**1**

**91028M**

910285

# NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

## Te Pāngarau me te Tauanga, Kaupae 1, 2012

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

9.30 i te ata Rāapa 14 Whiringa-ā-rangi 2012
Whiwhinga: Whā

| Paetae | Paetae Kaiaka | Paetae 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 mehemea e ōrite ana te Tau Ākonga ā-Motu kei tō pepa whakauru ki te tau kei runga ake nei.

**Me whakautu e koe ngā pātai KATOA kei roto i te pukapuka nei.**

Whakaaturia ngā mahinga KATOA.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te(ngā) whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2–31 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

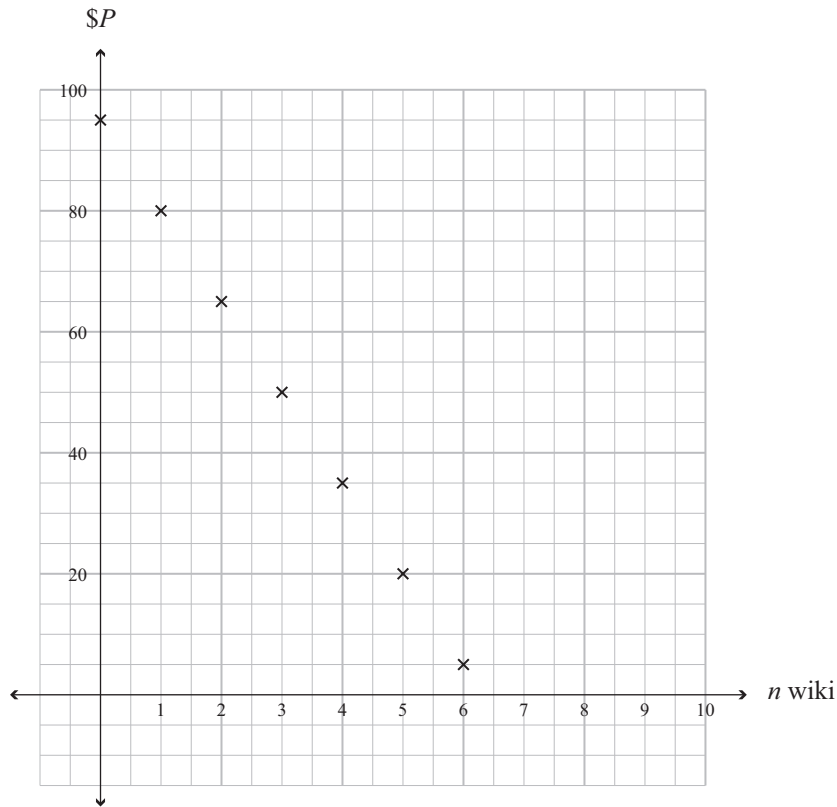**HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.**

**TAPEKE**

Kia 60 meneti hei whakautu i ngā pātai o tēnei pukapuka.

## PĀTAI TUATAHI

(a)   Kua tono moni, $P, a Jake mai i tōna pāpā.
Ko tāna, he utu i te moni ki a ia e ai ki te kauwhata kei raro iho.



(i)   E hia te utu ka utua e Jake ki tōna pāpā i ia wiki?

_____

(ii)   Homai te whārite o te rārangi e whakawhitia ana ngā pūwāhi i runga i te kauwhata.

P = _____

(iii)   Ka pau te toru wiki, ka haere a Jake mō tētahi haerenga i te taha o tōna hoa.

Kāore a Jake e utu i tōna pāpā i te wiki tuawhā.

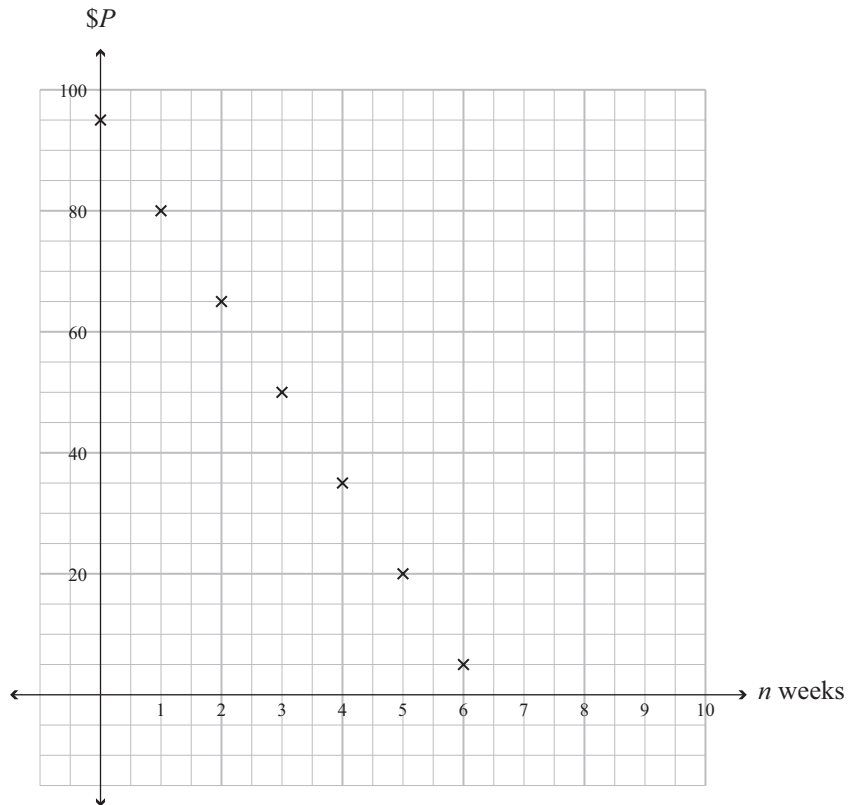Ka tīmata anō tōna utu i a ia i te wiki ka whai ake.

- He pēhea nei te pānga o tēnei ki te kauwhata?

_____

_____

_____

- Homai te whārite o te kauwhata mai i te wiki tuawhā, haere ake.

_____

_____

You are advised to spend 60 minutes answering the questions in this booklet.

**QUESTION ONE**

(a)   Jake has borrowed some money, $P, from his father.
He plans to pay him back according to the graph below.



(i)   How much does Jake pay his father back each week?

_____

(ii)   Give the equation of the line that passes through the points on the graph.

$P =$ _____

(iii) After three weeks Jake goes on a trip with a friend.

Jake does not pay his father during the fourth week.

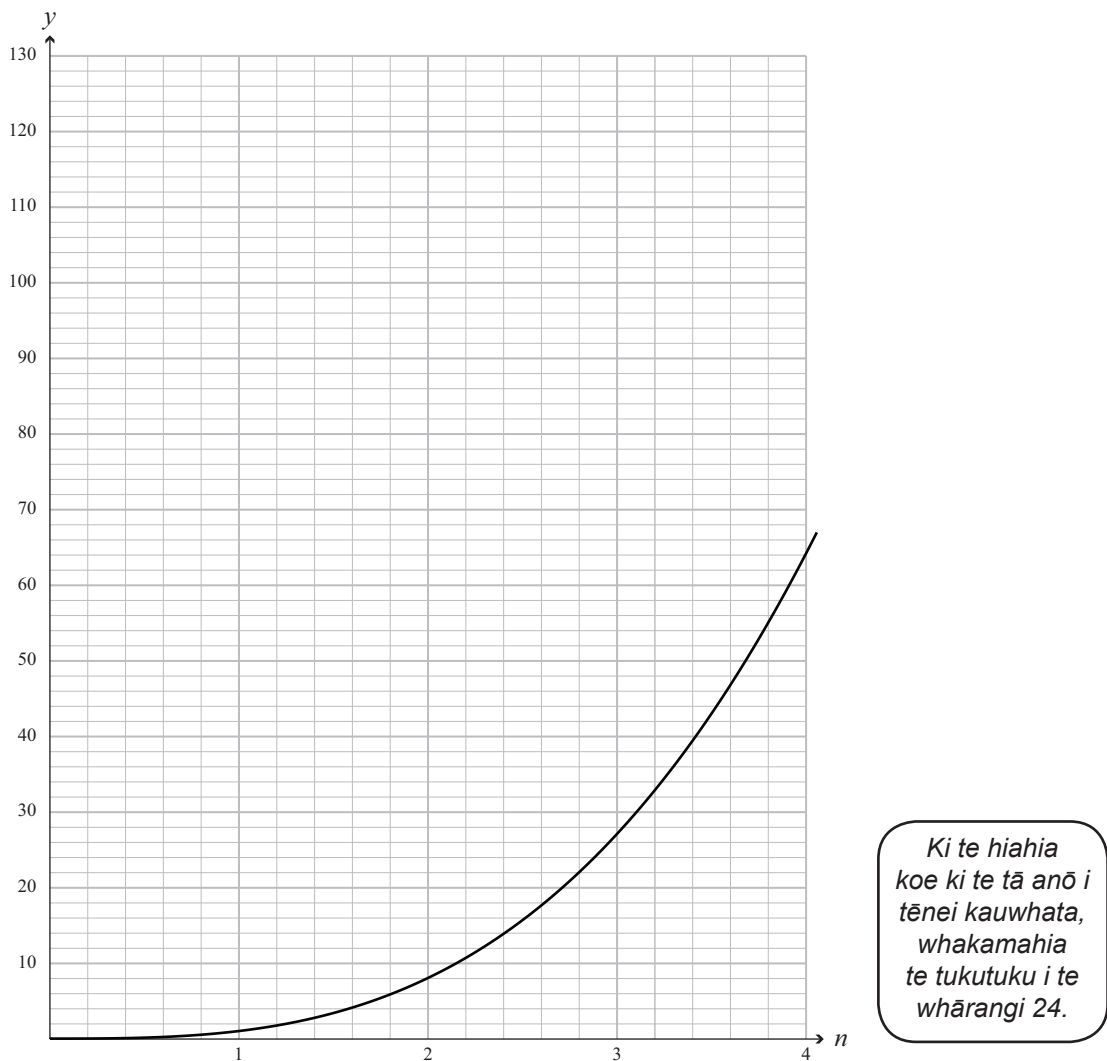He then continues paying him back the next week.

- How does this affect the graph?

- Give the equation of the graph from the fourth week onwards.

(b) (i) Whakaotihia te tūtohi o ngā uara i raro nei mō $n^3 + 3n^2 + 3n + 1$ mā te whakamahi i ia o ngā uara o $n$ i raro nei:

| $n$ | $(n^3 + 3n^2 + 3n + 1)$ |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |

(ii) Ka whakaatu te kauwhata o raro nei i te $y = n^3$



*Ki te hiahia koe ki te tā anō i tēnei kauwhata, whakamahia te tukutuku i te whārangi 24.*

Mai i te tūtohi o runga ake tuhia te $y = n^3 + 3n^2 + 3n + 1$ i tērā tukutuku anō.

(iii) Whakatauritea te kauwhata o $y = n^3$ me te kauwhata o $y = n^3 + 3n^2 + 3n + 1$

_____

_____

_____

(iv)   $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ mō ngā uara katoa o $a$ me $b$.
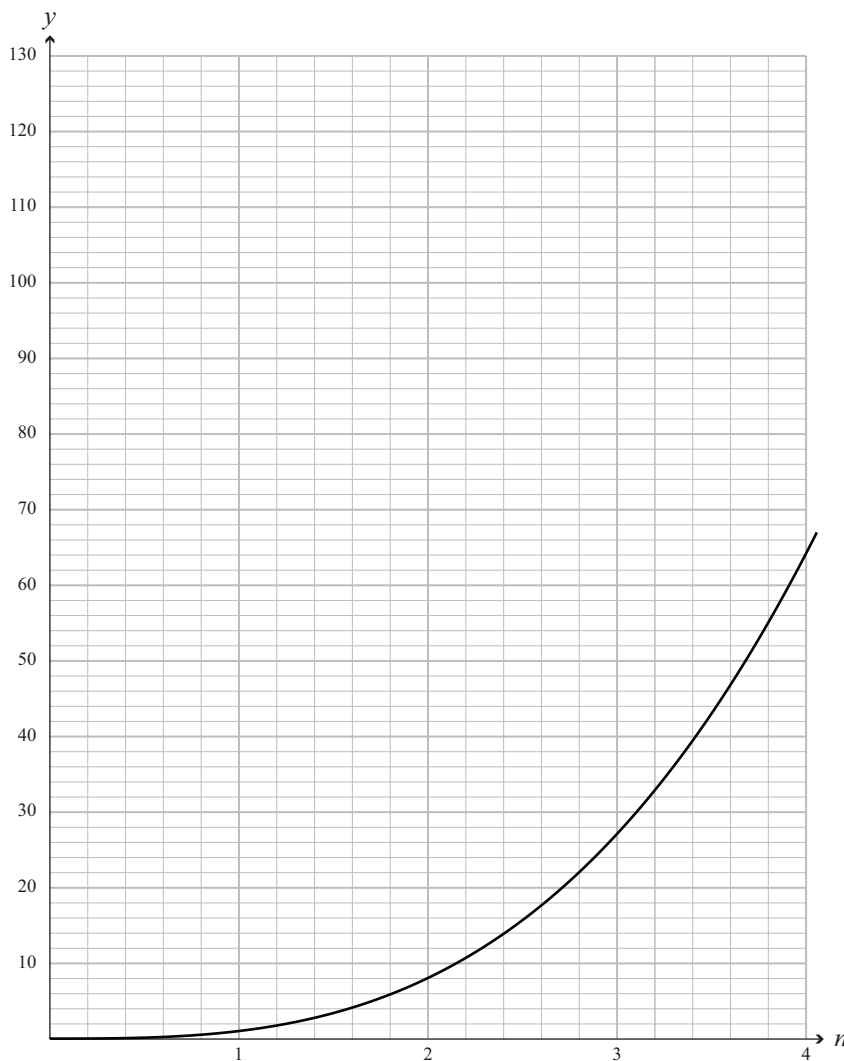
Whiriwhiria tētahi kīanga mō te rerekētanga i waenganui i ngā pūtoru o ētahi tauoti piritata e rua.

He pēhea nei te pānga o tēnei otinga ki te kauwhata i tāia e koe i te wāhanga (b) (ii)?

(b)  (i)  Complete the table of values below for $n^3 + 3n^2 + 3n + 1$ using each of the values of $n$ below:

| $n$ | $(n^3 + 3n^2 + 3n + 1)$ |
|-----|-------------------------|
| 1   |                         |
| 2   |                         |
| 3   |                         |
| 4   |                         |

(ii)  The graph below shows $y = n^3$



*If you need to redraw this graph, use the grid on page 25.*

From the table above plot $y = n^3 + 3n^2 + 3n + 1$ on the same grid.

(iii)  Compare the graph of $y = n^3$ and the graph of $y = n^3 + 3n^2 + 3n + 1$

_____

_____

_____

(iv)  $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ for all values of $a$ and $b$.

Find an expression for the difference between the cubes of any two consecutive whole numbers.

How does this result relate to the graph you drew in part (b) (ii)?

# PĀTAI TUARUA

(a) Ka utua ētahi tauira mō te tuku mātārere whakatairanga ā-wiki ki ia whare.

Ka utua e te kamupene *He Mātārere Māu* he utu pūmau ki ngā tauira tae atu ki tētahi utu tāpiri mō **ia mātārere** ka tukua e rātou.

Ka whakaaturia e te kauwhata i raro nei te rahi ka utua ki te tauira mō te tuku i ngā mātārere a *He Mātārere Māu*.
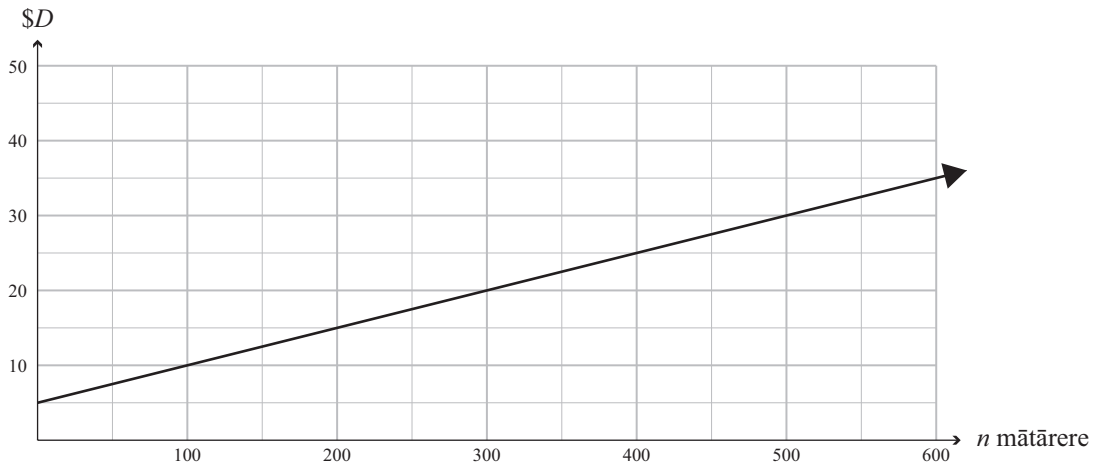


(i) E hia te utu ka utua ki te tauira mō ia mātārere ka tukua e ia mō *He Mātārere Māu*?

_____

_____

(ii) Homai te whārite mō te moni, $D, ka whiwhi i te tauira, hei runga tonu i te maha, n, o ngā mātārere ka tukua e ia.
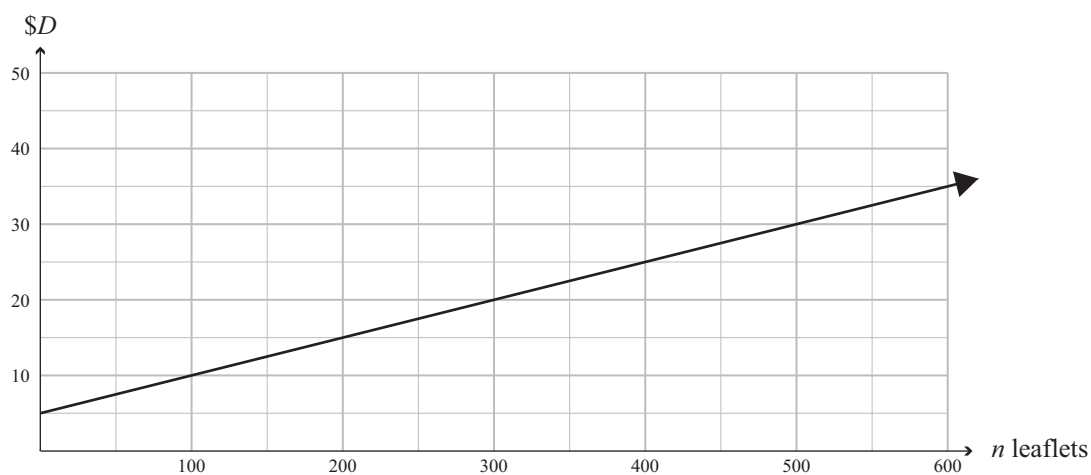
_____

_____

## QUESTION TWO

(a)  School students are paid to deliver weekly advertising leaflets to each house.

*Leaflets from Us* pay students a fixed amount plus an amount for **each leaflet** they deliver.

The graph below shows the amount a student is paid for delivering the leaflets for *Leaflets from Us*.



(i)  How much is the student paid for each leaflet they deliver for *Leaflets from Us*?

_____

_____

(ii)  Give the equation for the amount, $D, a student would receive, depending on the number of leaflets, $n$, that they deliver.

_____

_____

(b) Ko te utu ka utua e tētahi atu kamupene a *Leaflet Delivery Co,* hei runga tonu i te tau o **ngā pūhanga katoa o te 50 mātārere** e tukua ai e te tauira.

Ka utua he utu pūmau ki a ia me tētahi utu tāpiri mō ia pūhanga o te 50 mātārere ka tukua.

Mēnā ka tukua e te tauira neke atu i te 300 mātārere, ka nui ake te utu anō mō ia pūhanga.

| Te tau mātārere kua tukua (*n*) | Te moni kua utua (**$D**) |
|---|---|
| 1 – 50 | $11 |
| 51 – 100 | $15 |
| 101 – 150 | $19 |
| 151 – 200 | $23 |
| 201 – 250 | $27 |
| 251 – 300 | $31 |
| 301 – 350 | $36 |
| 351 – 400 | $41 |
| 401 – 450 | $46 |
| 451 – 500 | $51 |

(i) I te tukutuku i raro nei tāia te kauwhata kia whakaatu i te utu ka utua ki te tauira mō te tuku i te *n* mātārere mō *Leaflet Delivery Co*.



*Ki te hiahia koe ki te tā anō i tēnei kauwhata, whakamahia te tukutuku i te whārangi 26.*
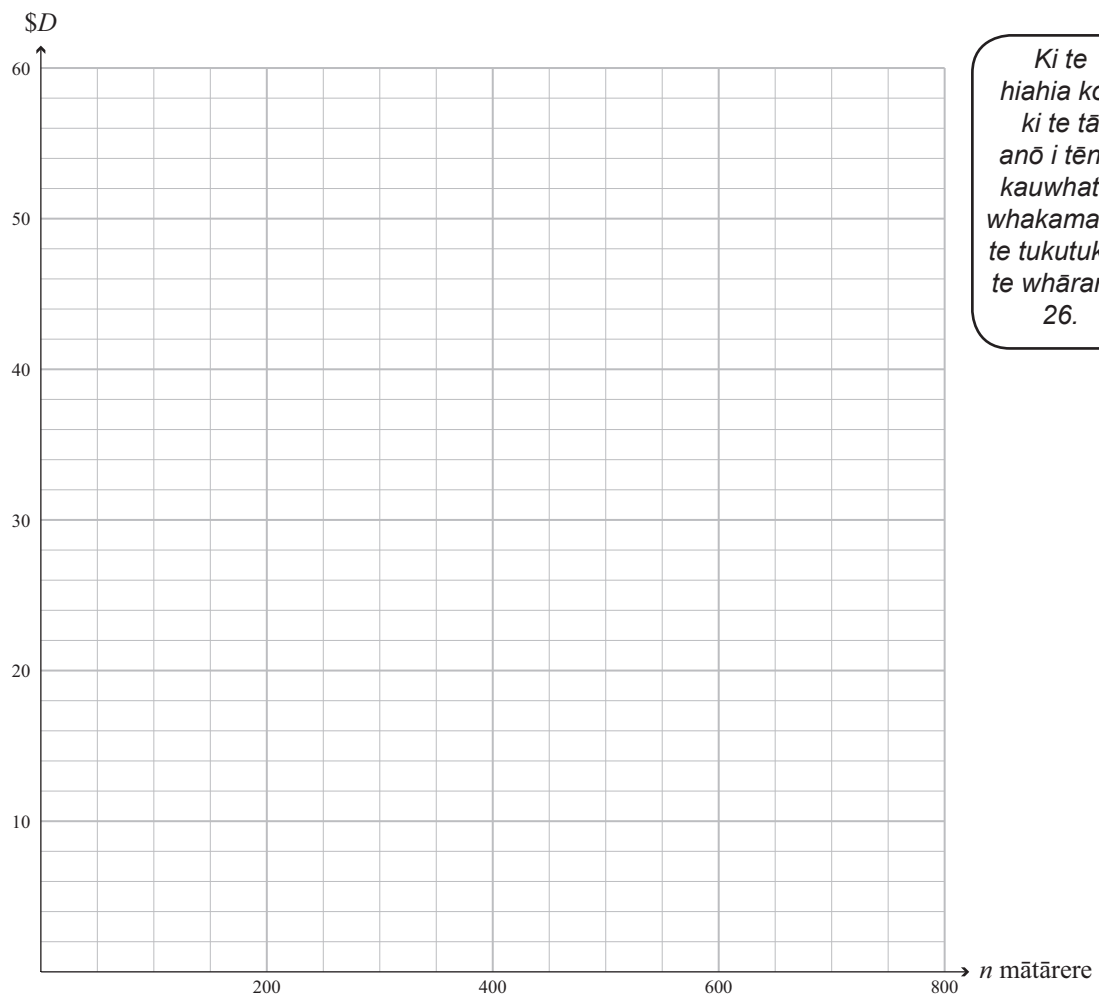
(ii) E 247 ngā mātārere ka tukua e Simone mō *Leaflet Delivery Co*.

E hia te utu ka utua ki a ia mō **ia** pūhanga o te 50 mātārere ka tukua e ia ?

_____

_____

(iii) Ka tuku a Simone i te mātārere 301, ka mōhio ia ka nui ake te utu ki a ia mō ia mātārere, i te utu ina ka tuku atu ia i te mātārere 349.

Whakamāramahia he aha i pēnei ai.
Whakaaturia ngā tātaitanga hei tautoko i tō whakautu.

_____

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_____

(c) Whakamārama mai he pēhea, he aha hoki i rerekē ai te kauwhata i te wāhanga (b) i te kauwhata i te wāhanga (a).

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(b) The amount the student is paid by another company *Leaflet Delivery Co* depends on the number of **whole bundles of 50 leaflets** the student delivers.

They are paid a fixed amount plus an amount for each whole bundle of 50 leaflets they deliver.

If a student delivers more than 300 leaflets they are paid more per bundle.

| Number of leaflets delivered (*n*) | Amount paid ($*D*) |
|---|---|
| 1 – 50 | $11 |
| 51 – 100 | $15 |
| 101 – 150 | $19 |
| 151 – 200 | $23 |
| 201 – 250 | $27 |
| 251 – 300 | $31 |
| 301 – 350 | $36 |
| 351 – 400 | $41 |
| 401 – 450 | $46 |
| 451 – 500 | $51 |

(i) On the grid below draw the graph to show the amount a student is paid for delivering *n* leaflets for *Leaflet Delivery Co*.

*If you need to redraw this graph, use the grid on page 27.*
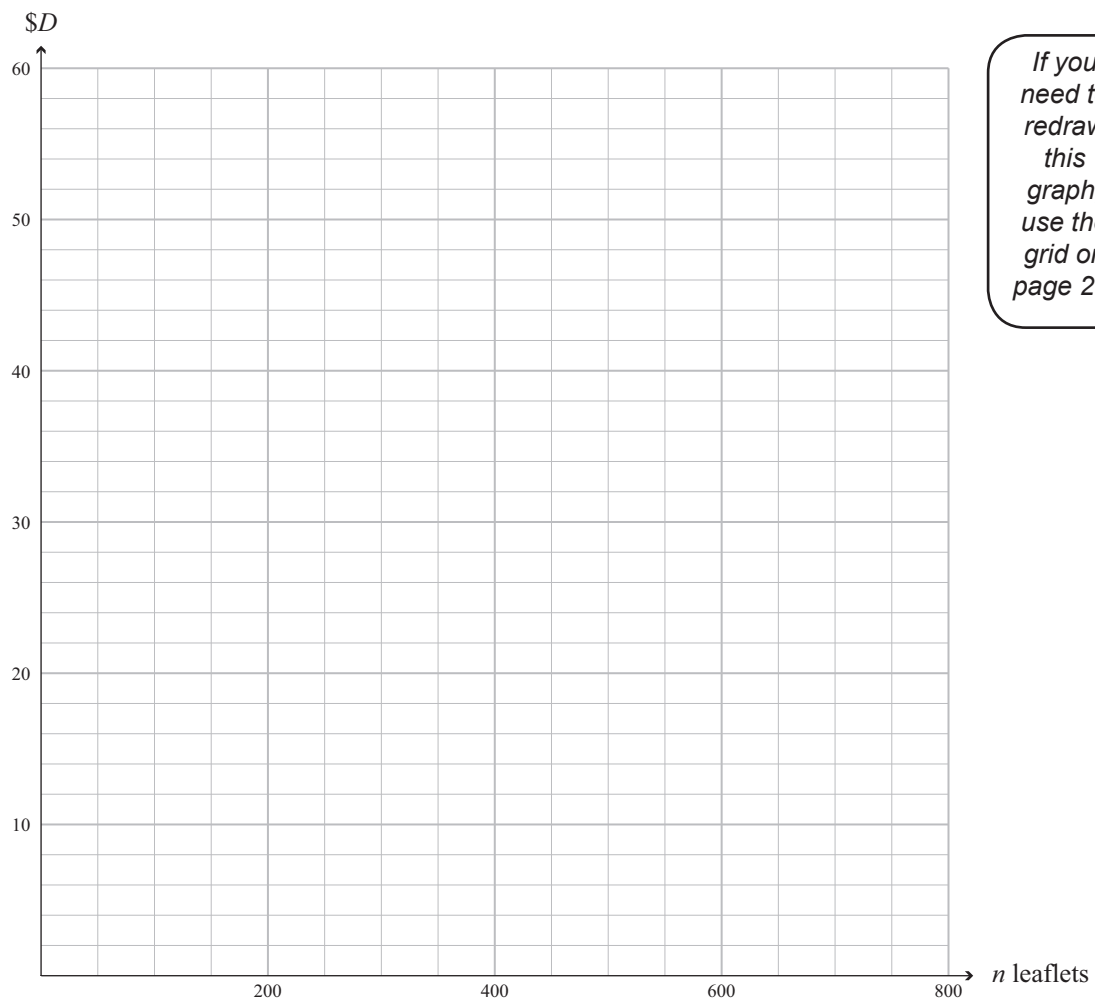
(ii) Simone delivers 247 leaflets for *Leaflet Delivery Co*.

How much is she being paid for **each** bundle of 50 leaflets she delivers?

_____

_____

(iii) When Simone delivers her 301st leaflet she works out she is actually paid more per leaflet than when she delivers her 349th leaflet.

Explain why.

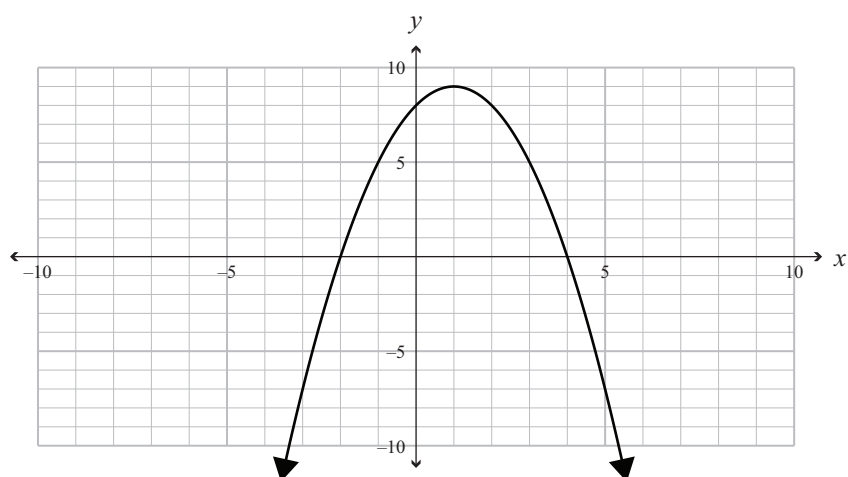Show calculations to support your answer.

_____

_____

_____

_____

(c) Explain how and why the graph in part (b) is different to the graph in part (a).

_____

_____

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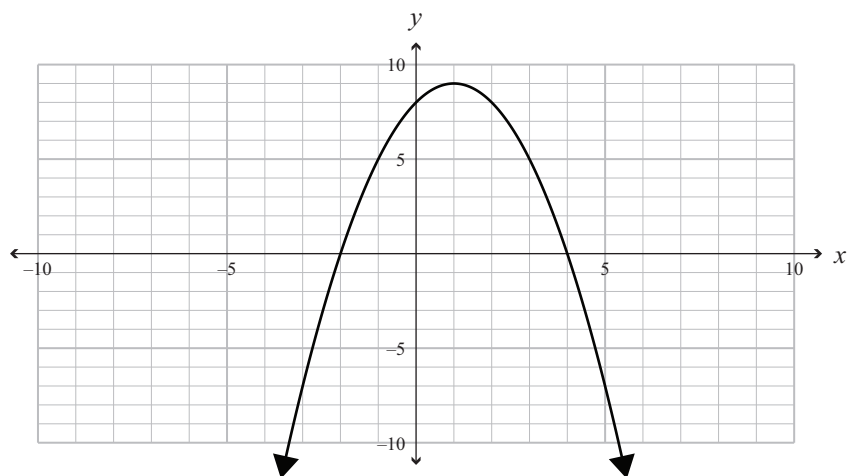


*y* = _____

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

$y =$ _____

## PĀTAI TUATORU

(a)  (i)  Tuhia te kauwhata o $y = x(x + 2)$
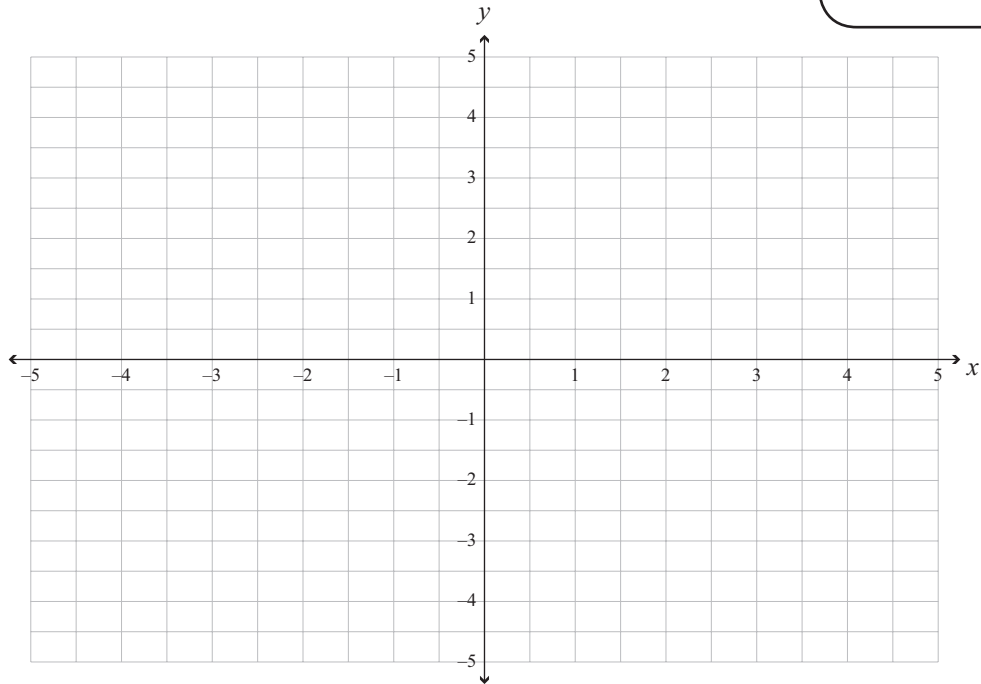
(ii)  Homai ngā **taunga** o ngā haukotinga $x$.

_____

(iii)  Ki tērā kauwhata anō tuhia te $y = (x - 3)(x - 1) + 4$

(iv)  Whakamārama mai he pēhea nei te rerekētanga o te kauwhata o $y = x(x + 2)$ i te kauwhata o $y = (x - 3)(x - 1) + 4$
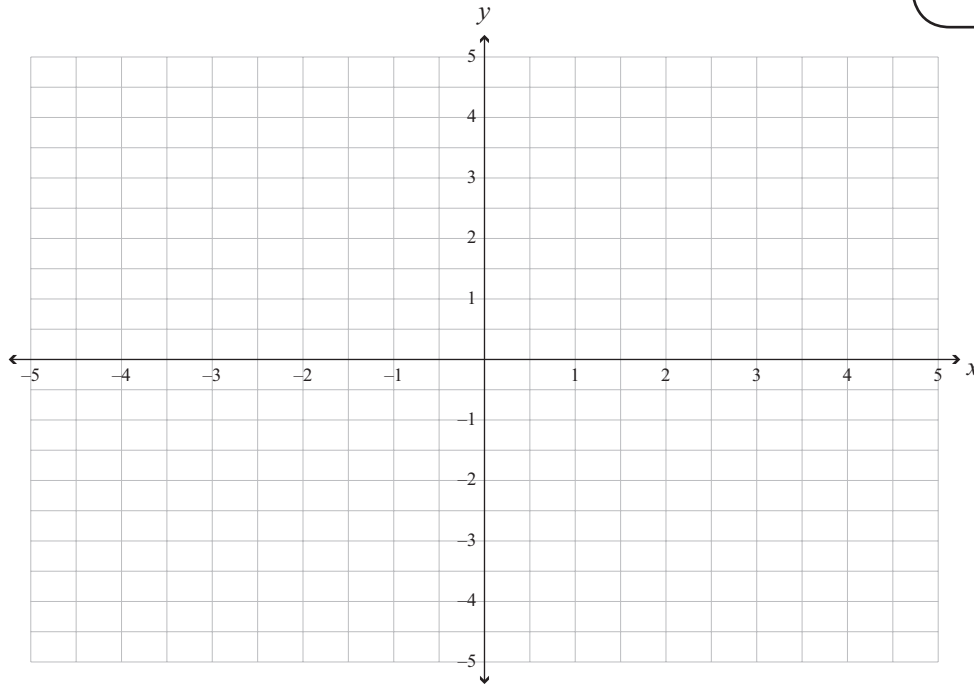
_____

_____

_____

(v)  He pēhea nei te whakaatu mai o ēnei rerekētanga i ngā whārite?

_____

_____

_____

## QUESTION THREE

(a)   (i)   Sketch the graph of $y = x(x + 2)$



(ii)   Give the **coordinates** of the $x$ intercepts.

_____

(iii)   On the same graph sketch $y = (x - 3)(x - 1) + 4$

(iv)   Explain how the graph of $y = x(x + 2)$ is different from the graph of $y = (x - 3)(x - 1) + 4$
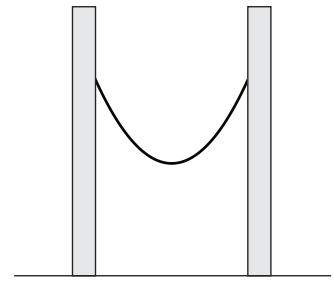
_____

_____

_____

(v)   How are these differences shown in the equations?

_____

_____

_____

(b) Kei tētahi papa tākaro e tārewa **hangarite** ana tētahi taura i waenganui i ētahi pou e rua.

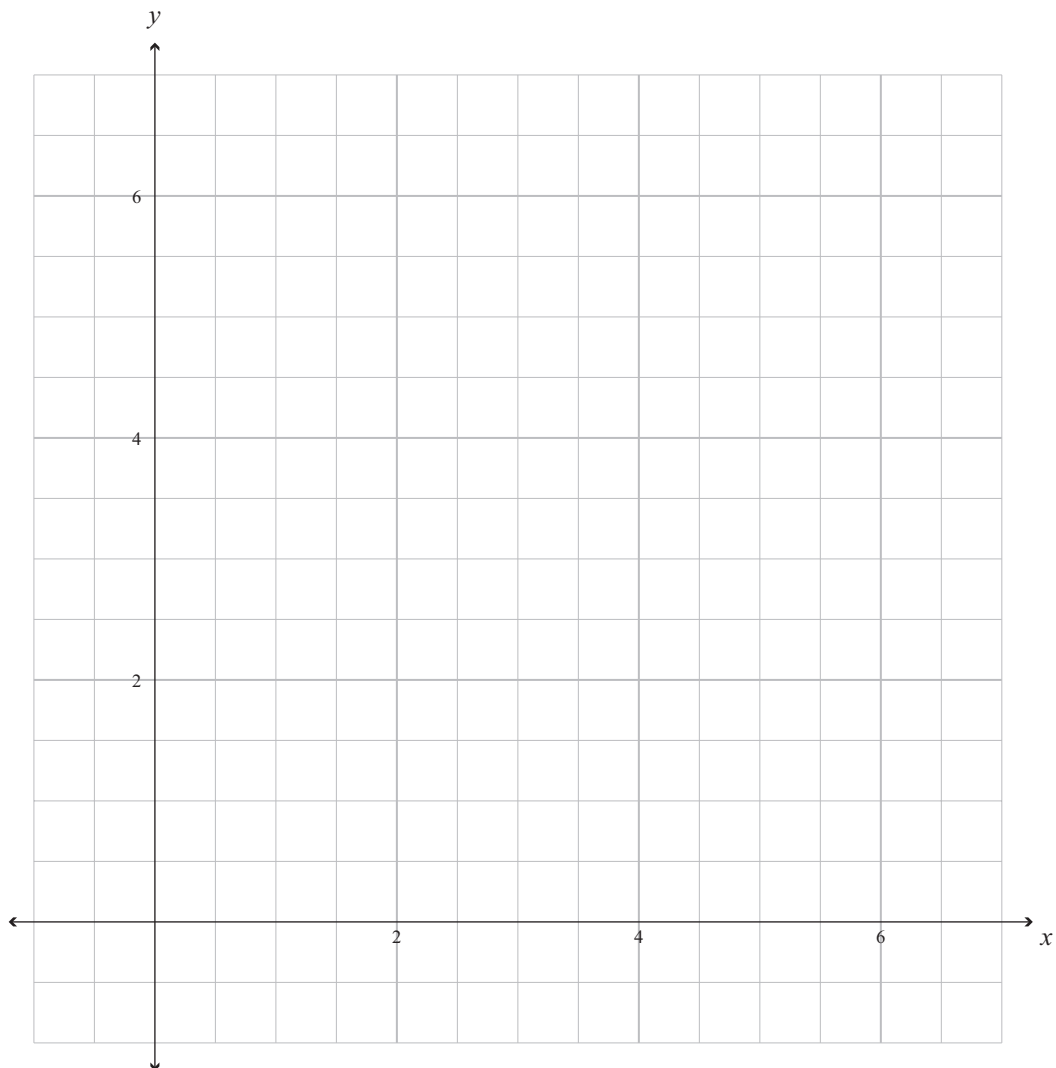Ka whakatauiratia te āhua o te taura mā te whārite:

$h = x^2 - 4x + 6$

ina ko $h$ mita te teitei o te taura o runga ake i te papa, ā,

ko $x$ mita te tawhiti mai i te pou o te taha mauī.

(i) He pēhea te tawhiti o runga ake i te papa o ngā pūwahi e tūhono ai te taura ki ngā pou?

_____

_____

_____

(ii) Tuhia te kauwhata o $h = x^2 - 4x + 6$, ā, whakaaturia hoki te tūnga o ia pou.



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

(b)  A rope in a playground is hanging **symmetrically** between 2 poles.

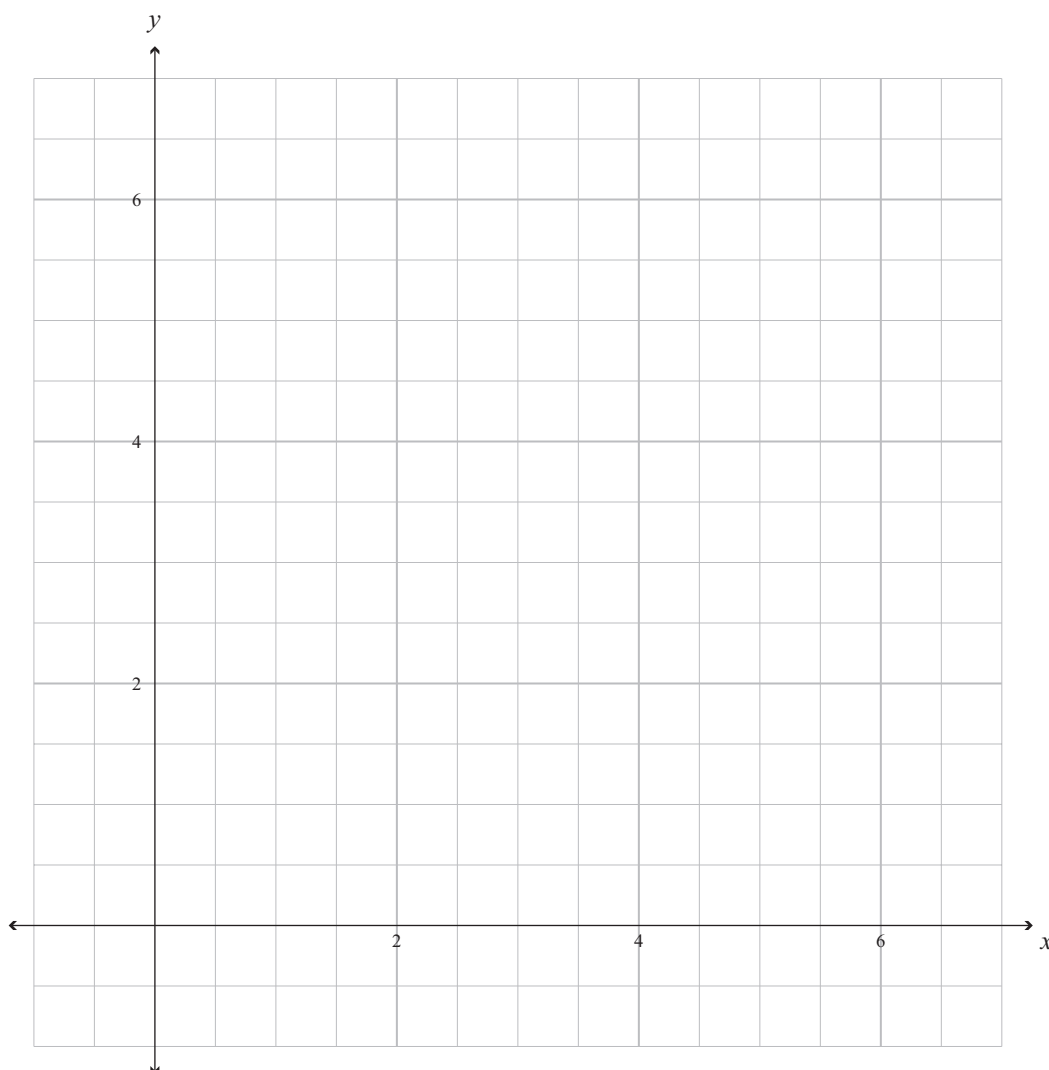The shape of the rope is modelled by the equation:

$h = x^2 - 4x + 6$

where $h$ metres is the height of the rope above the ground

and $x$ metres is the distance from the pole on the left side.
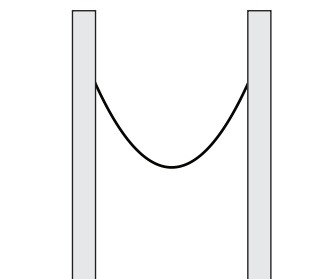
(i)   How far above the ground are the points where the rope is attached to the poles?

(ii)  Sketch the graph of $h = x^2 - 4x + 6$, and show the position of each pole.

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

(iii) Ko ētahi atu pou e rua kei te noho wehe, he 8 m te tawhiti.

E tārewa ana tētahi atu taura i waenganui i aua pou.

Kua tūhonotia te taura ki ia pou kia 5 m te teitei o runga ake i te papa.

Ko te pūwahi hahaka rawa o te taura he 1 m o runga ake i te papa.

Ka whakatauiratia te āhua mā tētahi unahi.

Homai te whārite o te unahi.

$y =$ _____

(iii) Two other poles are 8 m apart.

Another rope is hanging between them.

The rope is attached to each of the poles at a height of 5 m above the ground.

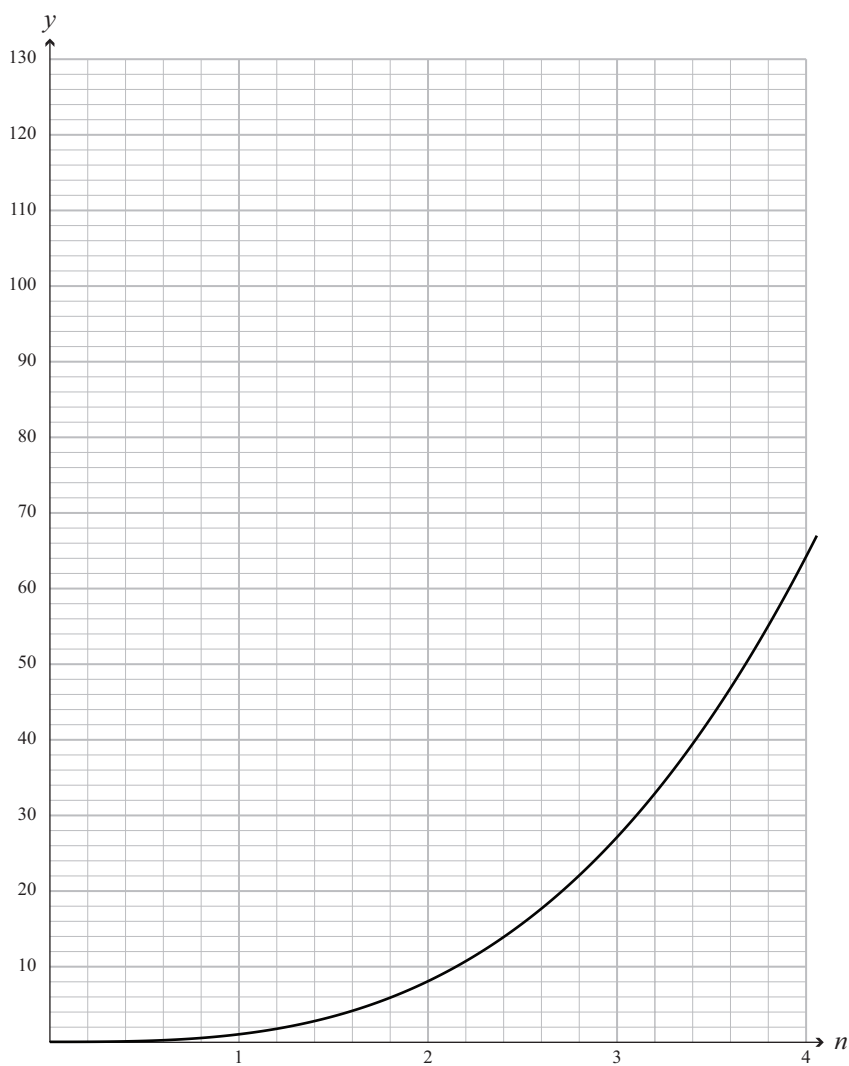The lowest point of the rope is 1 m above the ground.

The shape can be modelled by a parabola.

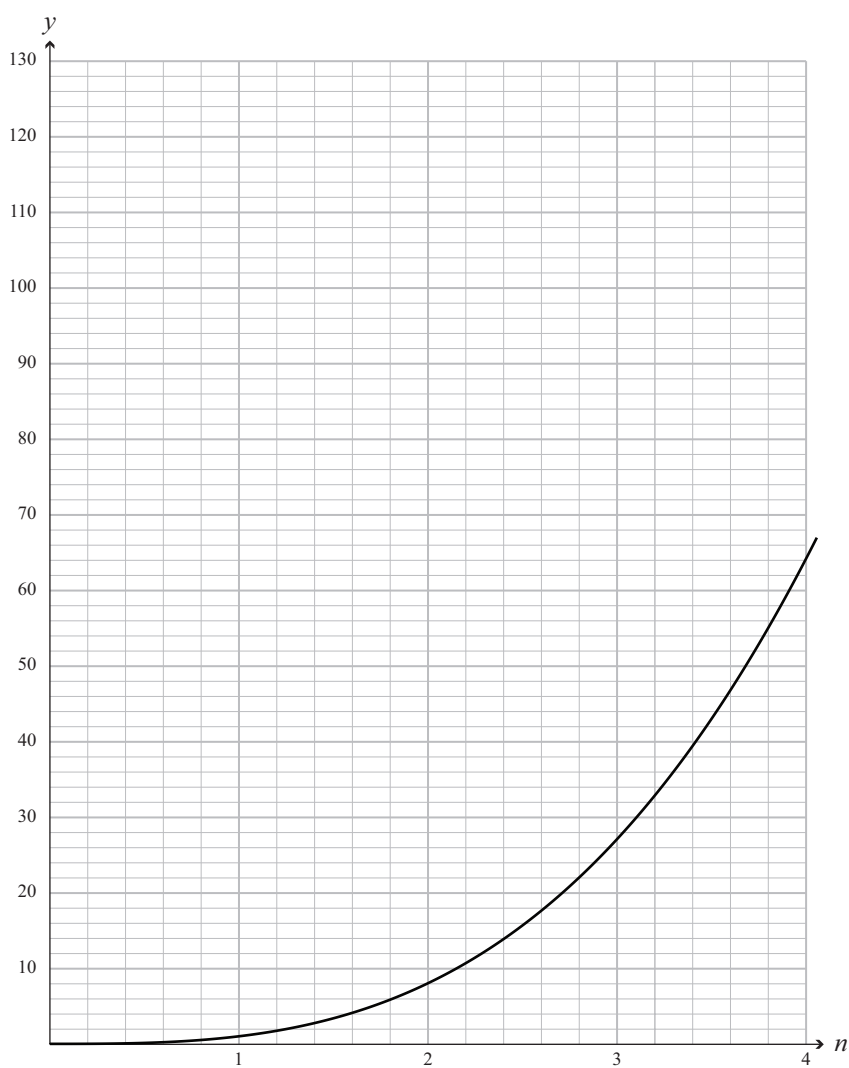Give the equation of the parabola.

$y =$ _____

Ki te hiahia koe ki te tuhi anō i tēnei kauwhata mai i te Pātai Tuatahi (b)(ii), tuhia ki te tukutuku o raro. Kia mārama te tohu ko tēhea te kauwhata ka hiahia koe kia mākahia.
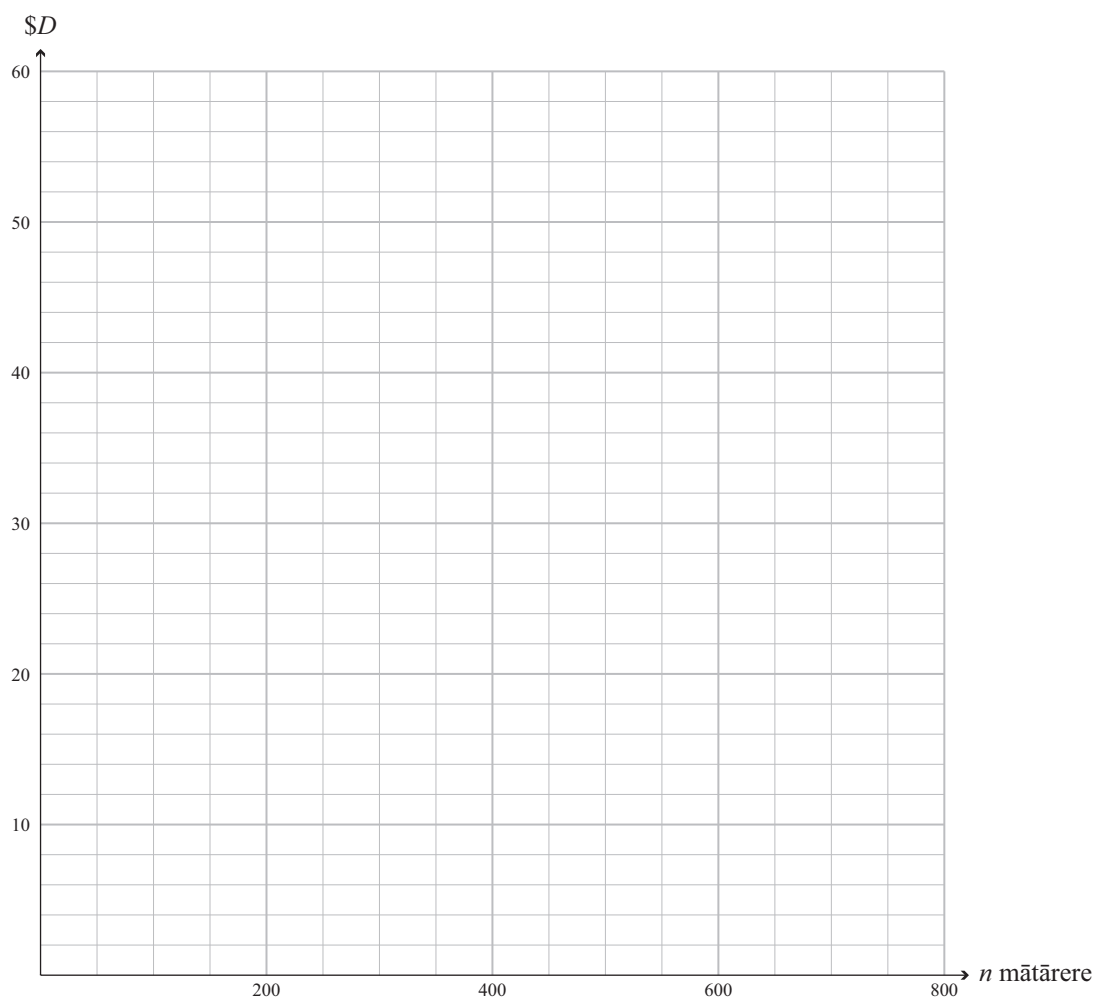
If you need to redraw the graph from Question One (b)(ii), draw it on the grid below. Make sure it is clear which graph you want marked.
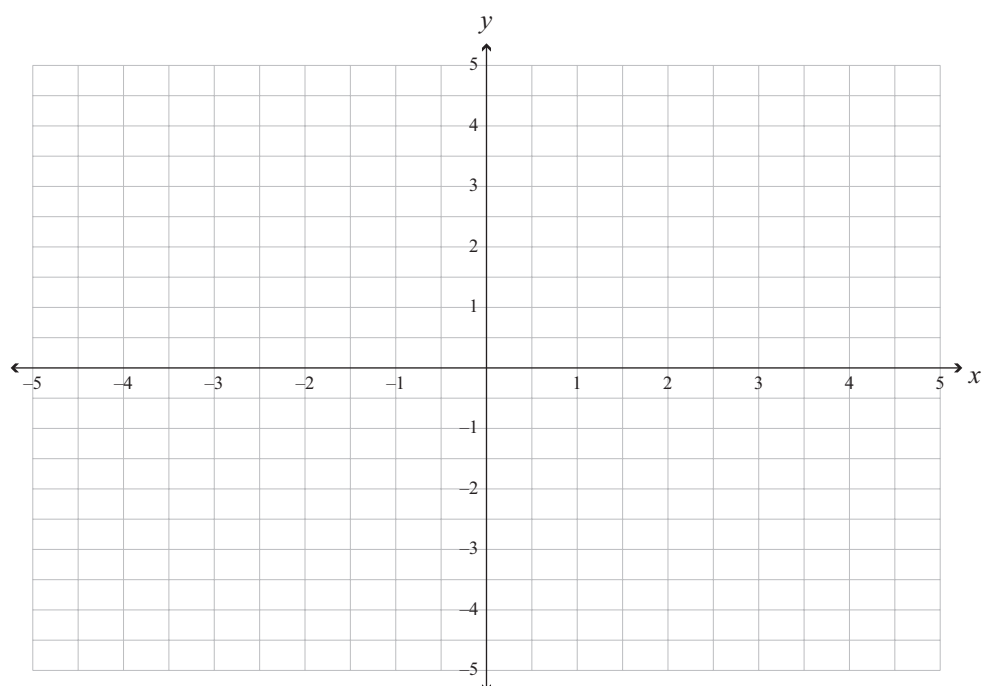
Ki te hiahia koe ki te tuhi anō i tēnei kauwhata mai i te Pātai Tuarua (b)(i), tuhia ki te tukutuku o raro. Kia mārama te tohu ko tēhea te kauwhata ka hiahia koe kia mākahia.

$D

60

50

40

30

20

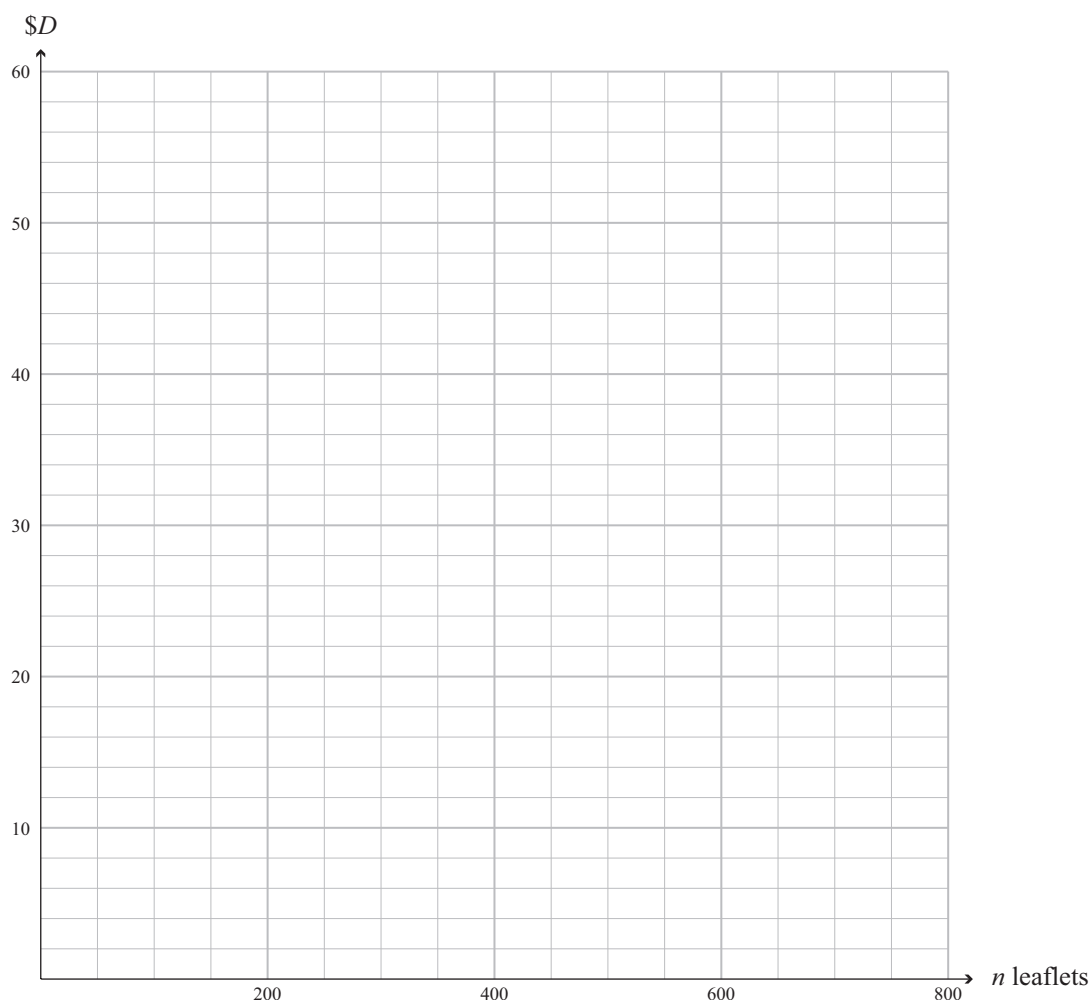10

200    400    600    800    $n$ mātārere

Ki te hiahia koe ki te tuhi anō i tēnei kauwhata mai i te Pātai Tuatoru (a)(i), tuhia ki te tukutuku o raro. Kia mārama te tohu ko tēhea te kauwhata ka hiahia koe kia mākahia.
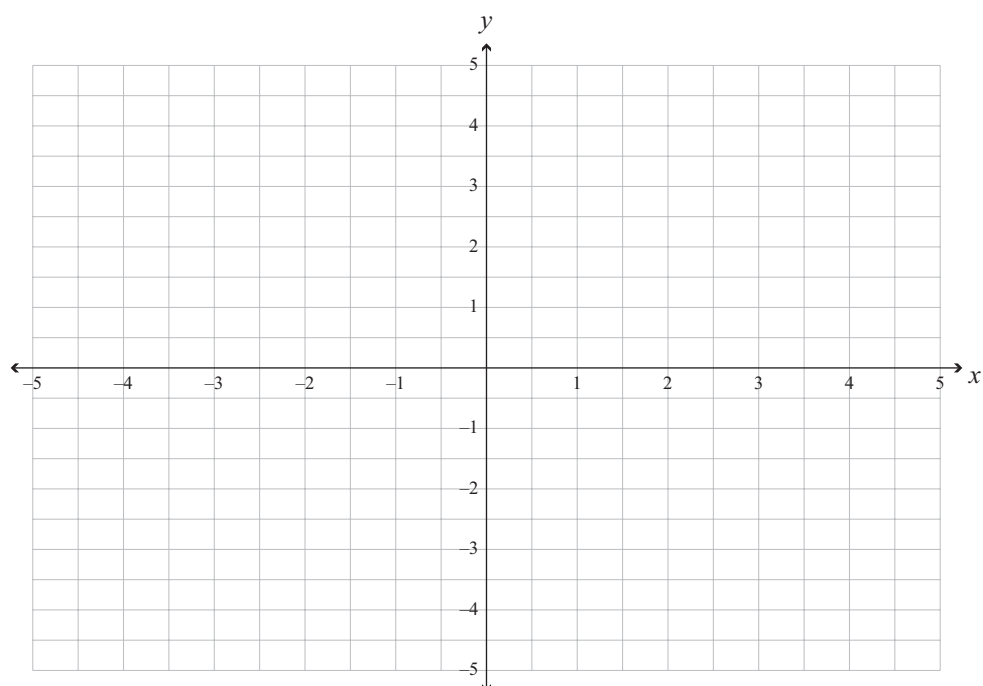
$y$

$x$

Te Pāngarau me te Tauanga 91028M, 2012

If you need to redraw the graph from Question Two (b)(i), draw it on the grid below. Make sure it is clear which graph you want marked.

$D

60

50

40

30

20

10

200          400          600          800

$n$ leaflets

If you need to redraw the graph from Question Three (a)(i), draw it on the grid below. Make sure it is clear which graph you want marked.

$y$

5

4

3

2

1

−5   −4   −3   −2   −1          1   2   3   4   5   $x$

−1

−2

−3

−4

−5

Mathematics and Statistics 91028, 2012

Ki te hiahia koe ki te tuhi anō i te kauwhata mō te Pātai Tuatoru (b)(ii), tuhia ki te tukutuku i raro. Kia mārama te tohu ko tēhea te kauwhata ka hiahia koe kia mākahia.

If you need to redraw the graph from Question Three (b)(ii), draw it on the grid below. Make sure it is clear which graph you want marked.
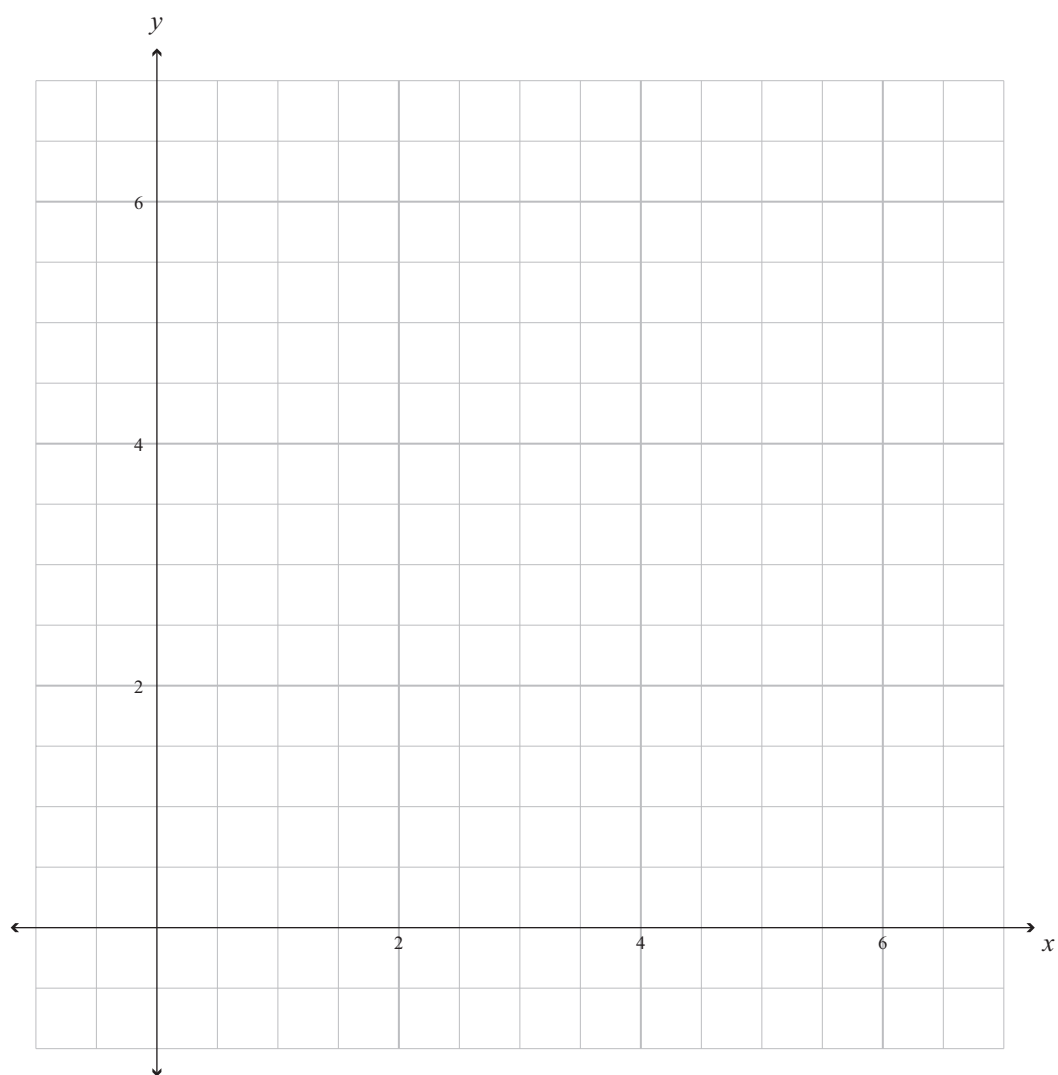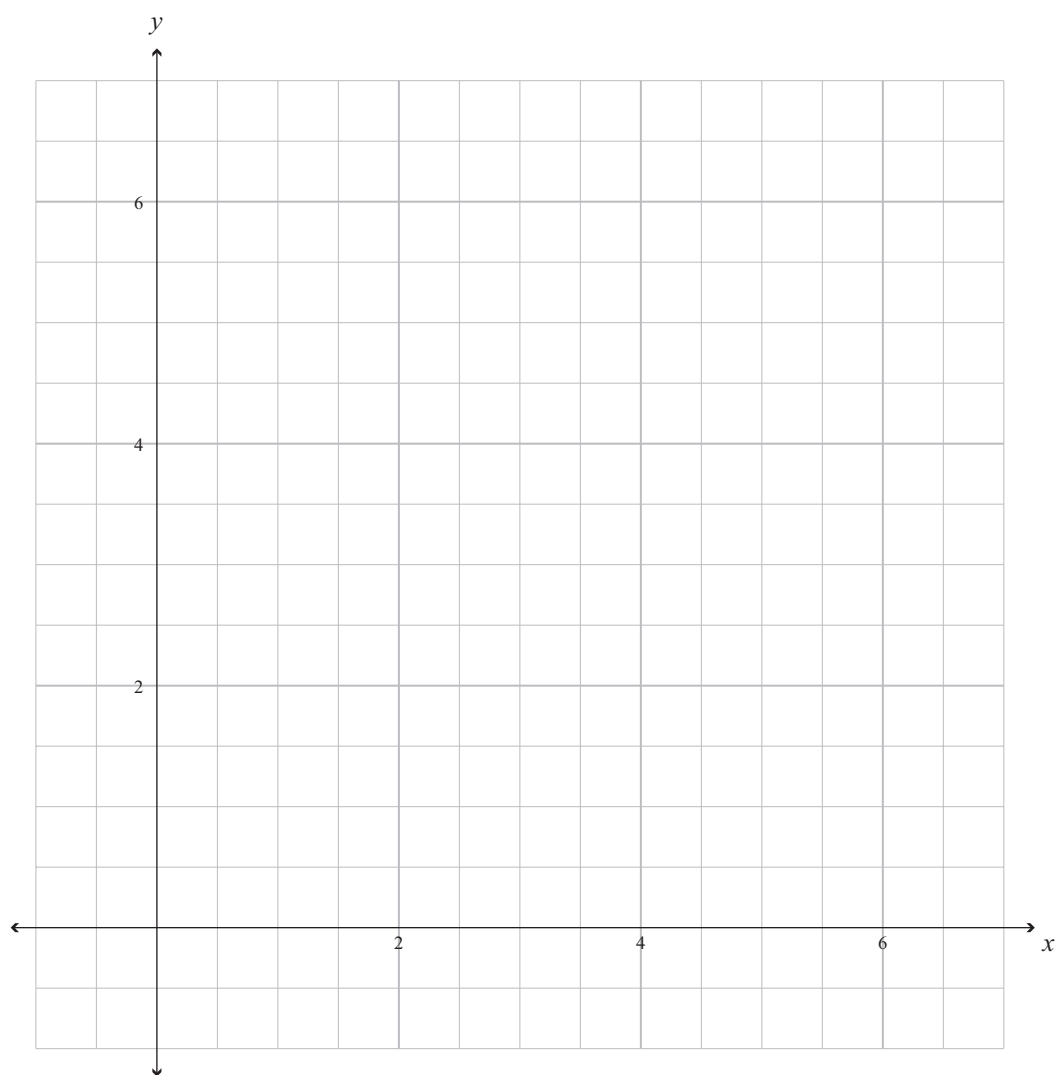
| TAU PĀTAI | **He puka anō mēnā ka hiahiatia.**<br>**Tuhia te (ngā) tau pātai mēnā e hāngai ana.** | MĀ TE KAIMĀKA ANAKE |
|---|---|---|
| | | |

QUESTION
NUMBER

*English translation of the wording on the front cover*

## Level 1 Mathematics and Statistics, 2012

## 91028  Investigate relationships between tables, equations and graphs

9.30 am Wednesday 14 November 2012
Credits: Four

| 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 space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–31 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.**