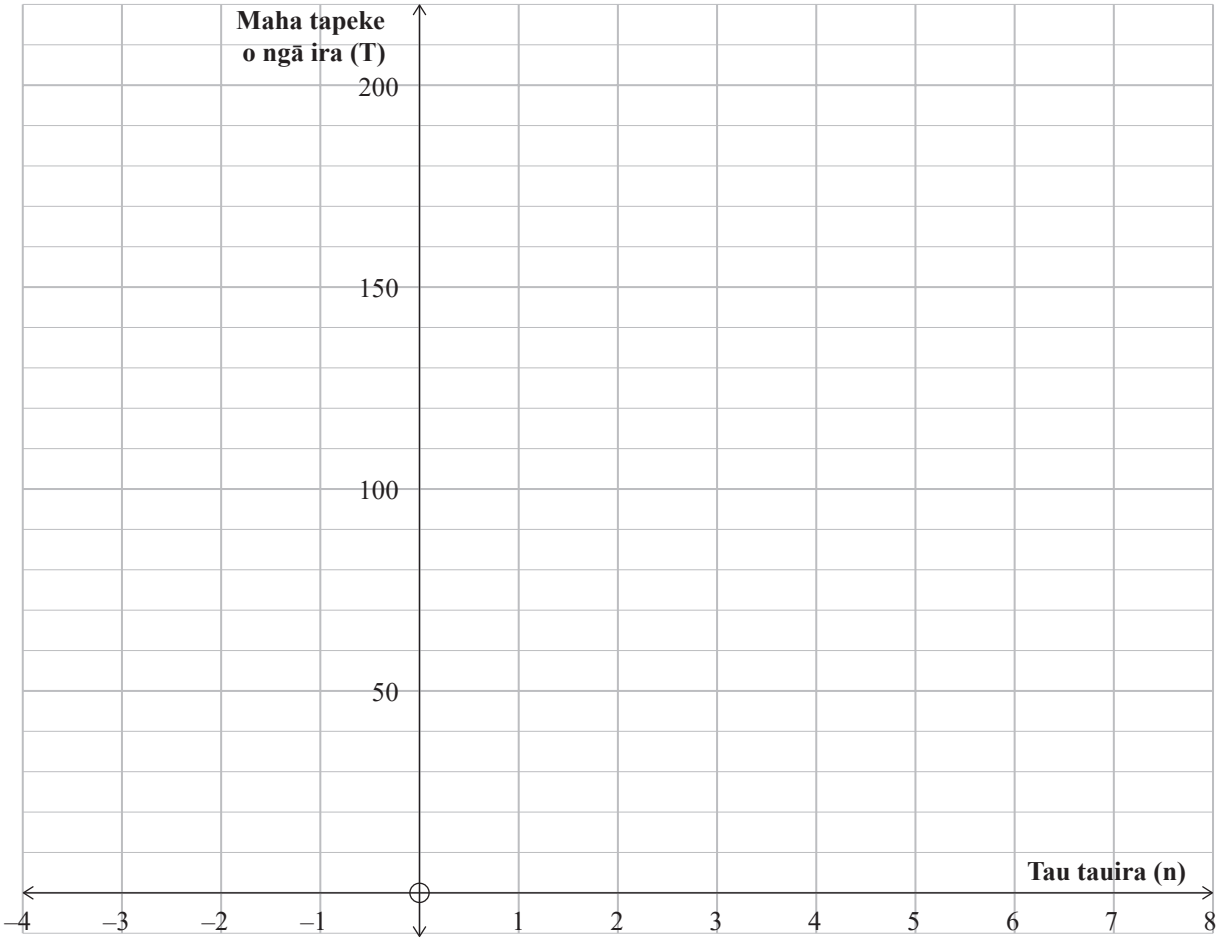
Ki te hiahia koe ki te tātuhi anō i tō urupare ki te Tūmahi Tuarua (a), whakamahia te tukutuku i raro nei.
Kia mārama tonu tō tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.



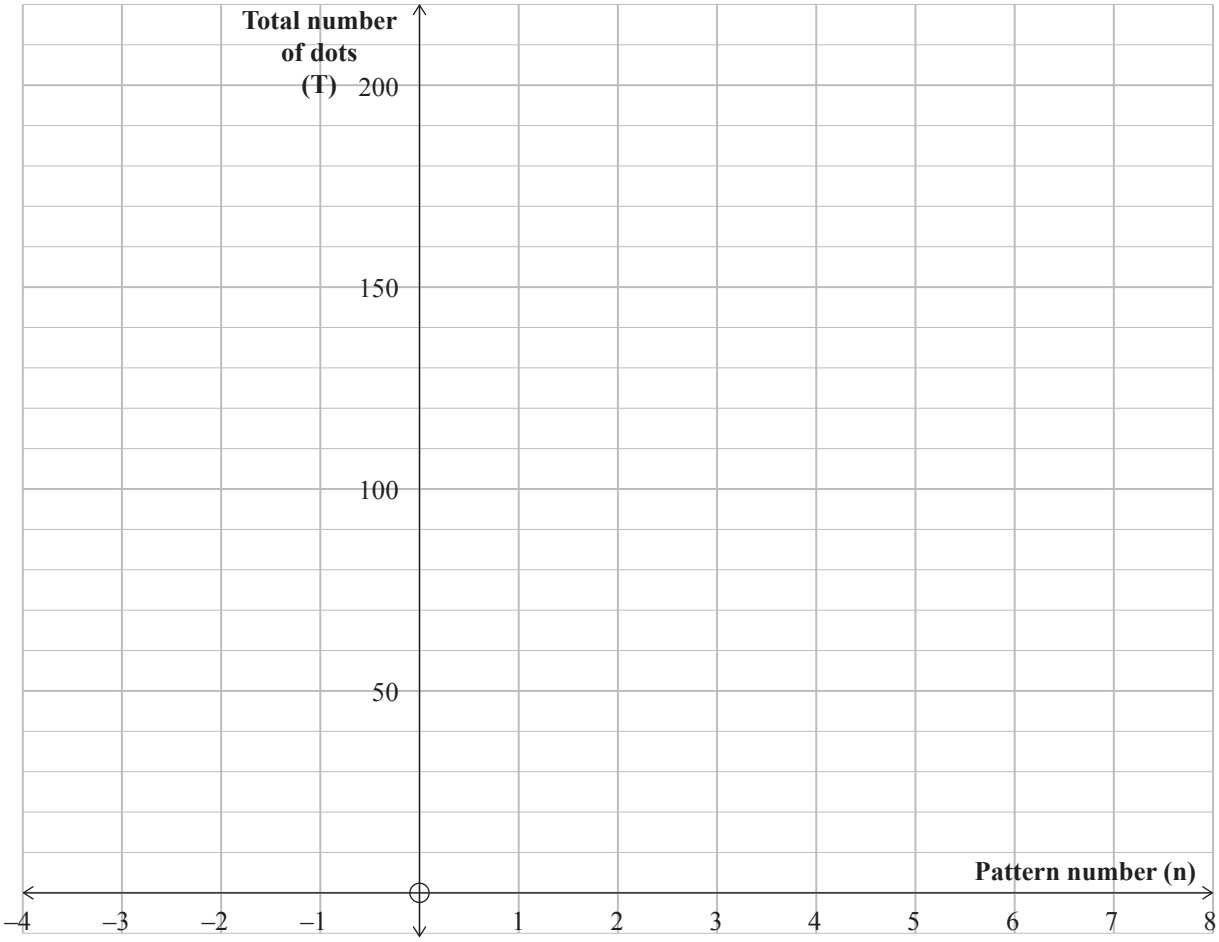
If you need to redo Question Two (a), use the grid below. You should make it clear which answer you want marked.



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



If you need to redo Question Three (b)(iii), use the grid below. You should make it clear which answer you want marked.



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

TAU TŪMAHI

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

QUESTION NUMBER

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

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 1 Mathematics and Statistics 2021

91028M Investigate relationships between tables, equations and graphs

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.

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 2–39 in the correct order and that none of these pages is blank.

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

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