See back cover for an English translation of this cover

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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 koe i tuhi kōrero ki tēnei pukapuka

Te Pāngarau me te Tauanga, Kaupae 1, 2022

91028 Te tūhura i ngā hononga i waenga i ngā tūtohi, i ngā whārite, me ngā kauwhata

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te tūhura i ngā hononga i waenga i ngā tūtohi, i ngā whārite, me ngā kauwhata.	Te tūhura i ngā hononga i waenga i ngā tūtohi, i ngā whārite, me ngā kauwhata mā roto i te whakaaro pānga.	Te tūhura i ngā hononga i waenga i ngā tūtohi, i ngā whārite, me ngā kauwhata mā roto 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 o runga ake i tēnei whārangi.

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

Whakaaturia ngā whiriwhiringa KATOA.

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

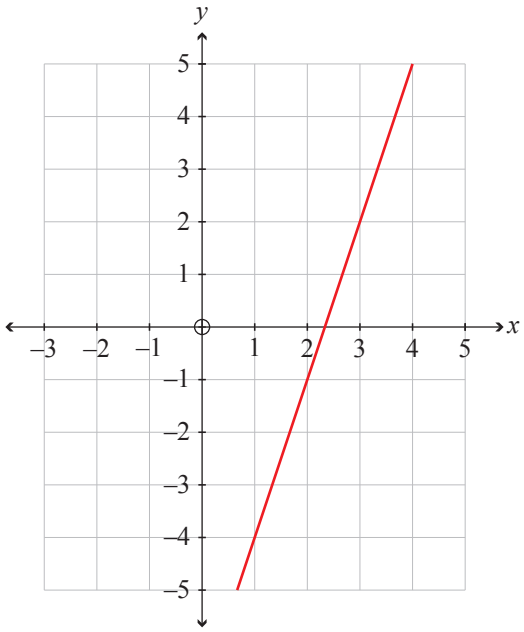
Tirohia kia kitea ai e tika ana te raupapa o ngā whārangi 2–43, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

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

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

TE TŪMAHI TUATAHI

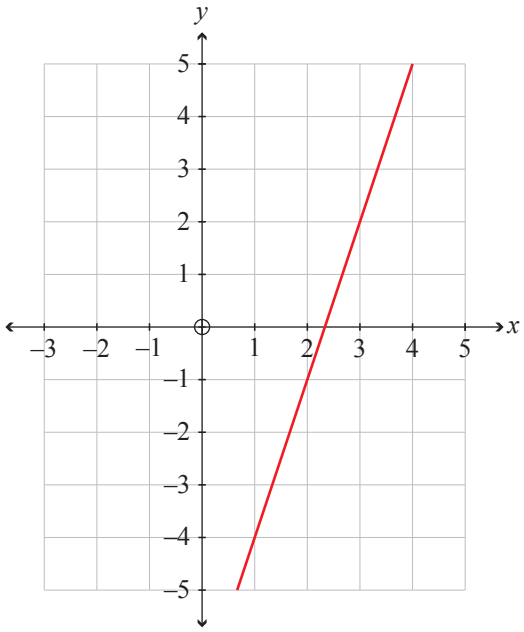
(a) Tuhia te whārite mō te kauwhata kei raro nei.



Te whārite: _____

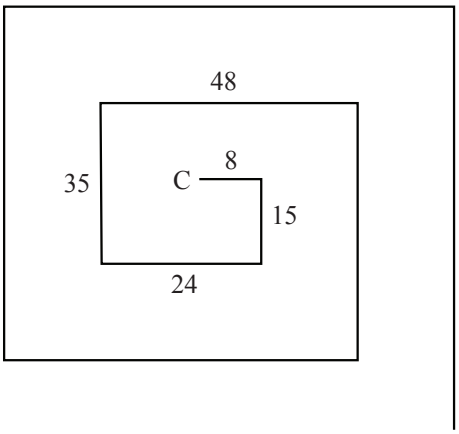
QUESTION ONE

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



Equation is: _____

(b) E whakaatu ana te hoahoa kei raro nei i ngā taha 10 tuatahi o tētahi tauira tōrino, e tīmata ana i te pokapū C. E tohua ana hoki te roa, ā-mitarau, o ngā taha e 5 tuatahi.



KĀORE i tuhia ā-āwhatatia te hoahoa

Kei te tūtohi kei raro nei te roa o ia taha.

Te tau o te taha (n)	Te roa o te taha (L) (cm.)
1	8
2	15
3	24
4	35
5	48
6	
7	
8	

(i) Whiriwhiria he whārite hei whakaata i te roa o te taha, *L,* ahakoa te tau o te taha, *n*, i tēnei tauira tōrino.

Parahautia tō whakautu.

(b) The diagram below shows the first 10 sides of a spiral pattern, starting at the central point C.
It also gives the lengths, in cm, of the first 5 sides.

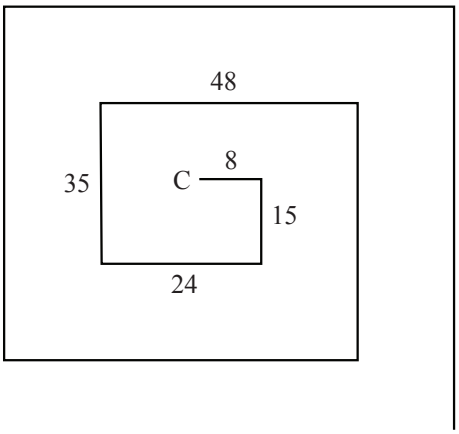


Diagram is NOT to scale

The length of each side is shown in the table below.

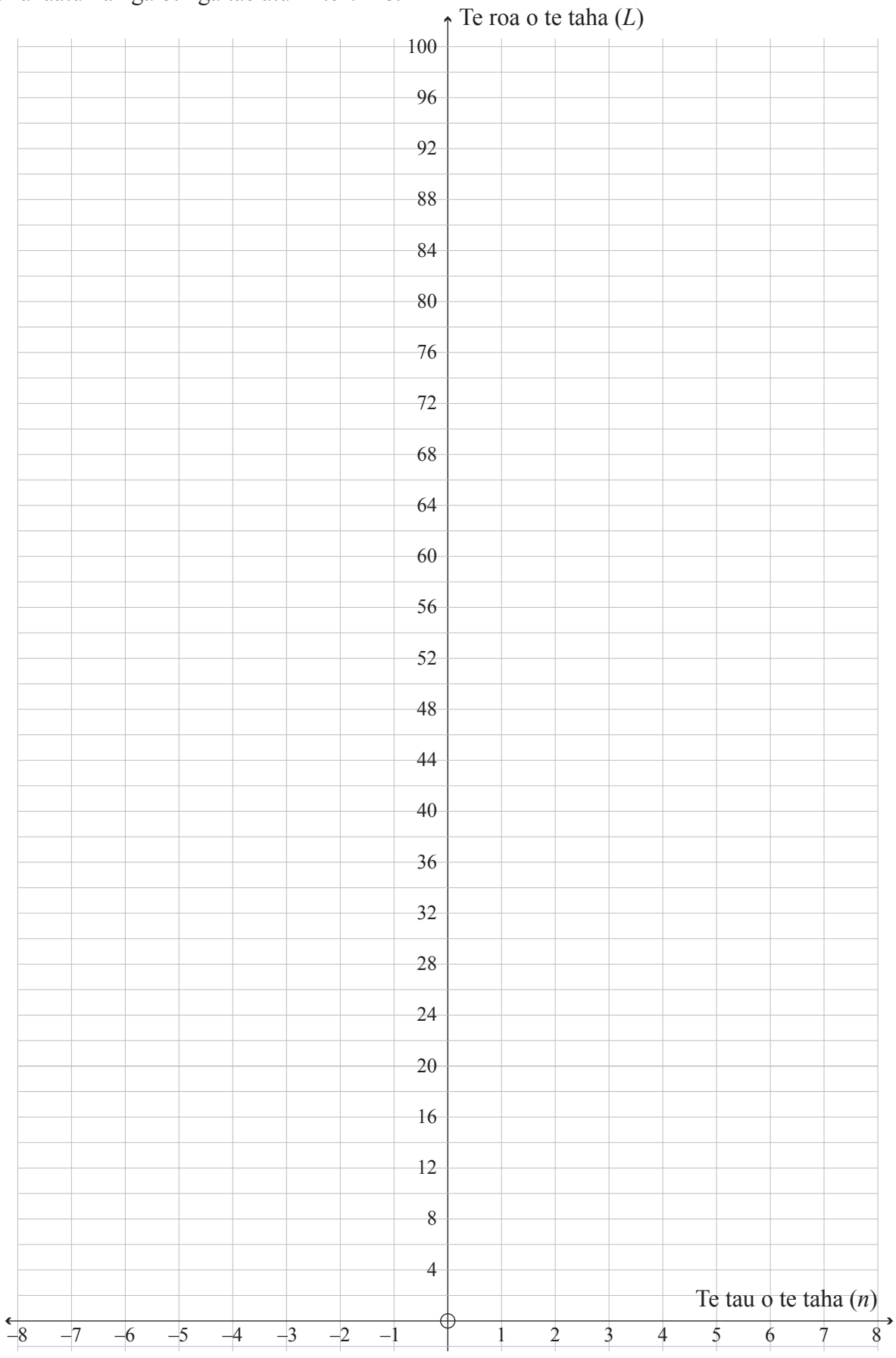
Side number (n)	Side length (L) (cm.)
1	8
2	15
3	24
4	35
5	48
6	
7	
8	

(i) Find an equation that represents the side length, L, for any given side number, n, in this spiral pattern.

Justify your answer.

(ii) Mā te whakamahi i ngā tuaka kei raro nei, tuhia mai he kauwhata hei whakaatu i te tauira i (b)(i).

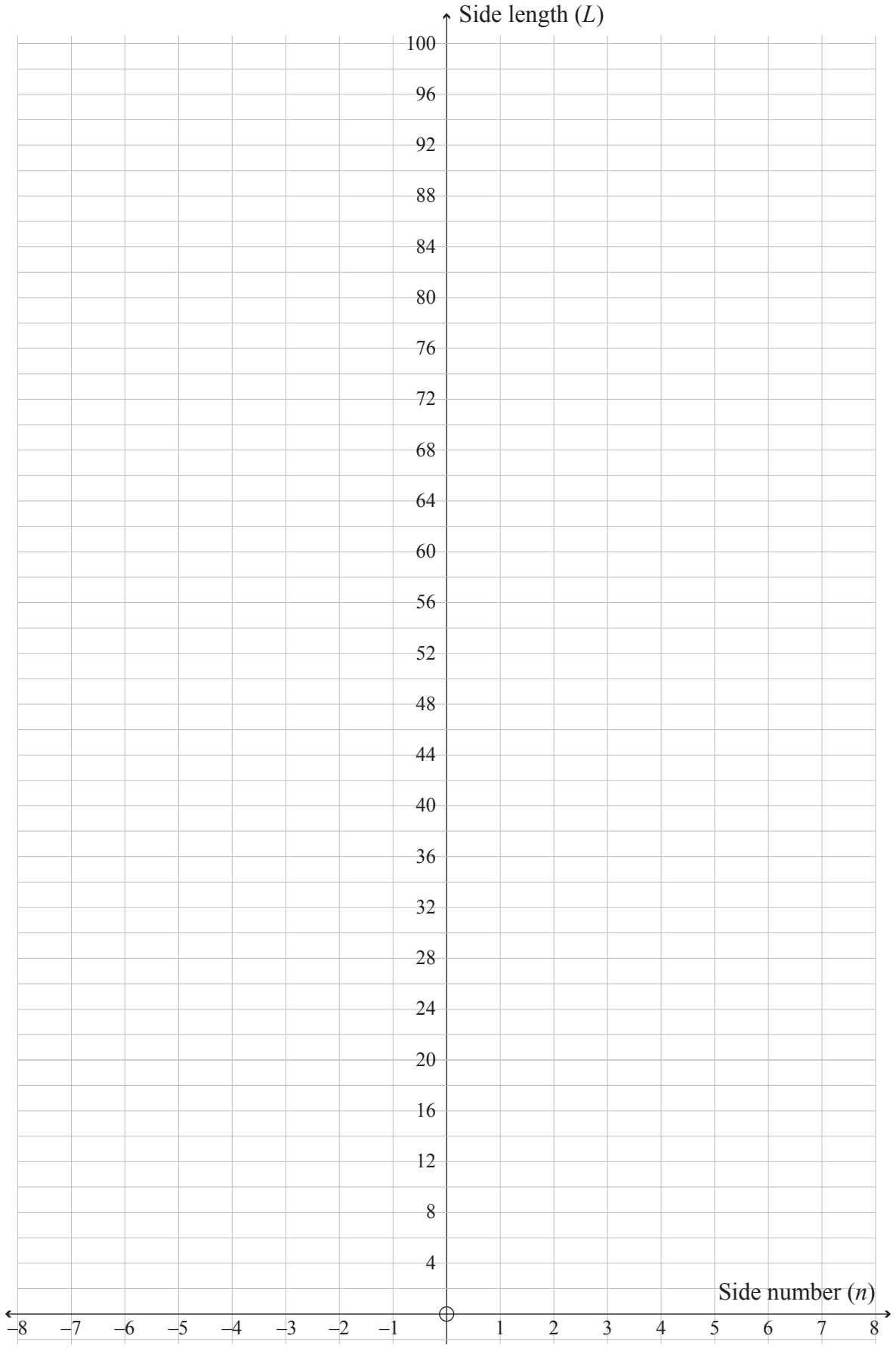
Whakaatuhia ngā otinga tae atu ki te $n = 8$.



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

(ii) Using the axes below, draw the graph to show the pattern in (b)(i).

Show the results as far as $n = 8$.



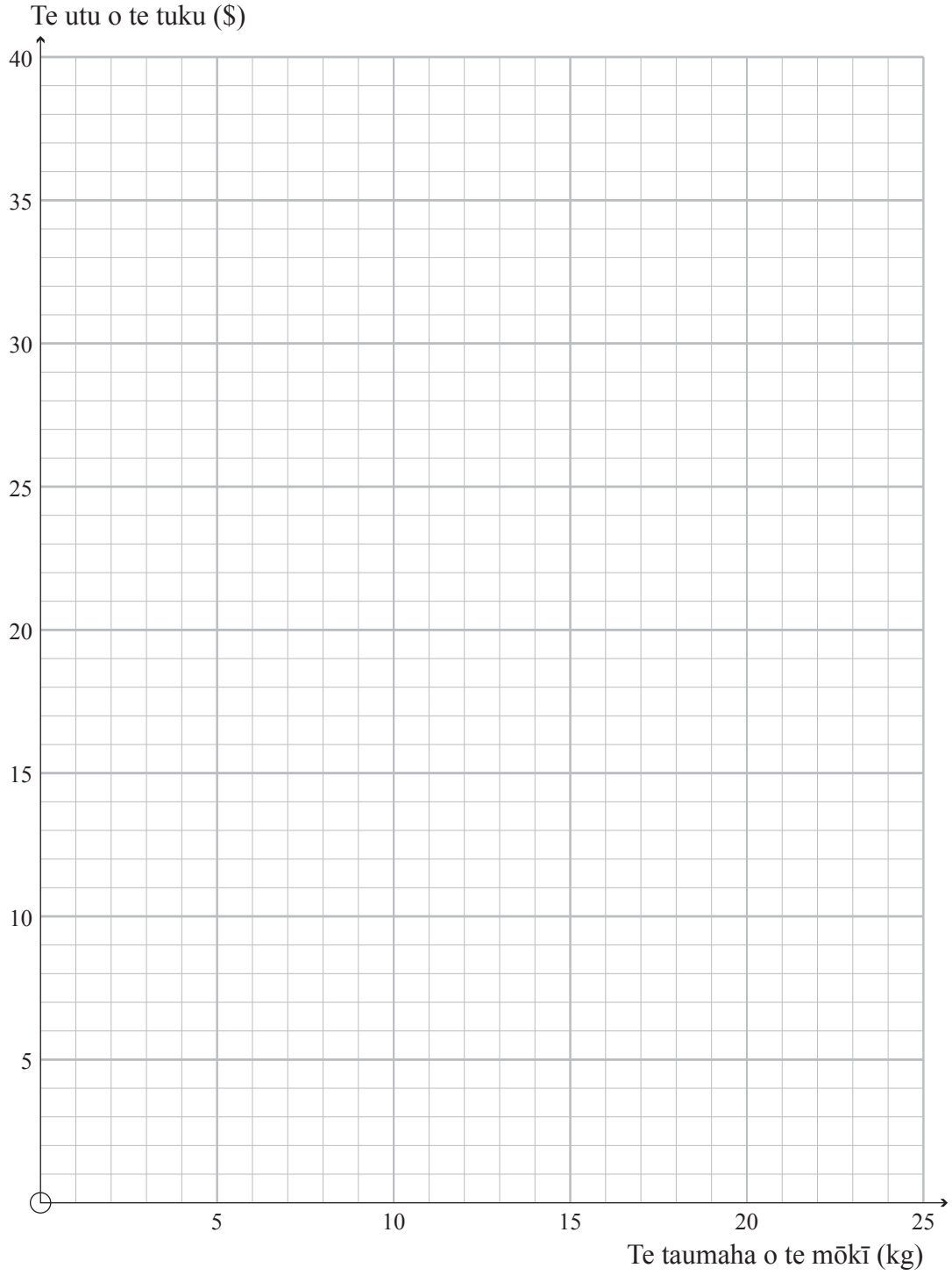
If you need to redraw your graph, use the grid on page 33.

(c) Ka whakatau tētahi umanga karere, a *Parcels to You*, i te utu o te tuku e ai ki te taumaha o te mōkī.

Mēnā e iti iho ana te taumaha o te mōkī i te 6 kg, ka $8 te utu o te tuku.

Mēnā ka 6 kg, e nui ake ana rānei i tēnā, te taumaha o te mōkī, ka $1.50 te utu i ia kg, ā, ka āpitihia hoki te $1 i ia mōkī tae atu ki te 25 kg te taumaha.

(i) Tuhia he kauwhata tika ki te tukutuku kei raro nei, e whakaatu ana i te utu o te tuku e hāngai ana ki te taumaha o ngā mōkī ka tukuna e *Parcels to You*.



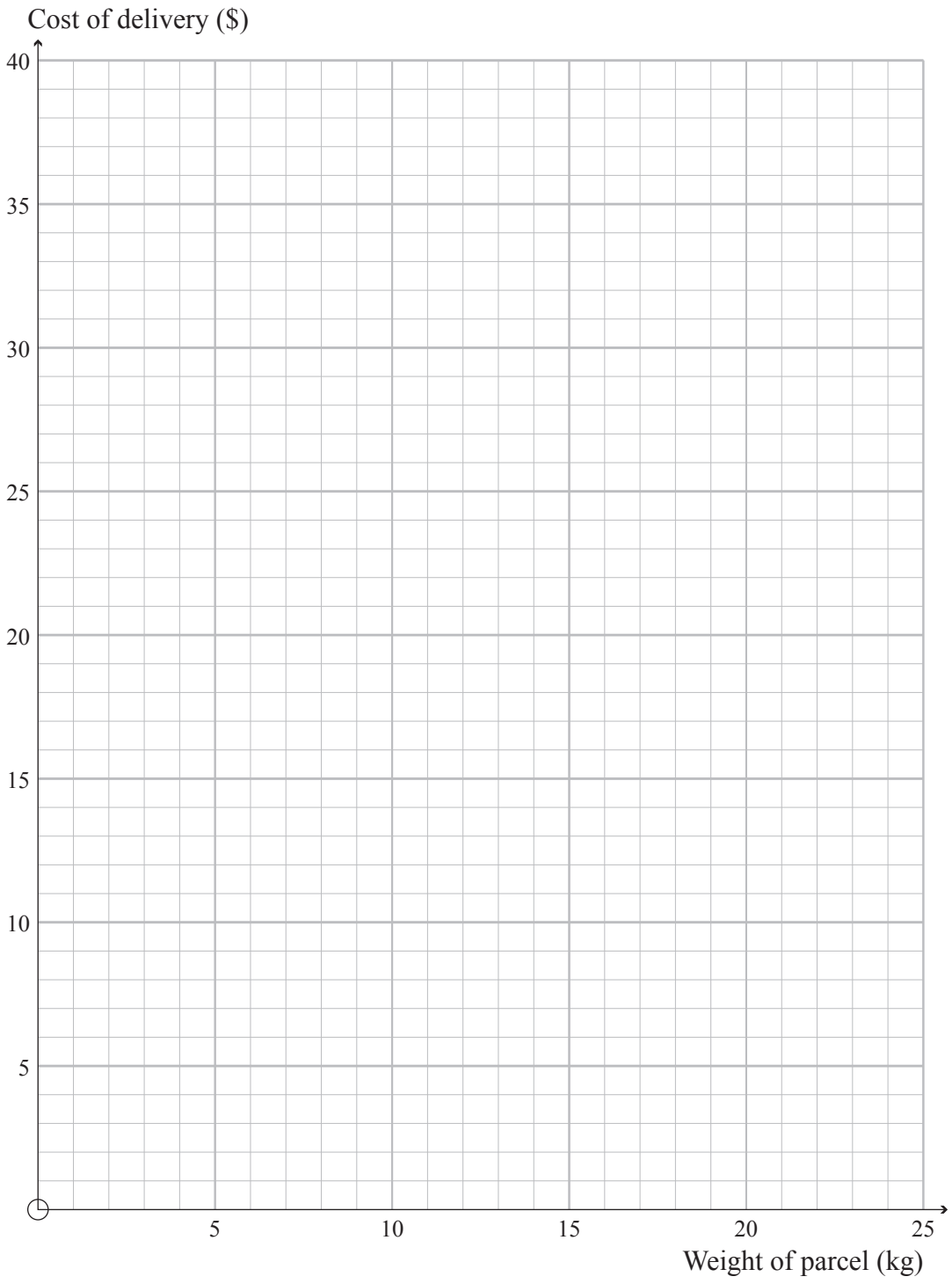
Ki te hiahia koe ki te tuhi anō i tō kauwhata, whakamahia te tukutuku kei te whārangi 34.

(c) A courier company, *Parcels to You*, decides on the cost of delivery, according to the weight of the parcel.

If a parcel weighs less than 6 kg, then the cost of the delivery will be $8.

If a parcel weighs 6 kg or more, then the charge will be at a rate of $1.50 per kg, plus an extra fixed cost of $1 for each parcel up to a weight of 25 kg.

(i) On the grid below, plot an accurate graph showing the cost of delivery for the weights of parcels delivered by *Parcels to You*.



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

(ii) Kei tētahi atu umanga karere, kei a *Hohoro Delivery*, tā rātou ake mahere utu hei tātai i te utu o te tuku i ngā mōkī.

E $2 i ia kg te utu whānui a *Hohoro Delivery* ki te tuku i ngā mōkī kei raro iho i te 15 kg te taumaha.

Engari, mēnā ka noho te taumaha o te mōkī ki waenga i te 15 kg me te 25 kg, ka pūmau te utu ki te $34.

Whakatauritea ngā utu o te tuku mōkī mā *Parcel to You,* me te tuku mā *Hohoro Delivery*.

Me whakaatu taunakitanga koe mō ngā whārite, mō ngā tau, ME ngā kauwhata.

(Whakamahia te tukutuku i te wāhanga (i) kei te whārangi 8 hei tuhi i tō kauwhata mō *Hohoro Delivery*.)

(ii) Another courier company, *Hohoro Delivery*, has their own pricing plan for calculating the cost of delivering parcels.

Hohoro Delivery charge a standard delivery rate of $2 per kg, for parcels up to a weight of 15 kg.

If, however, a parcel weighs from 15 kg up to 25 kg, then the charge will be a fixed cost of $34.

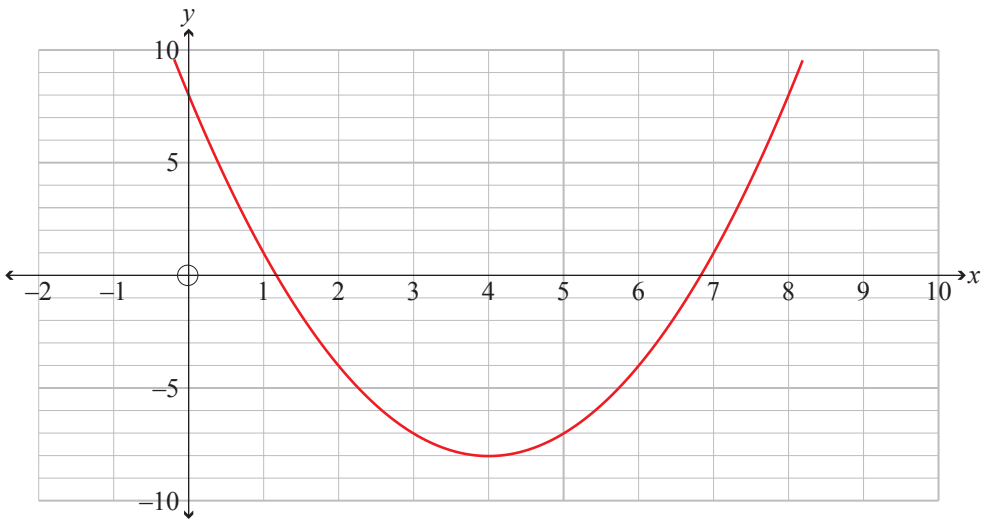
Compare the costs of delivering parcels using *Parcel to You* and *Hohoro Delivery*.

You should provide evidence of all equations, domains, AND graphs.

(Use the grid from part (i) on page 9 to draw your graph for *Hohoro Delivery*.)

TE TŪMAHI TUARUA

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



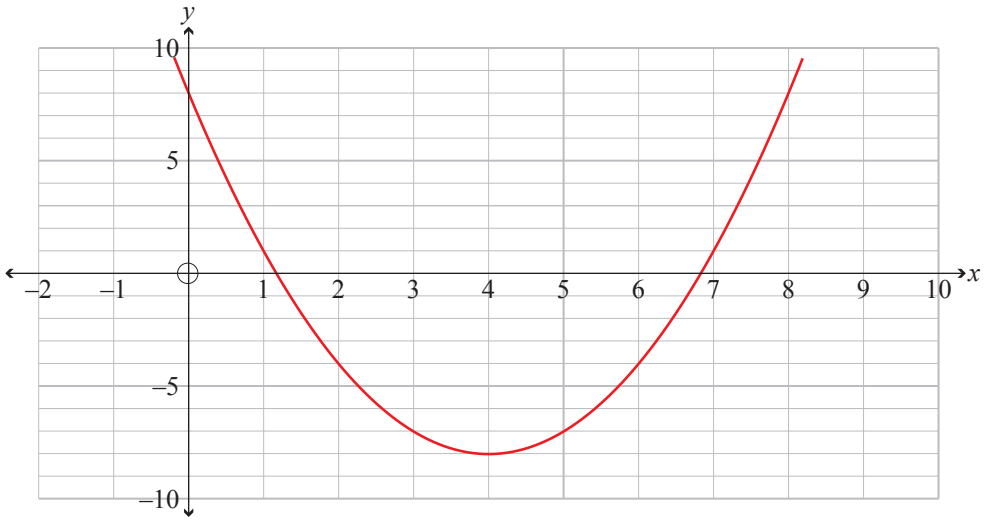
Te whārite: _____

(ii) Whakaahuatia, ki te kupu, te whakatauritenga o te taunga me te āhua o te kauwhata o $y = 4(x + 8)^2 + 16$ ki te kauwhata kei runga nei.

Me kaua e iti iho i te RUA ngā kōrero taunaki.

QUESTION TWO

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



Equation is: _____

(ii) Describe, in words, how the position and shape of the graph of $y = 4(x + 8)^2 + 16$ compares to the graph above.

Give at least TWO supporting statements.

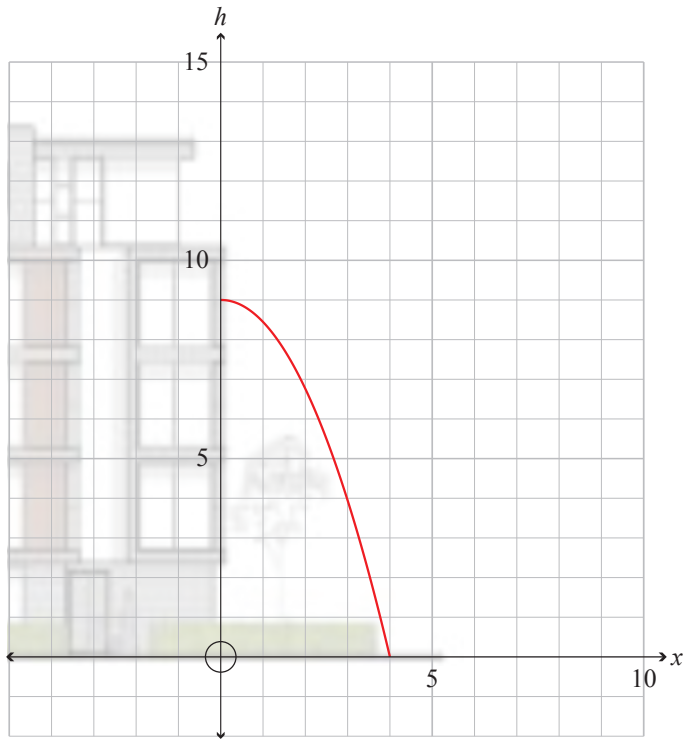
(b) I whiu a Hemi i tētahi pōro i te matapihi i tōna wharenoho i te papa tuatoru.

E 9 mita te teitei o te matapihi i runga ake i te papa.

I rere iho te pōro, i tēnei taumata teitei katoa, i te ara unahi e whakatauirahia ana e te whārite $h = -px^2 + q$,

arā, ko h te teitei o te pōro, ā-mita, i runga ake i te papa,
ā, ko x te tawhiti huapae, ā-mita, i te pūtake o tō Hemi wharenoho.

(i) Tuhia te uara o q.



(ii) Mēnā e 4 mita te tawhiti o te taunga o te pōro i te pūtake o te wharenoho, he aha te uara o p?

Parahautia tō whakautu.

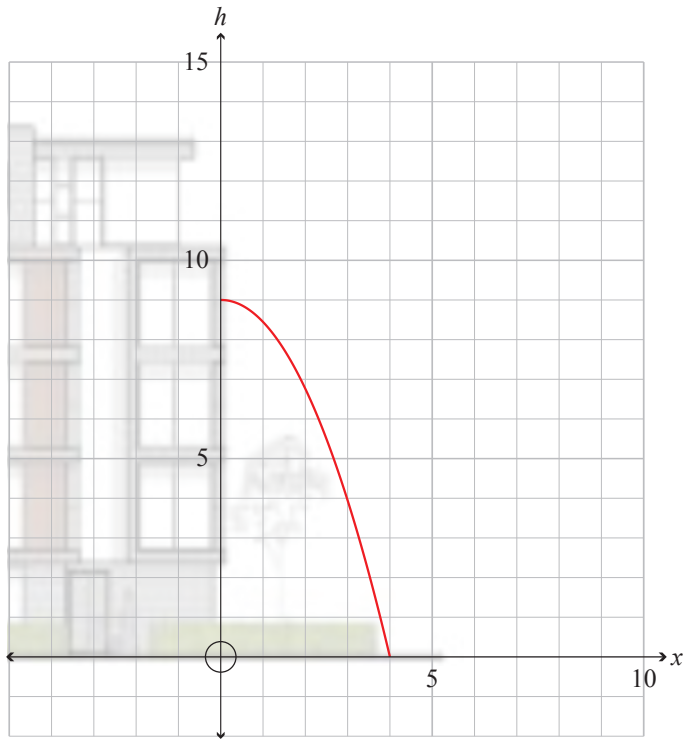
(b) Hemi threw a ball out of a window from his third-floor apartment.

The vertical height of the window above the ground is 9 metres.

The ball travelled, from this maximum height, downwards in a parabola path that can be modelled by the equation $h = -px^2 + q$,

where h is the height of the ball, in metres, above the ground
and x is the horizontal distance, in metres, from the base of Hemi's apartment block.

(i) Write down the value of q.



(ii) If the ball landed 4 metres away from the base of the apartment building, what is the value of p?

Justify your answer.

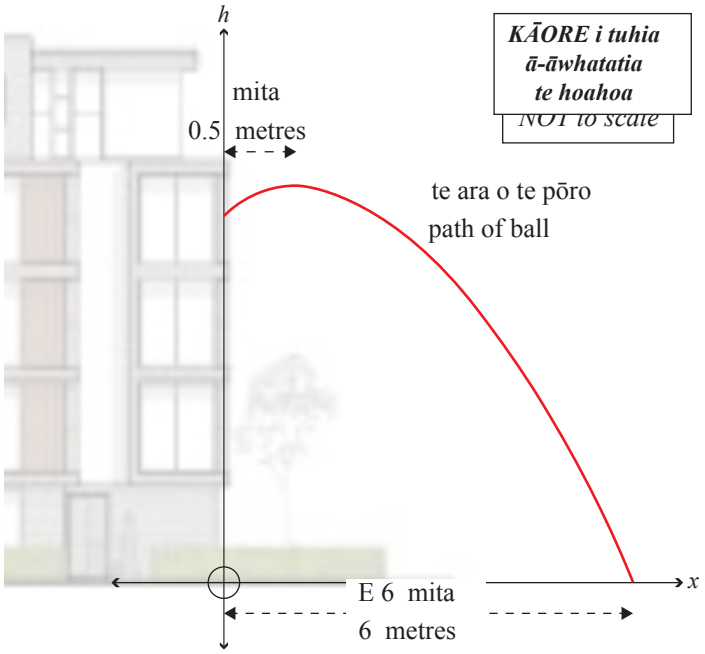
(iii) Kātahi a Hemi ka whiu ake i tētahi pōro anō, i taua matapihi tonu rā, e 9 mita nei te teitei i runga ake i te papa, ā, e rere ana anō i te ara unahi.

I tae te pōro ki tōna taumata teitei katoa i te wā e 0.5 mita ana te tawhiti huapae i te pūtake o te wharenoho.

E 6 mita te tawhiti o te taunga o te pōro ki te papa i te pūtake o te wharenoho.

- Whiriwhiria te whārite e whakatauira ana i te ara o te pōro tae noa ki tana taunga ki te papa.
- Whakamahia tō whārite hei tautohu i te taumata teitei katoa o te pōro i runga ake i te papa.

Parahautia tō whakautu ki ngā whiriwhiringa e tōtōpū ana, e mārama ana anō hoki.



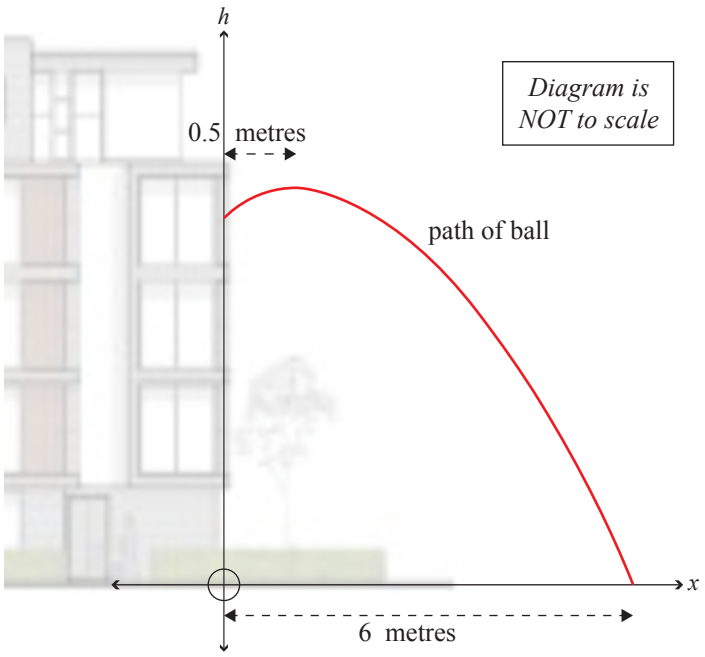
(iii) Hemi then threw a second ball upwards, from the same window 9 metres above the ground, also in a parabola path.

The ball reached its maximum height when it was a horizontal distance of 0.5 metres from the base of the apartment block.

The ball landed on the ground at a distance of 6 metres away from the base of the building.

- Find the equation that models the path of the ball until it landed on the ground.
- Use your equation to find the maximum height of the ball above the ground.

Justify your answer with full and clear working.

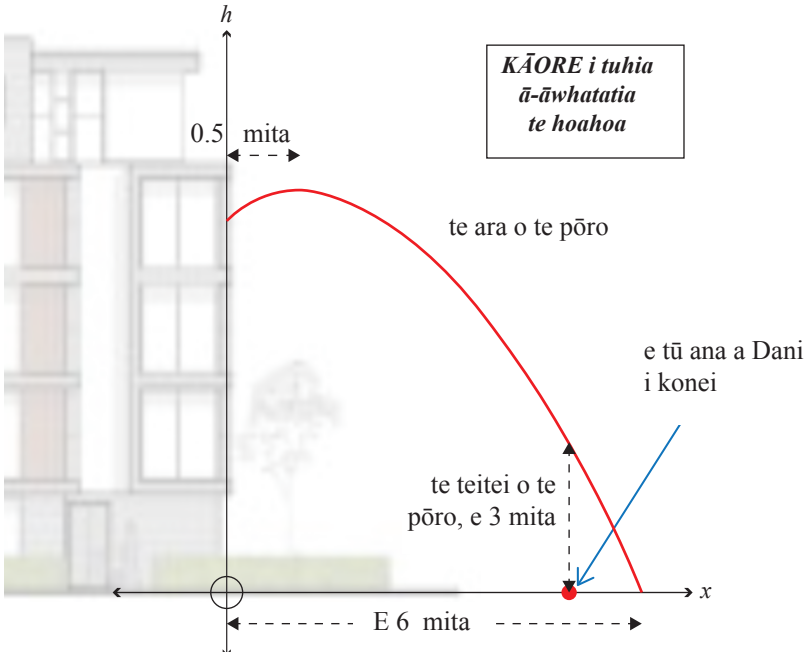


(iv) I mātakitaki a Dani i te pōro tuarua i whiua rā e Hemi (i te tūmahi (iii) o mua), ā, i kitea te pōro e rere ana i runga ake i tōna upoko, e 3 mita ana te teitei i runga ake i te papa.

Whiriwhiria te tawhiti o Dani i te pūtake o te wharenoho mā te whakamahi whārite, mā te whakamahi kauwhata RĀNEI.

Parahautia tō whakautu ki ngā whiriwhiringa e tōtōpū ana, e mārama ana anō hoki.

(E āhei ana tō whakamahi i te pepa tukutuku kei te whārangi e whai ake ana.)

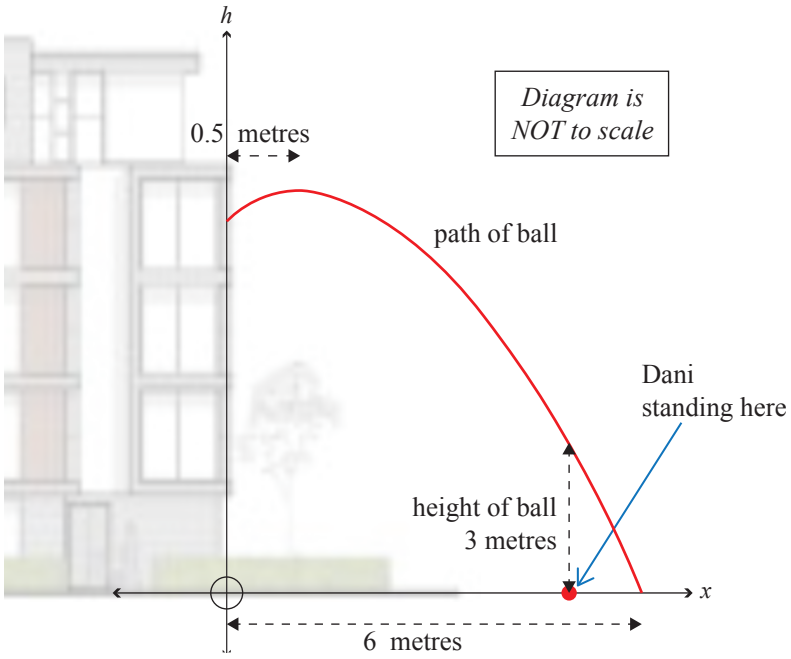


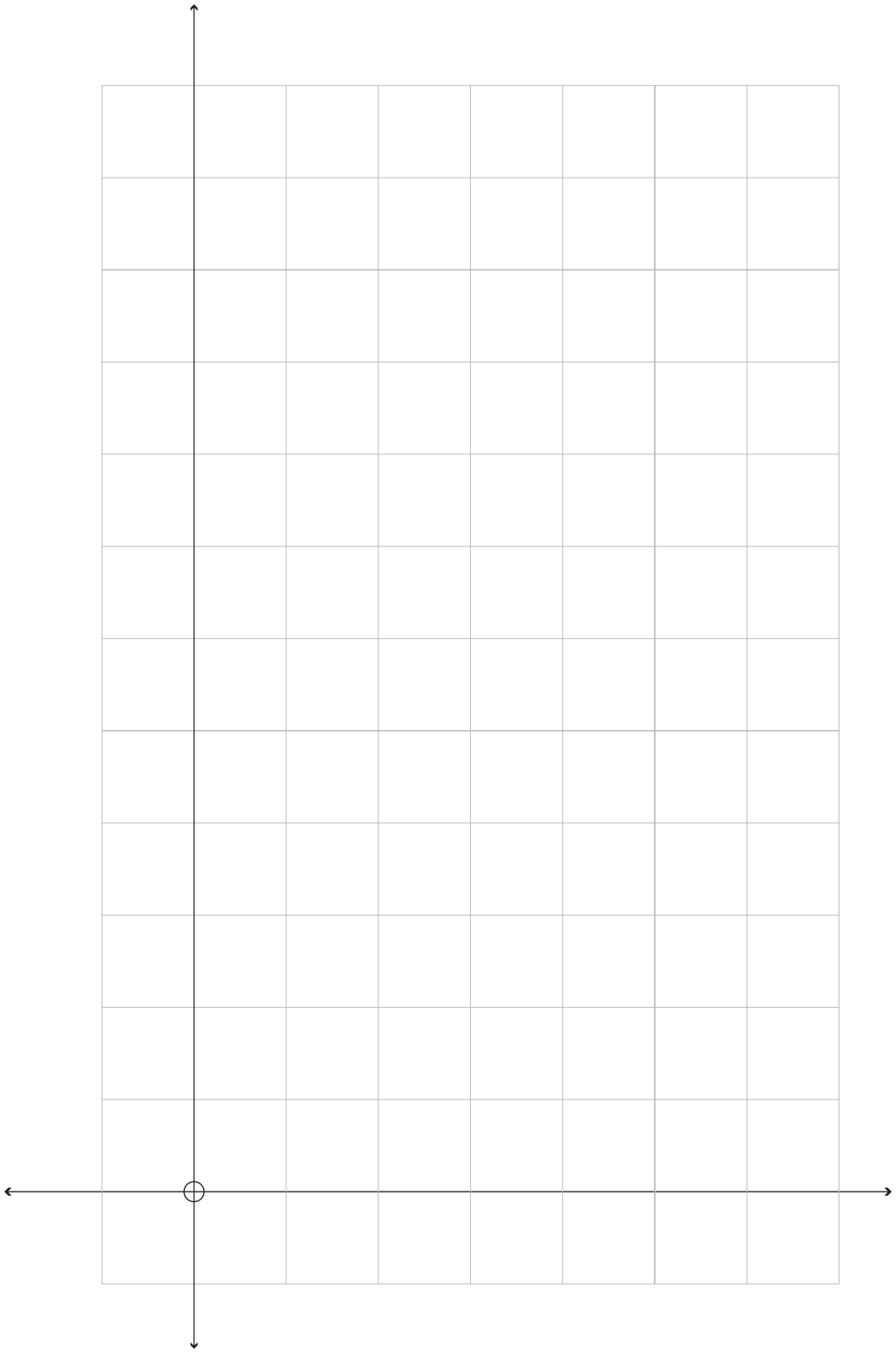
(iv) Dani watched the ball from Hemi's second throw (as in part (iii) above) and could see that the ball was at a height of 3 metres above the ground as it passed above her head.

Using equations OR graphs, find the distance of Dani from the base of the apartment block.

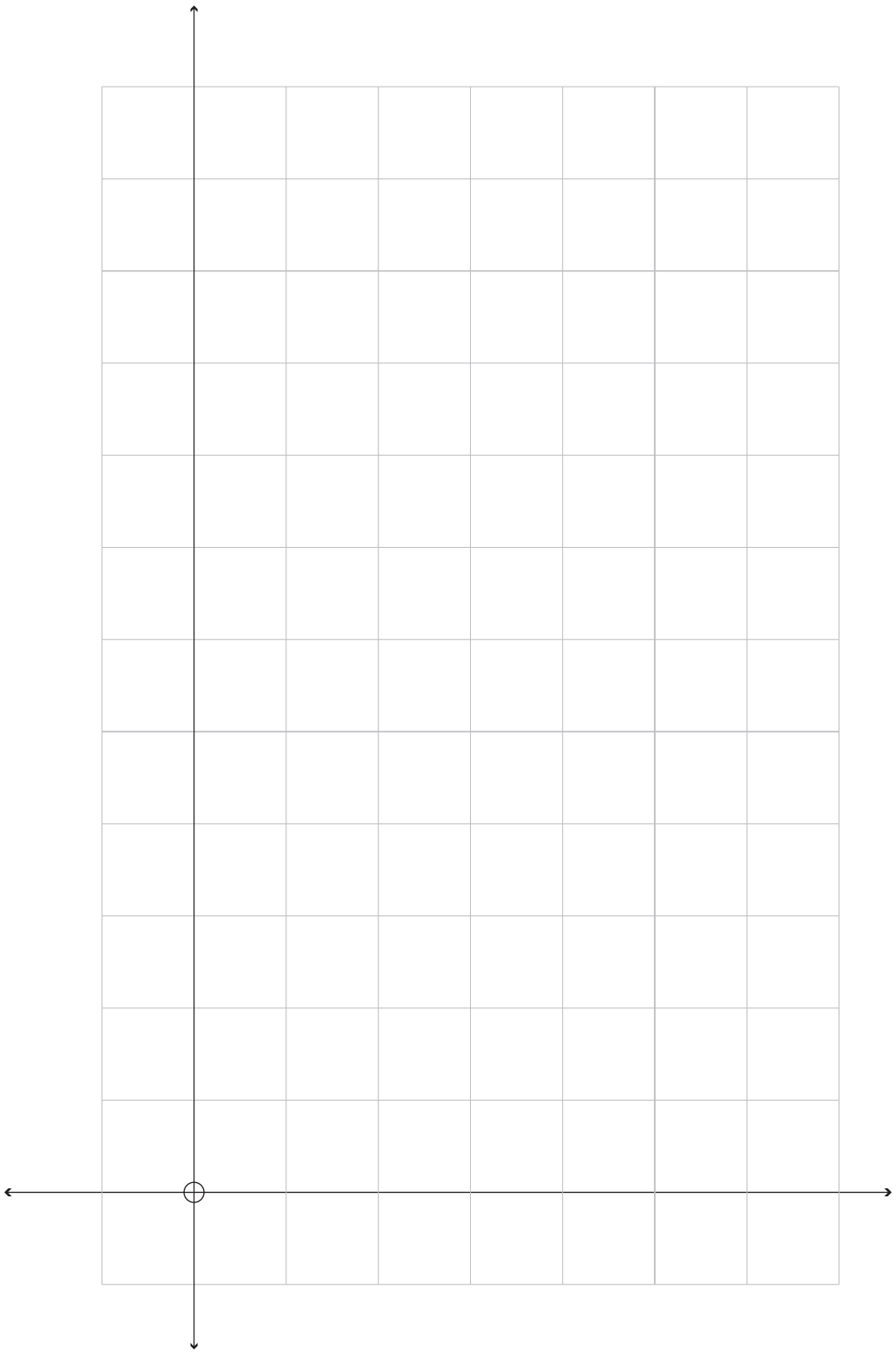
Justify your answer with full and clear working.

(You may choose to use the graph paper on the next page.)





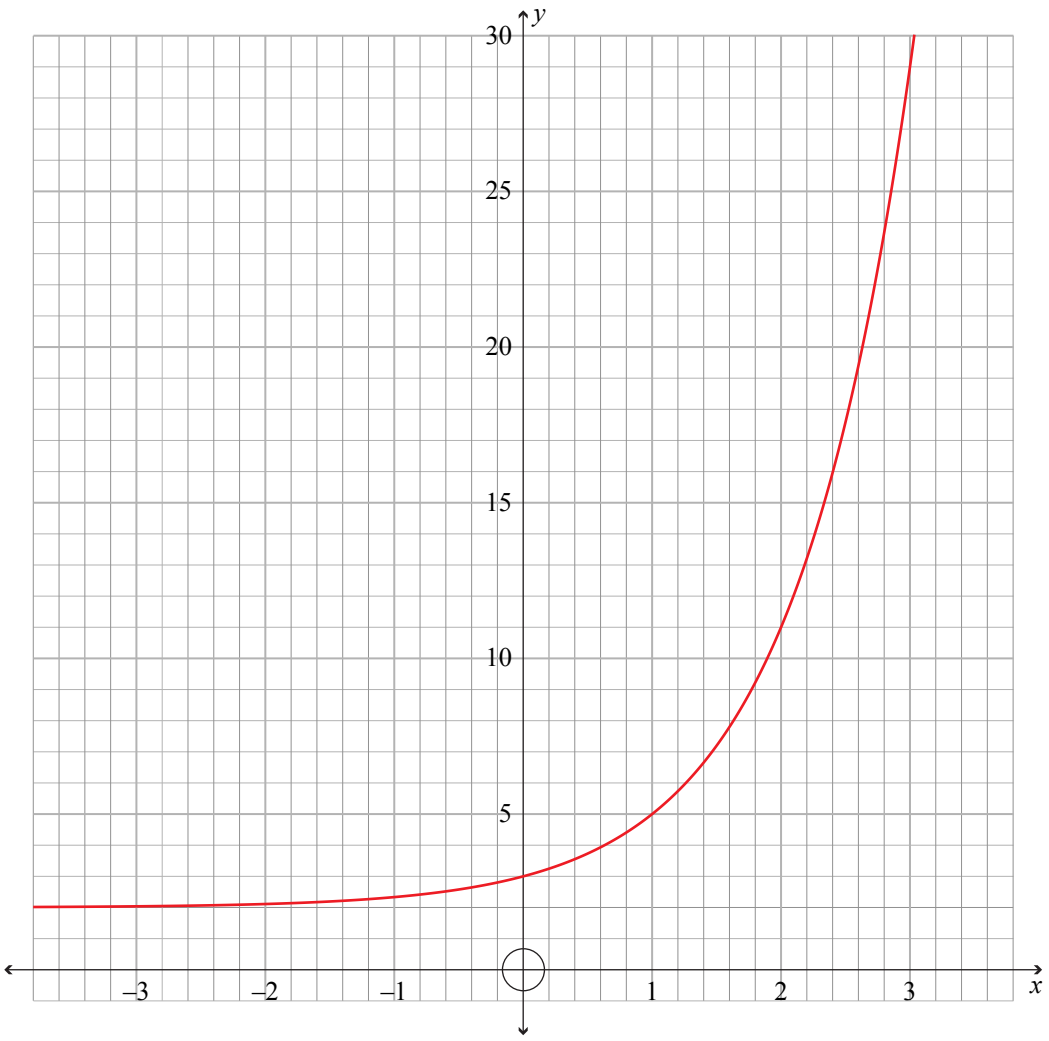
Ki te hiahia koe ki te tuhi anō i tō kauwhata, whakamahia te tukutuku kei te whārangi 36.



If you need to redraw your graph, use the grid on page 37.

TE TŪMAHI TUATORU

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

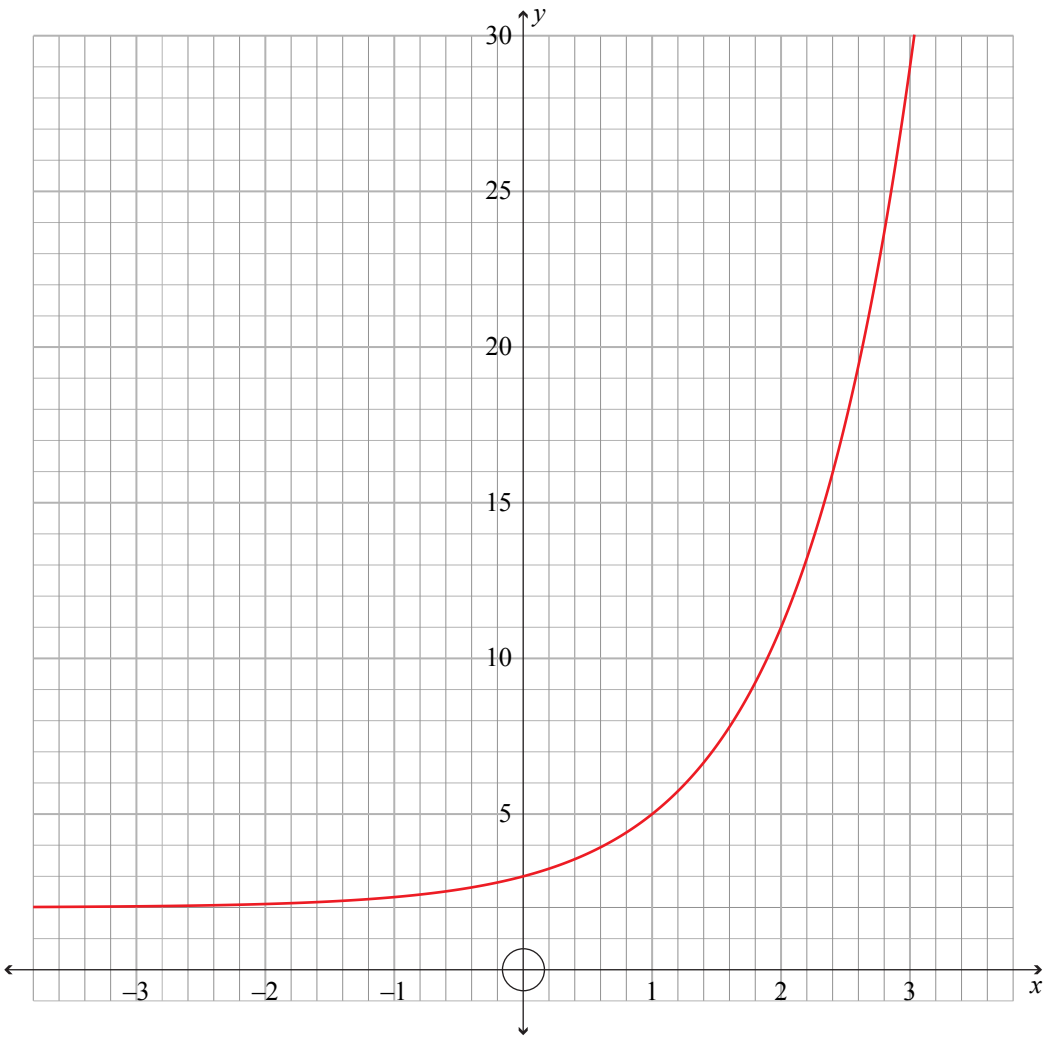


Te whārite: _____

(ii) Mēnā ka neke whakarungahia te kauwhata i te wāhanga (i) kia 5 ngā waeine, ā, ka whakaatahia hoki i te tuaka y, he aha te whārite o te kauwhata hou?

QUESTION THREE

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



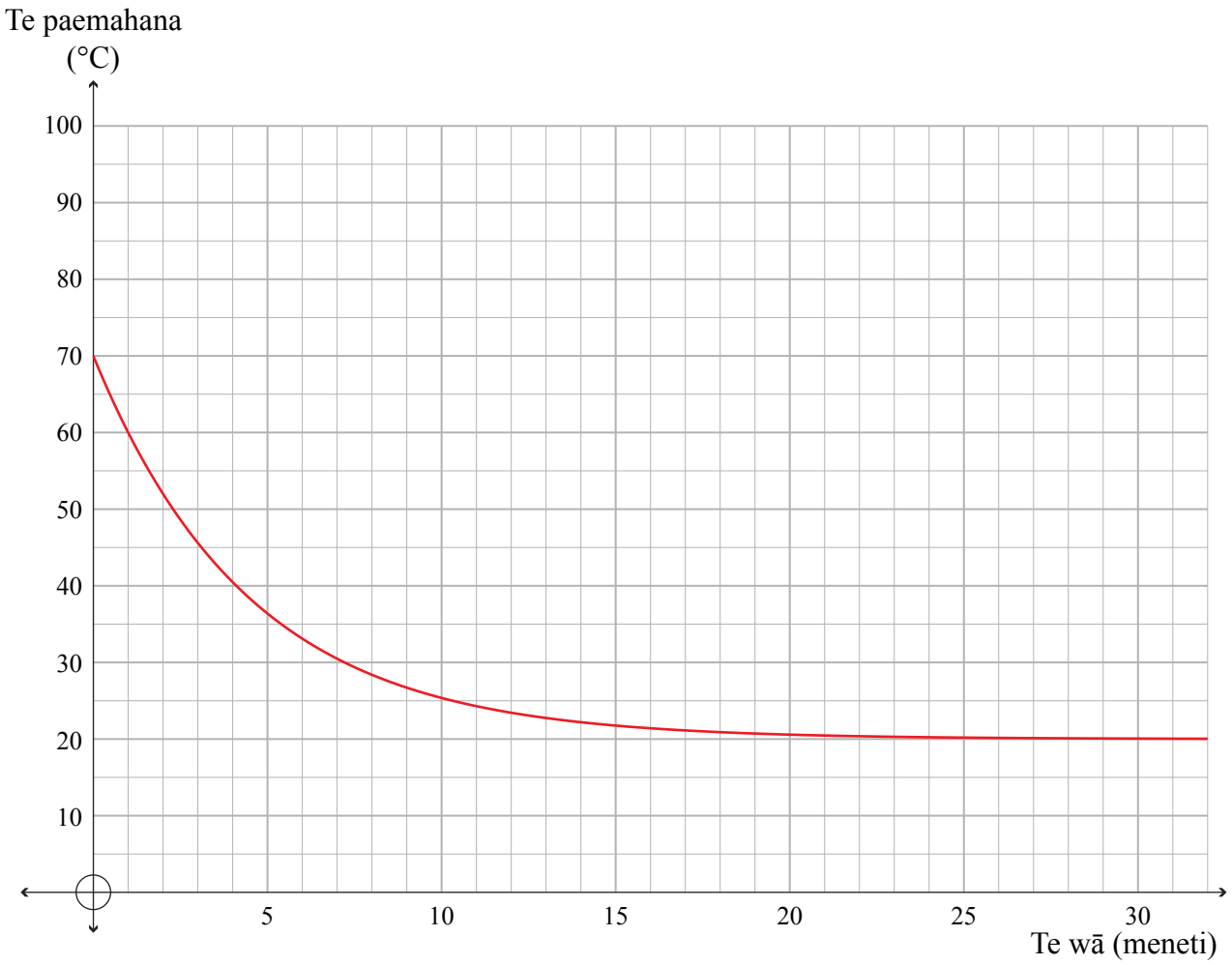
Equation is: _____

(ii) What would be the equation of the new graph if the graph from part (i) is shifted 5 units up and reflected in the y-axis?

(b) I whakaritea e Tim he kapu kawhe. Ko te 70 °C te inenga o te paemahana o te kawhe i te tīmatanga.

I waiho te kawhe i te tēpu o te kāuta mō ngā meneti e 30.

Kei te whakaaturia, i te kauwhata o raro nei, te paemahana, H °C o te kawhe i tōna kapu i te wā t meneti i muri i te wā i whakaritea ai.



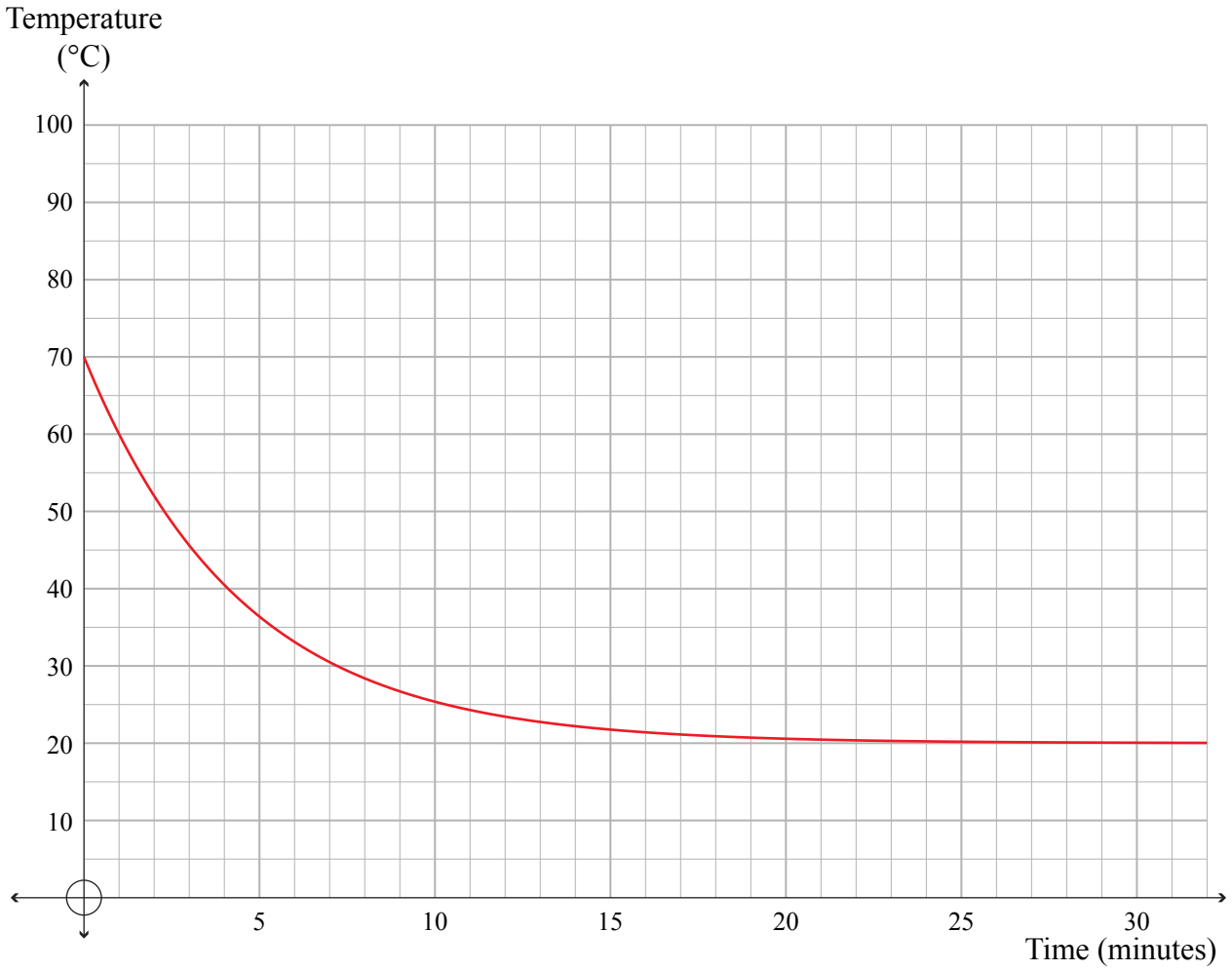
(i) He aha te paemahana o te rūma i te kāuta?

Parahautia tō whakautu.

(b) Tim made a cup of coffee. The temperature of the coffee at the start was measured at 70 °C.

The coffee was left on the kitchen table for 30 minutes.

The graph below shows the temperature, H °C, of the coffee in its cup at time t minutes after it was made.



(i) What was the room temperature in the kitchen?

Justify your answer.

(ii) Ka whakatauirahia te paemahana o te kawhe e tētahi whārite taupūtanga,

$$H = 50\,k^t + 20$$

arā, ko k te pāpātanga o te heke haeretanga o te paemahana o te kawhe,
ko H te paemahana ā-tohurau o te kawhe,
ā, ko t te wā, ā-meneti, mai i te wā i whakaritea ai te kawhe.

I muri i te meneti tuatahi, i heke te paemahana o te kawhe ki te 60 °C.

Whiriwhiria, whakamāoritia hoki te uara o k, i te horopaki o te paemahana o te rūma.

Parahautia tō whakautu.

(iii) I whakaritea he kapu tī e te whaea o Tim i taua wā tonu rā i whakaritea ai e Tim tana kawhe. I waiho ia i tana kapu tī kia mātao haere i tētahi rūma rerekē i te rūma o Tim.

Ko te 92 °C te paemahana o te tī i te tīmatanga.

Ko te 16 °C te paemahana o taua rūma rerekē.

Ka whakatauirahia te paemahana o te tī e te whārite taupūtanga,

$$H = w \times 0.85^t + v$$

arā, ko H te paemahana, ā-tohurau, o te tī,
ā, ko t te wā, ā-meneti, mai i te wā i whakaritea ai te tī.

Whiriwhiria te roa o te wā e makariri iho ai te kapu tī a te whaea o Tim, tēnā i te kapu kawhe a Tim, mā te whakamahi i ngā tūtohi RĀNEI, i ngā kauwhata RĀNEI, i ngā whārite RĀNEI.

Parahautia tō whakautu ki ngā whiriwhiringa e tōtōpū ana, e mārama ana anō hoki.

(E āhei ana tō whakamahi i te pepa tukutuku i te whārangi e whai ake ana.)

He wāhi anō mō ō tuhinga kei te whārangi e whai ake ana.

ii) The temperature of the coffee can be modelled by an exponential equation,

$$H = 50\,k^t + 20$$

where k is the rate at which the coffee temperature is decreasing,
H is the temperature of the coffee, in degrees Centigrade
and t is the time since the coffee was made, in minutes.

After the first minute the temperature of the coffee dropped to 60 °C.

Find and interpret the value of k, with relation to the room temperature.

Justify your answer.

(iii) Tim's mother made a cup of tea at exactly the same time as Tim made his coffee.
She left her tea to cool in a different room to Tim.

The temperature of the tea at the start was 92 °C.

The temperature of this different room was 16 °C.

The temperature of the tea can be modelled by the exponential equation,

$$H = w \times 0.85^t + v$$

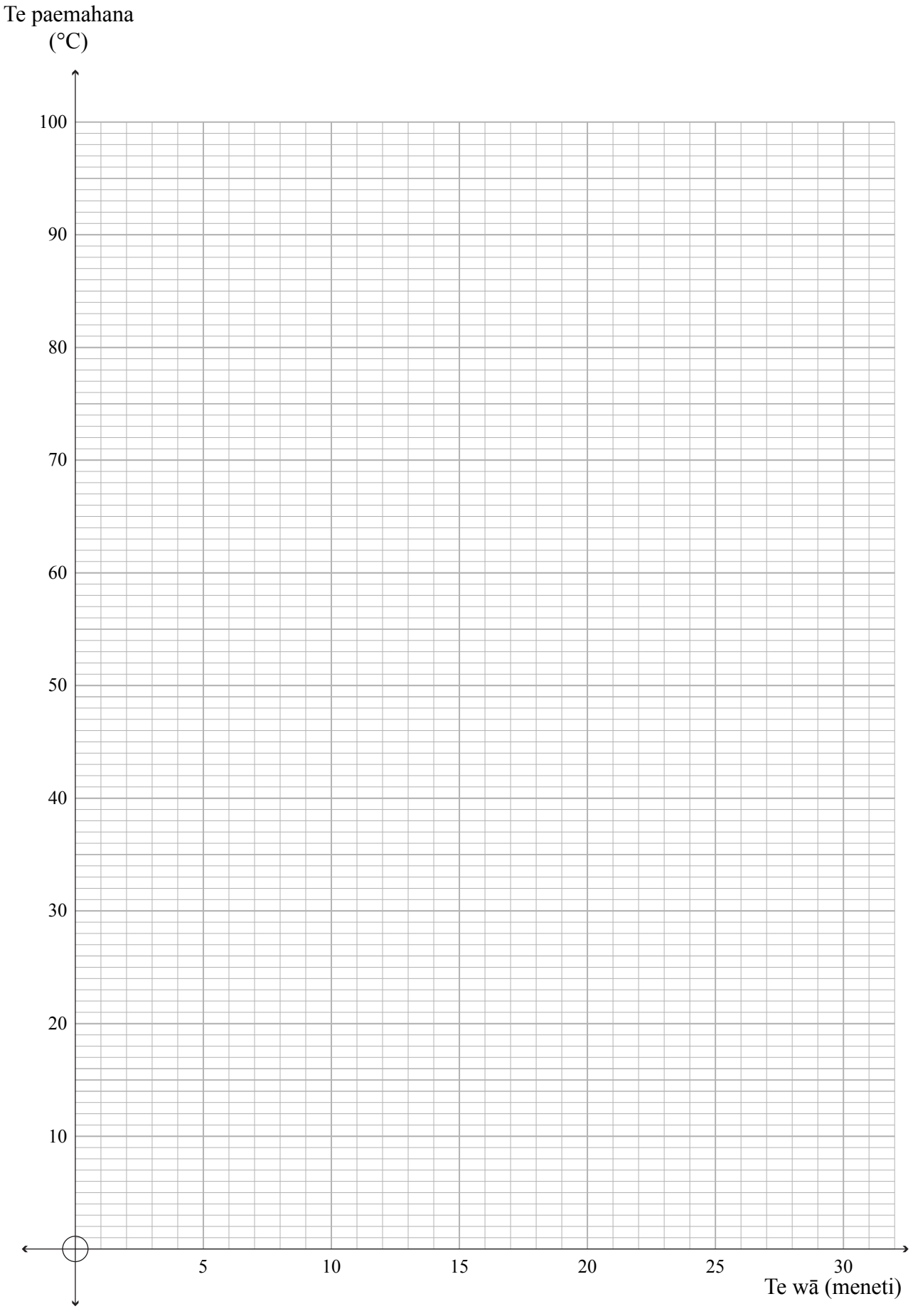
where H is the temperature of the tea, in degrees Centigrade
and t is the time since the tea was made, in minutes.

Using tables, graphs OR equations, find how long it took for Tim's mother's cup of tea to be cooler than Tim's cup of coffee.

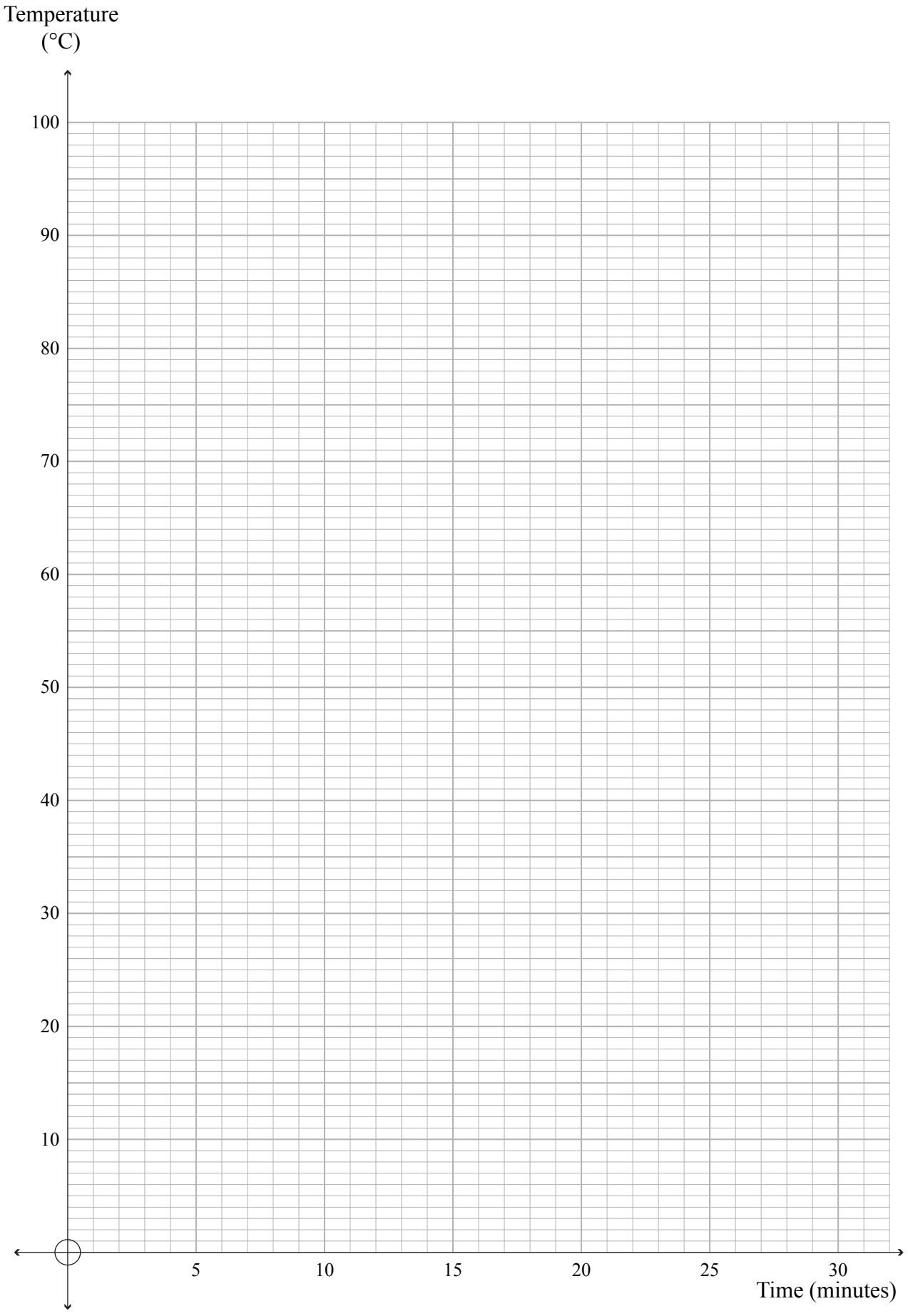
Justify your answer with full and clear working.

(You may choose to use the graph paper on the next page.)

There is more room for your answer on the next page.



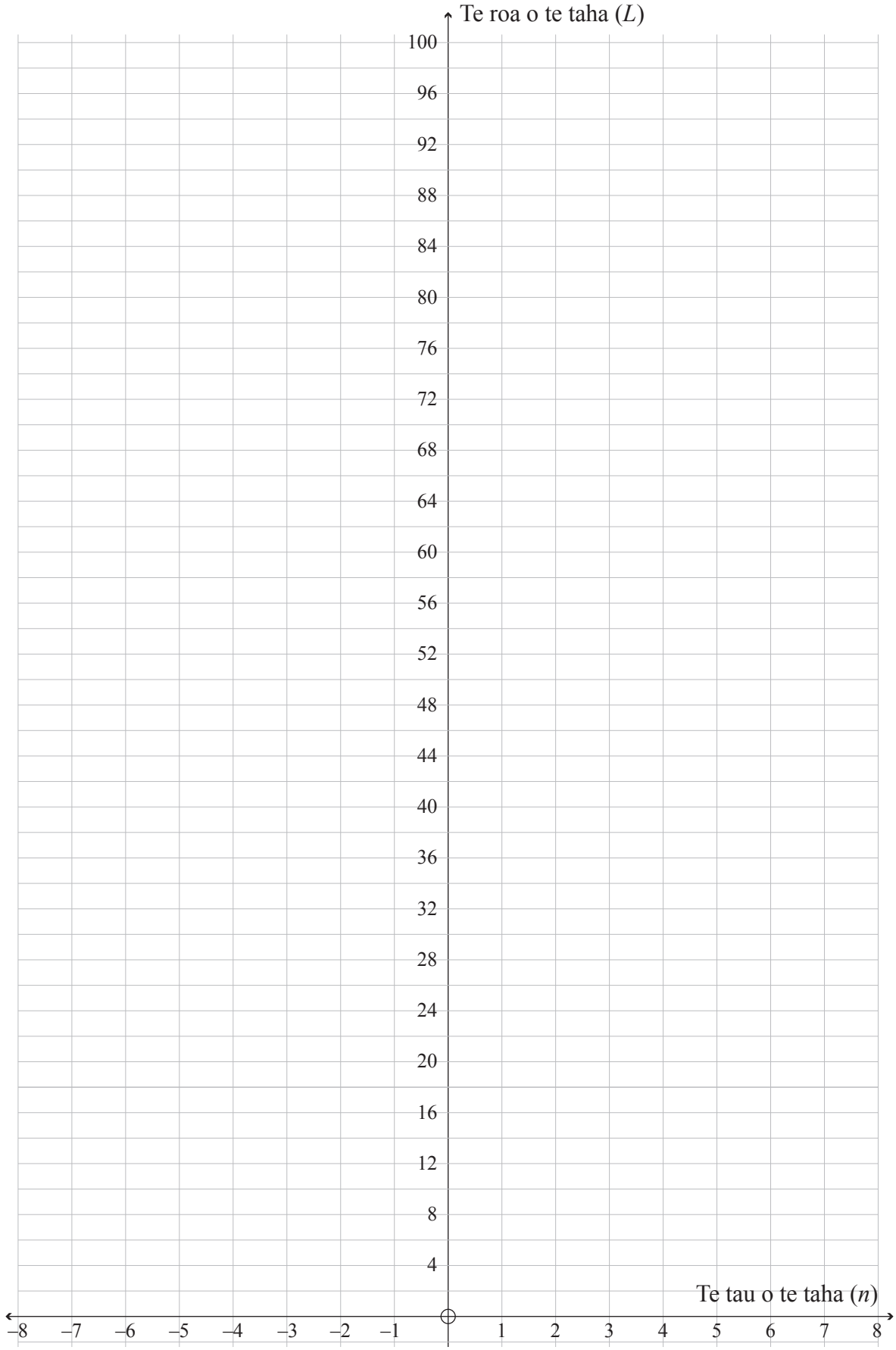
Ki te hiahia koe ki te tuhi anō i tō kauwhata, whakamahia te tukutuku kei te whārangi 38.



If you need to redraw your graph, use the grid on page 39.

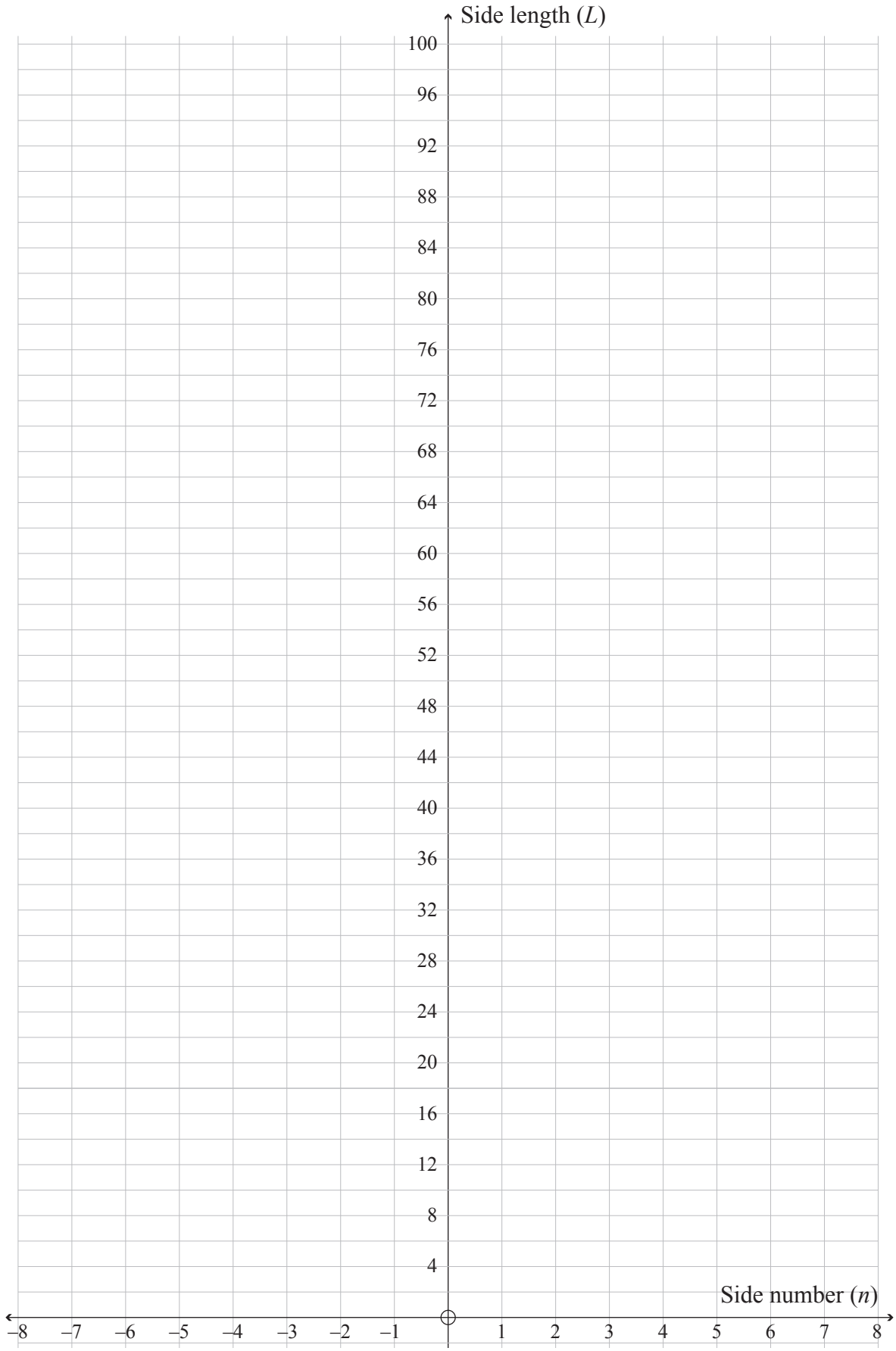
NGĀ HOAHOA WĀTEA

Ki te hiahia koe ki te tuhi anō i tō whakautu ki te Tūmahi Tuatahi (b)(ii), whakamahia te hoahoa kei raro nei. Me mātua whakamōhio mai ko tēhea te whakautu kia mākahia.

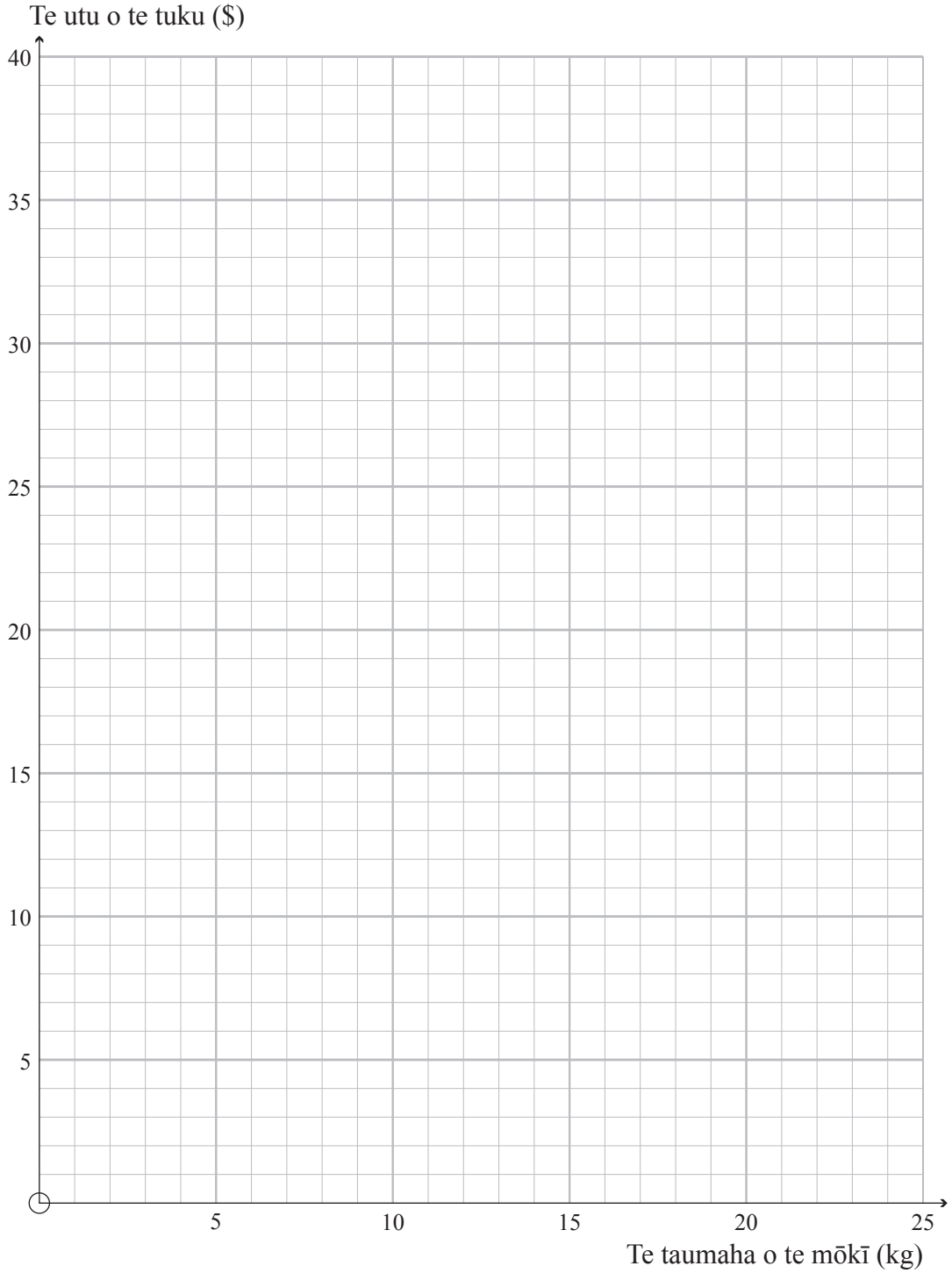


SPARE DIAGRAMS

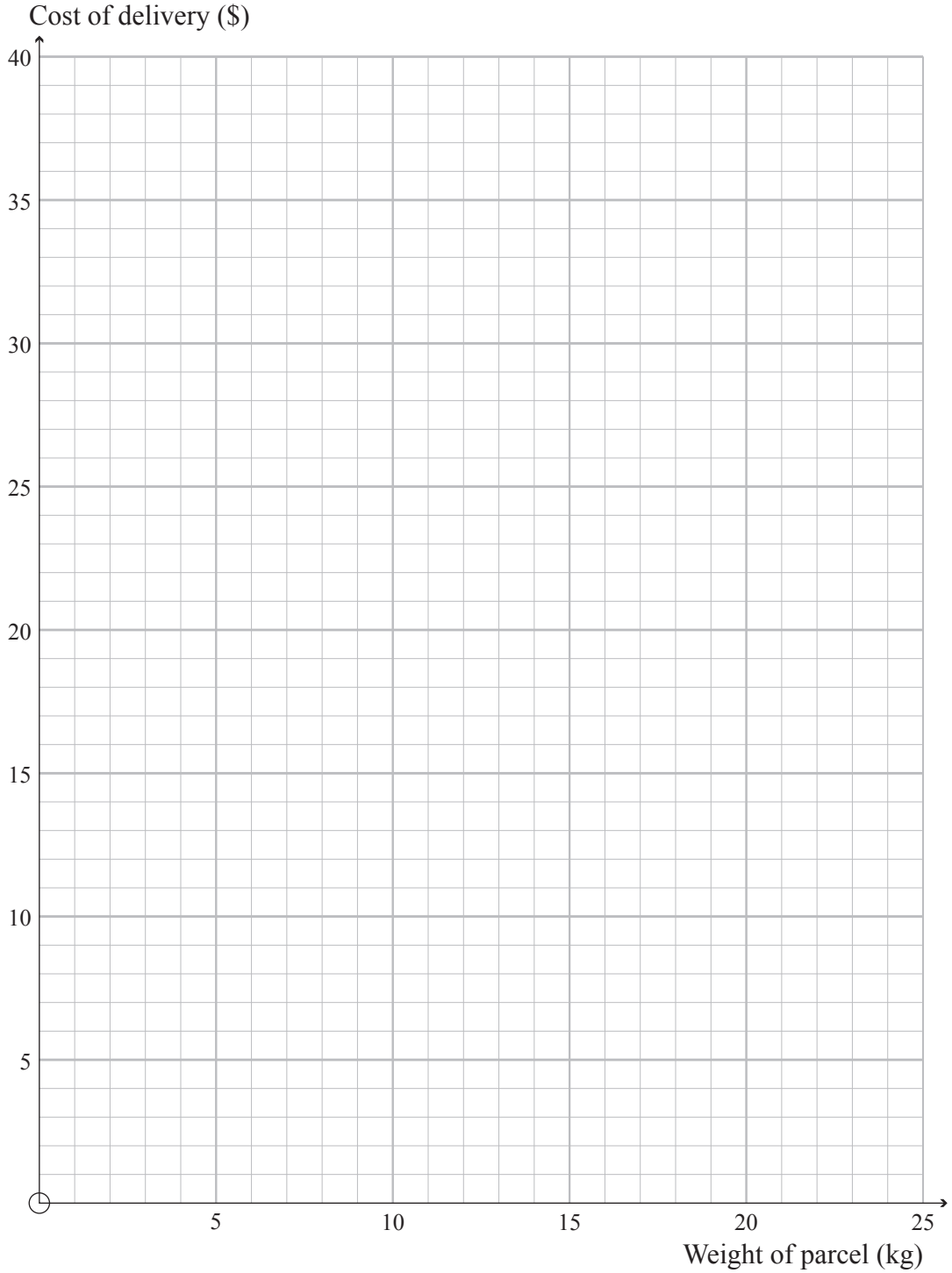
If you need to redraw your response to Question One (b)(ii), use the diagram below. Make sure it is clear which answer you want marked.



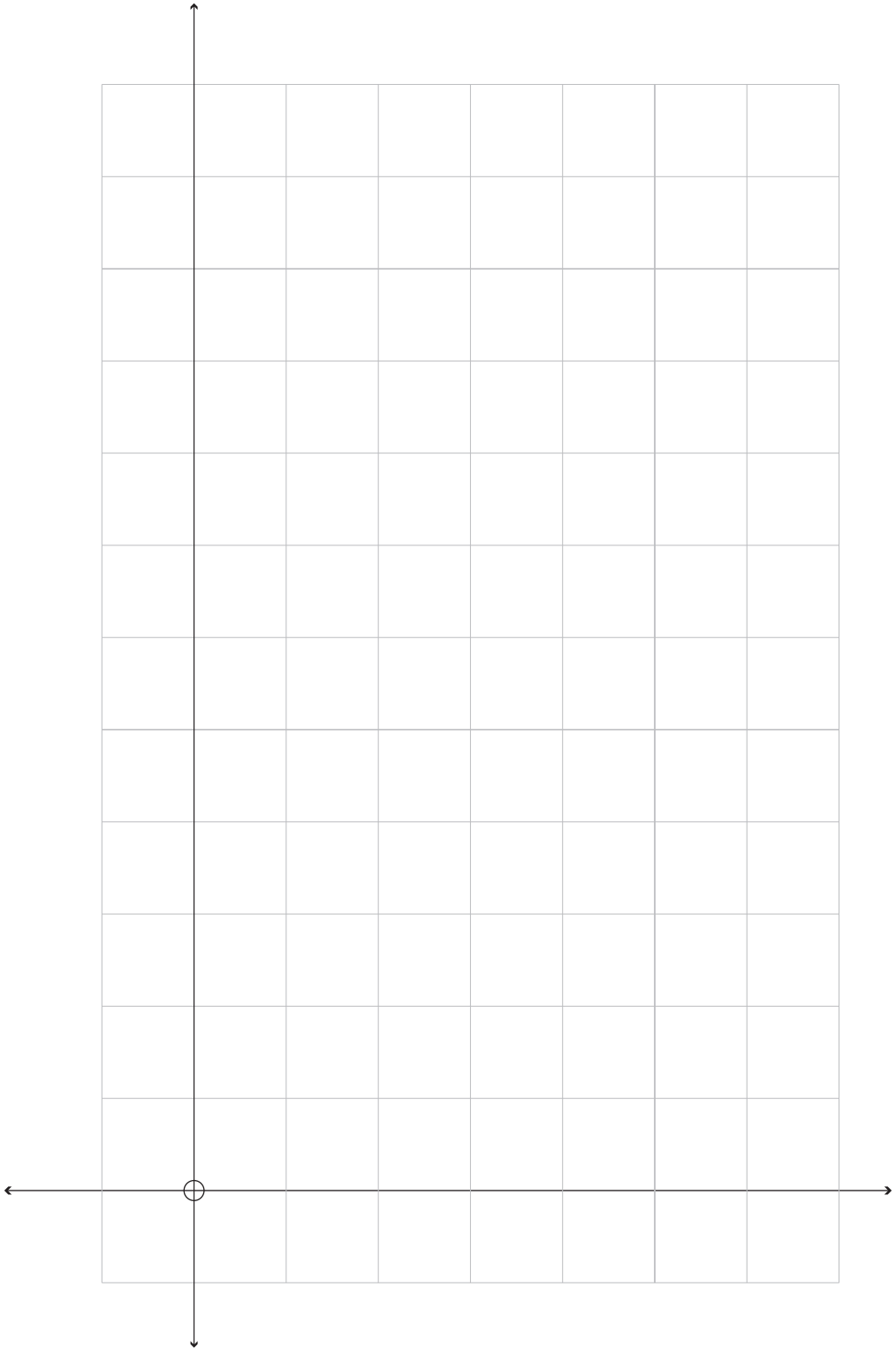
Ki te hiahia koe ki te tuhi anō i tō whakautu ki te Tūmahi Tuatahi (c)(i), whakamahia te hoahoa kei raro nei. Me mātua whakamōhio mai ko tēhea te whakautu kia mākahia.



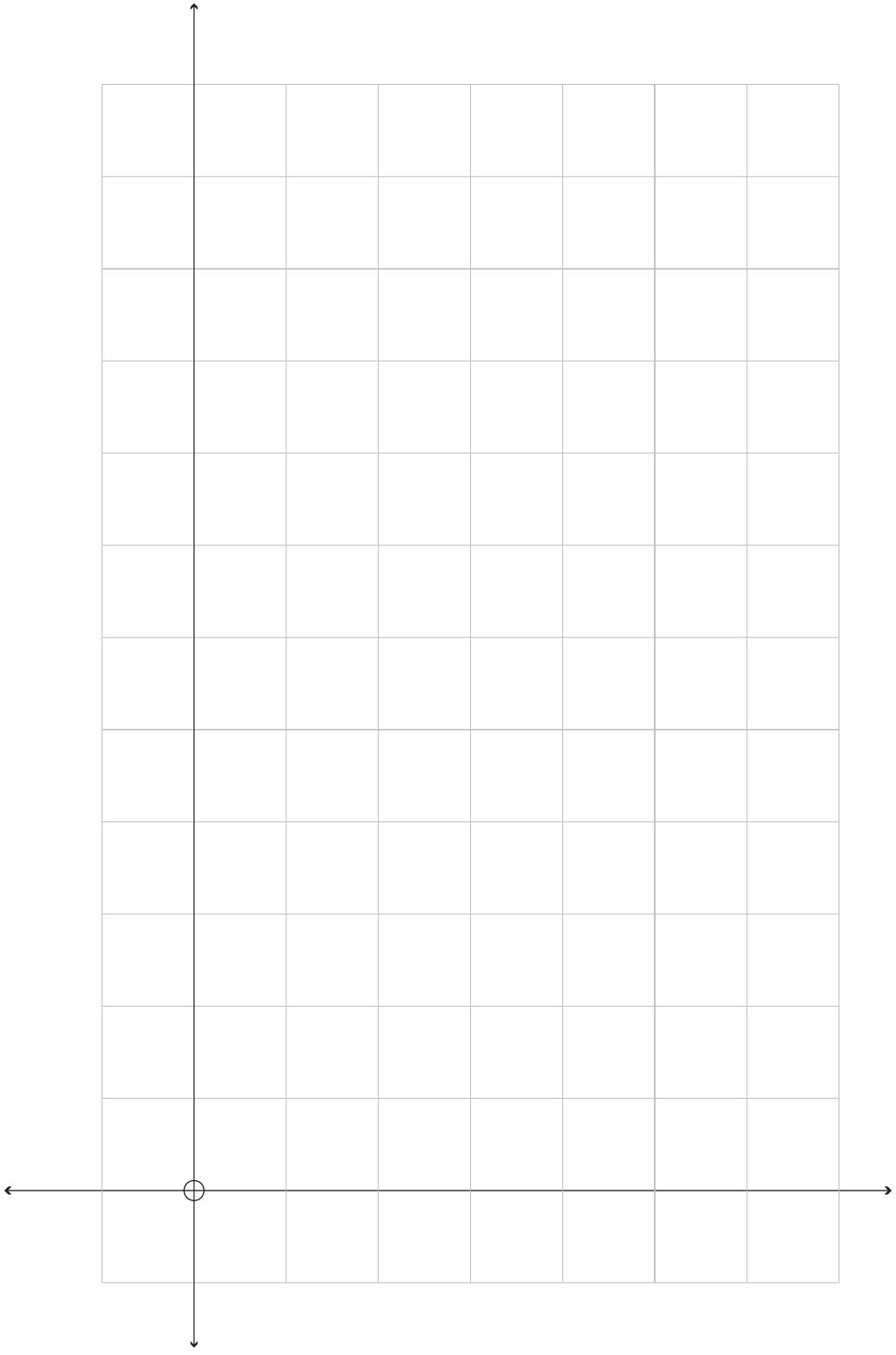
If you need to redraw your response to Question One (c)(i), use the diagram below. Make sure it is clear which answer you want marked.



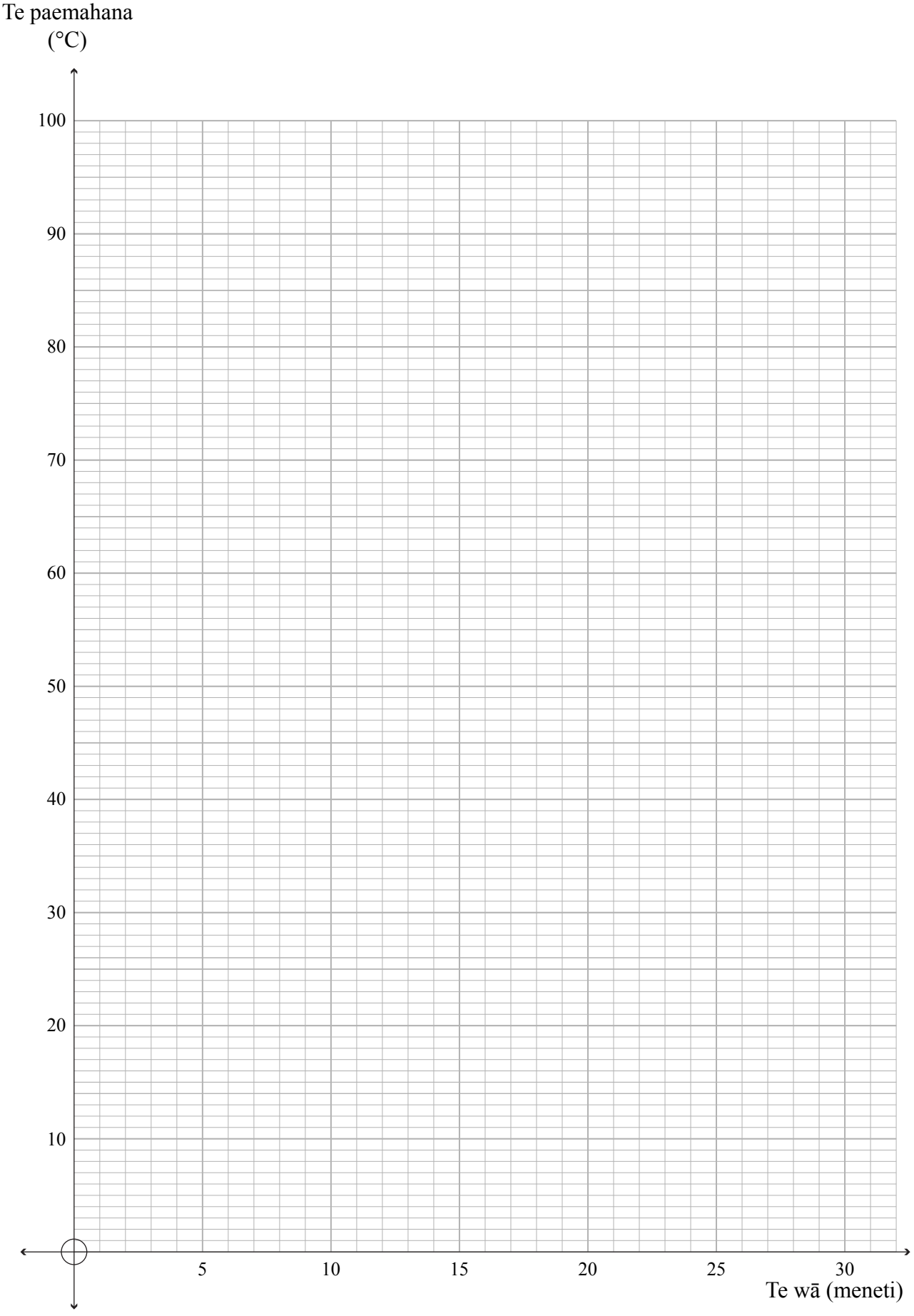
Ki te hiahia koe ki te tuhi anō i tō whakautu ki te Tūmahi Tuarua (b)(iv), whakamahia te hoahoa kei raro nei. Me mātua whakamōhio mai ko tēhea te whakautu kia mākahia.



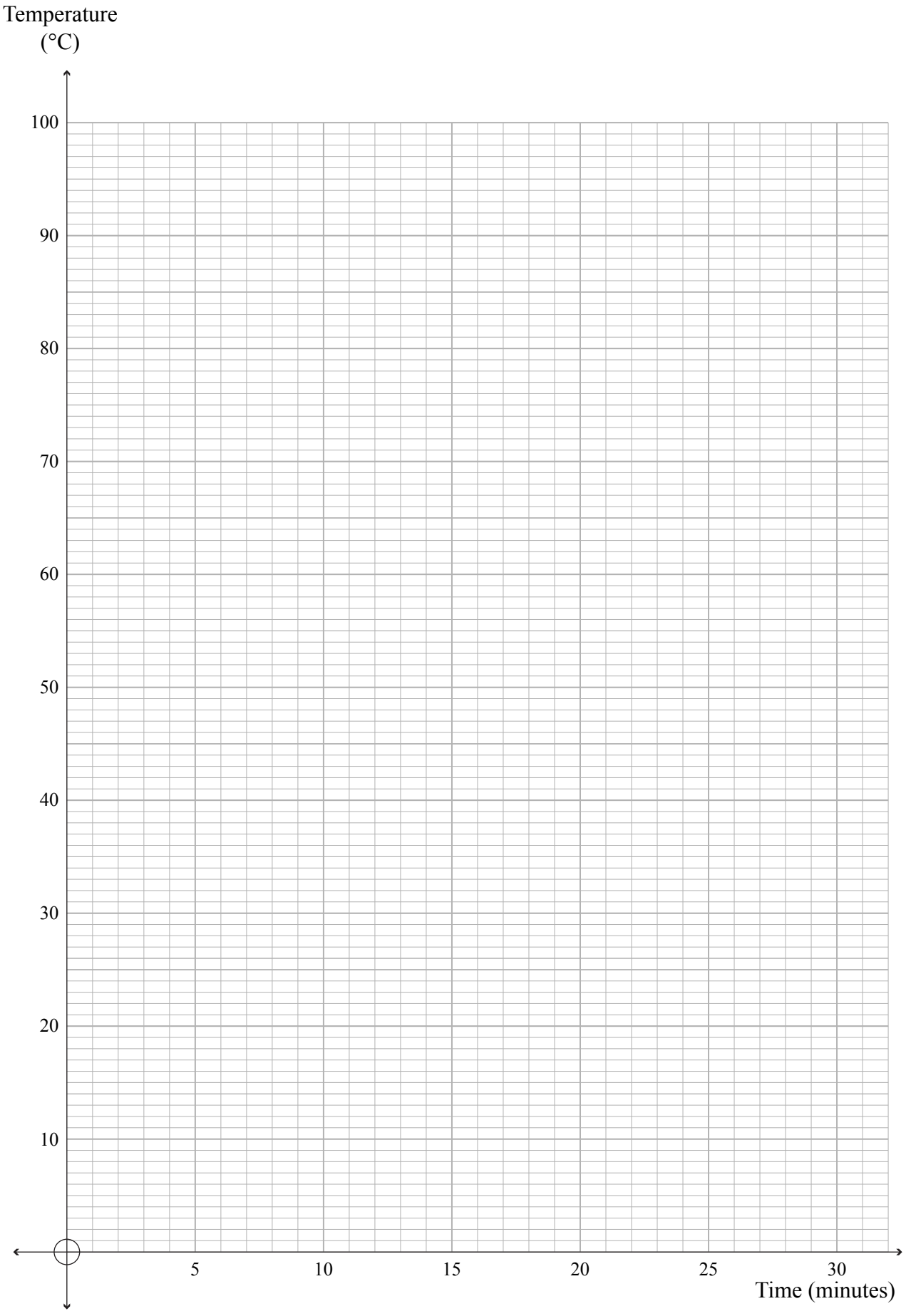
If you need to redraw your response to Question Two (b)(iv), use the diagram below. Make sure it is clear which answer you want marked.



Ki te hiahia koe ki te tuhi anō i tō whakautu ki te Tūmahi Tuatoru (b)(iii), whakamahia te hoahoa kei raro nei. Me mātua whakamōhio mai ko tēhea te whakautu kia mākahia.



If you need to redraw your response to Question Three (b)(iii), use the diagram below. Make sure it is clear which answer you want marked.



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

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 1 Mathematics and Statistics 2022

91028 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 2–43 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.