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91028



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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Level 1 Mathematics and Statistics, 2011

91028 Investigate relationships between tables, equations and graphs

9.30 am Monday 14 November 2011

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 2–14 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.

TOTAL

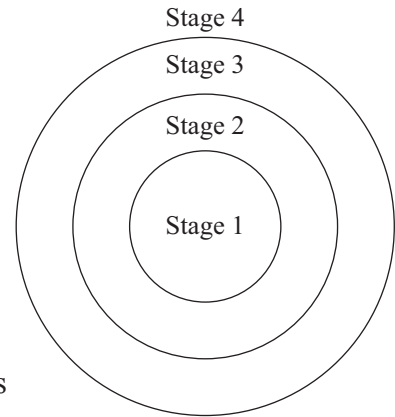
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You are advised to spend 60 minutes answering the questions in this booklet.

QUESTION ONE

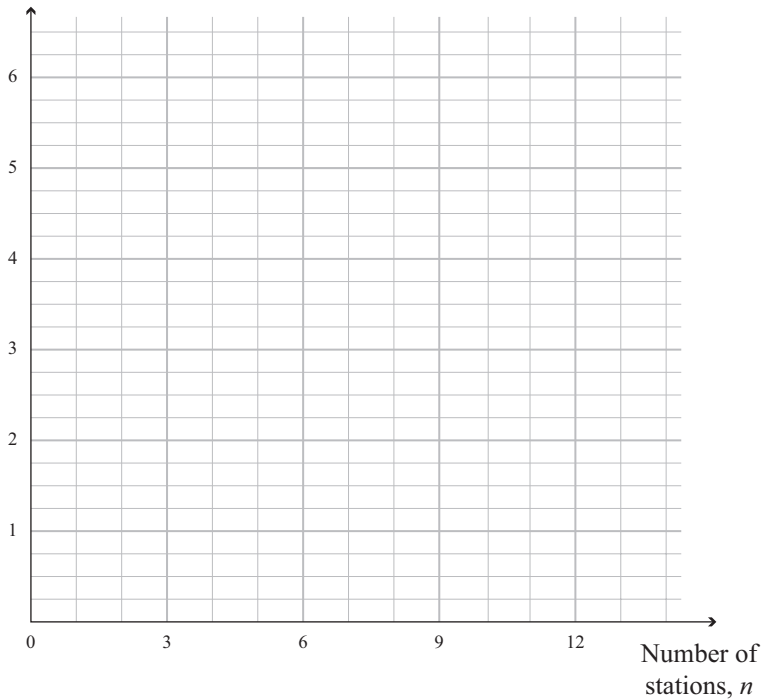
- (a) The table below gives the adult single train fares for travel from the centre of a city.

Number of stations, n	Stage number	Adult single fare
1 – 3	1	\$2.00
4 – 6	2	\$3.25
7 – 9	3	\$4.50
10 – 12	4	\$5.75



- (i) On the grid below, sketch the graph of the adult train fares against the number of stations from the centre of the city.

Adult single
fare (\$)



*If you need
to redraw this
graph, use the
grid on page 12.*

(ii) A child's fare is \$1.50 for the first stage.

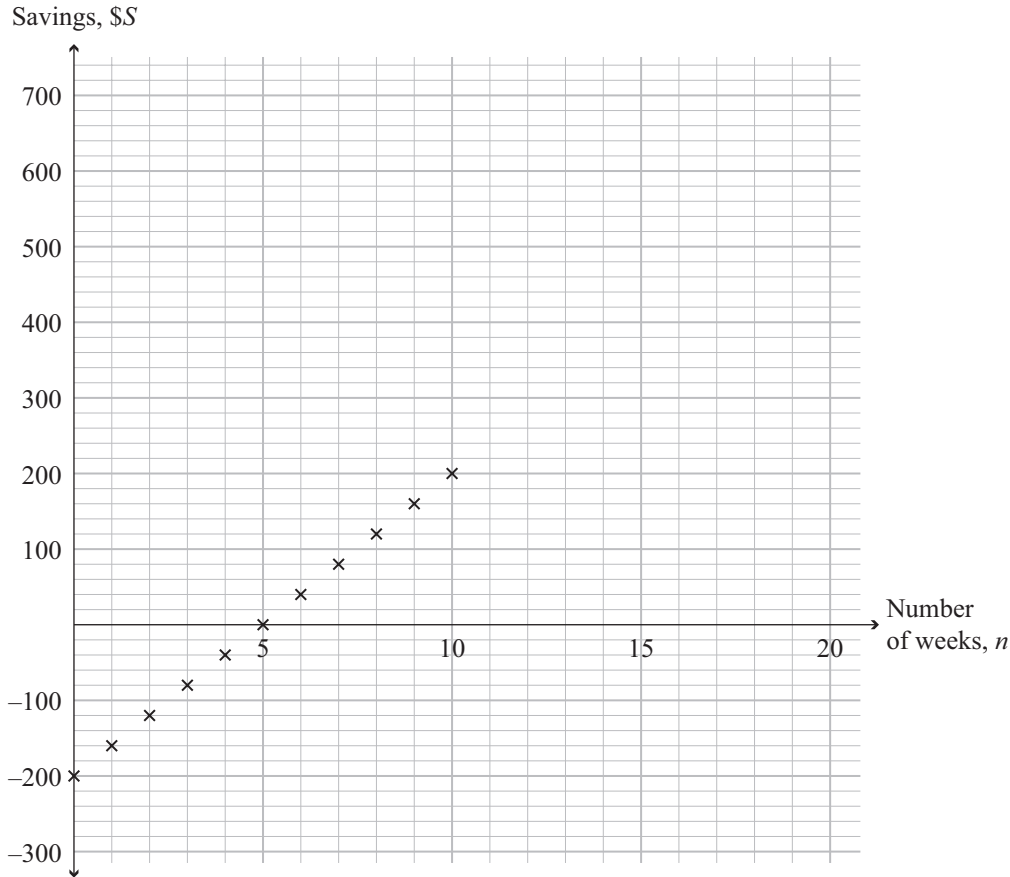
Each additional stage, for a child, increases the fare by 75 cents.

If a graph was drawn for the child's fares, describe the similarities and differences between the graphs of the child's fare and the adult's fare.

- (b) Blake receives a copy of his bank statement and finds he is overdrawn (he has a negative amount in the bank).

He starts a saving plan.

The graph below shows the amount of money Blake hopes to have in his bank account, $\$S$, if he follows his savings plan for n weeks.



- (i) How much does Blake plan to bank each week?

- (ii) Give the equation for the graph of Blake's saving plan in terms of $\$S$, the amount in Blake's account, and n , the number of weeks after the start of his saving plan.

QUESTION TWO

Emma is employing Ian to build a deck at her house.

She provides all the building material.

She pays Ian $\$P$ for the number of hours, h , that he works.

She also pays for Ian's travel to her home each day.

Ian works for 8 hours each day.

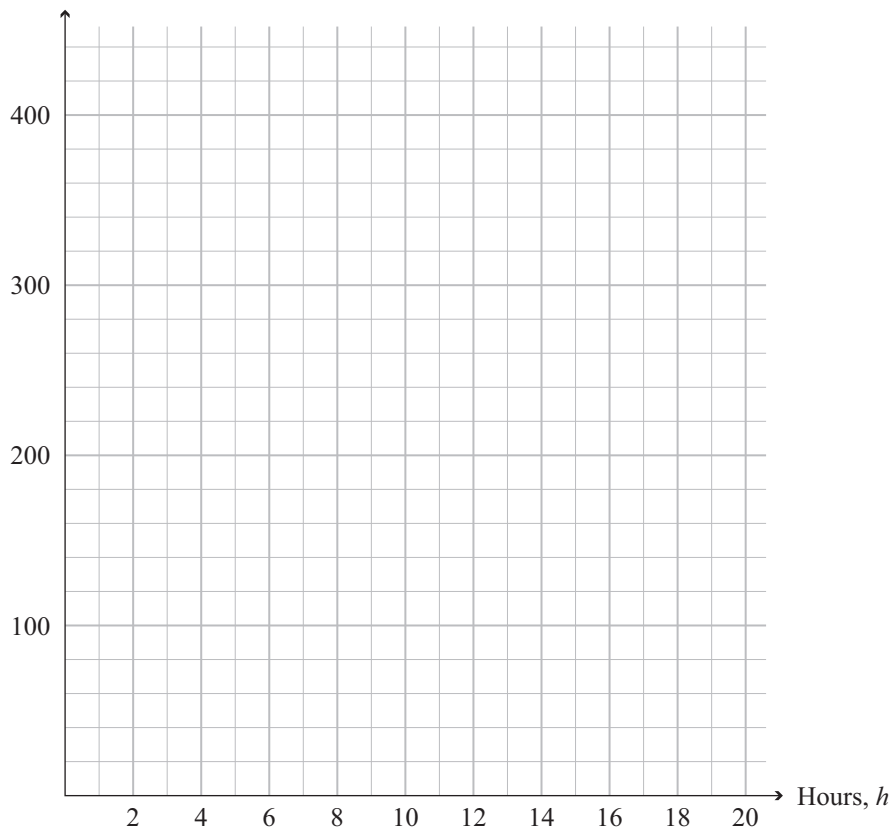
He knows the deck will take more than 4 hours to build.

To help Emma know how much she can expect to pay, Ian provides the following table:

Number of hours worked (h)	Payment (P)
4	\$160
5	\$185
6	\$210
7	\$235
8	\$260
9	\$345
10	\$370

- (a) On the grid below, plot a graph showing the payment required for the number of hours worked.

Payment (\$), P



If you need to redraw this graph, use the grid on page 12.

- (b) How much does Ian charge for his travel each day?

- (c) Explain why the graph rises more steeply after 8 hours.

- (d) What would Emma expect to pay if the work took 30 hours?

Explain your calculation.

- (e) Zarko lives next door to Emma and says he could build the deck for her.

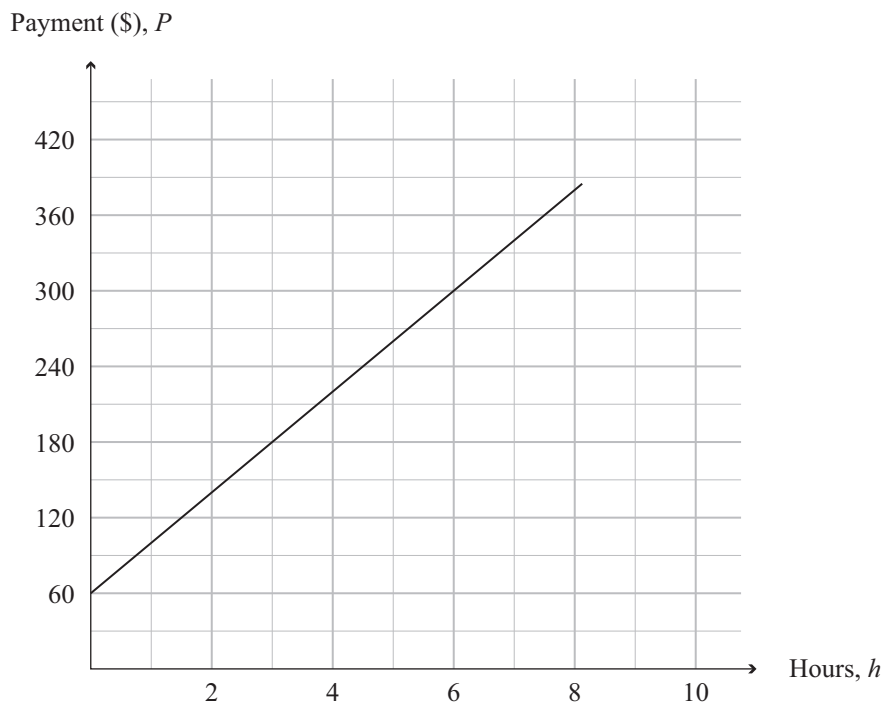
He does not need to be paid for his travel, but he charges \$35 an hour.

How long would the work take if the payments to Zarko and Ian were the same?

Explain how you calculated your answer.

Hint: there may be more than one solution.

- (f) Another builder gives Emma a graph, showing the amount she would charge for 8 hours work.



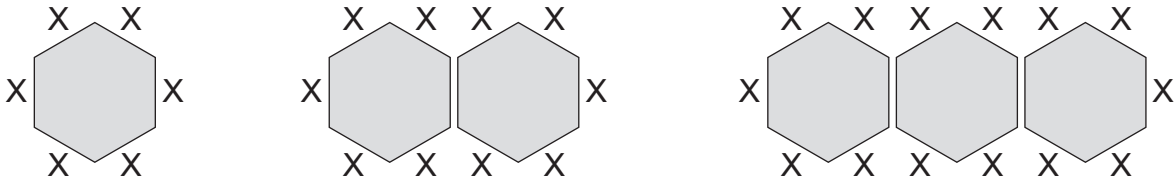
Give the rule for the payment that this builder would receive for the first 8 hours that she worked.

QUESTION THREE

(a) Brad and Zara were arranging hexagonal shaped tables for their wedding.

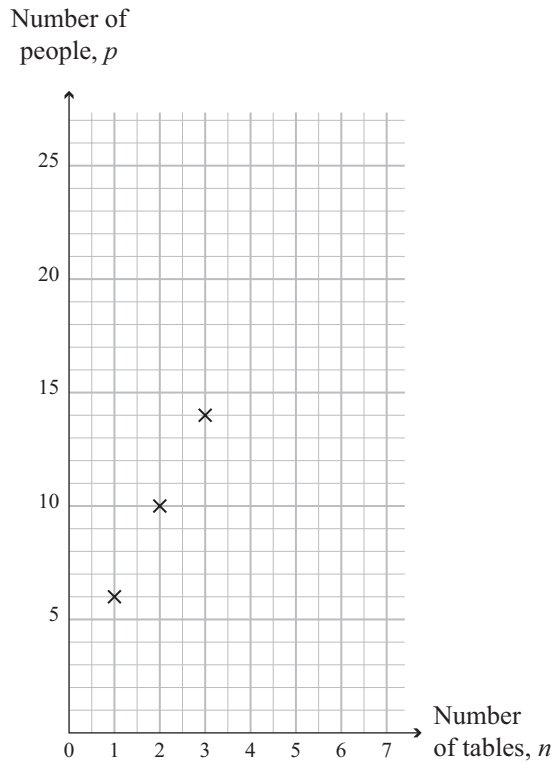
They try different arrangements of tables to see how many people they can fit when the tables are put next to each other, as shown in the diagram.

They mark where each person could sit with an X.



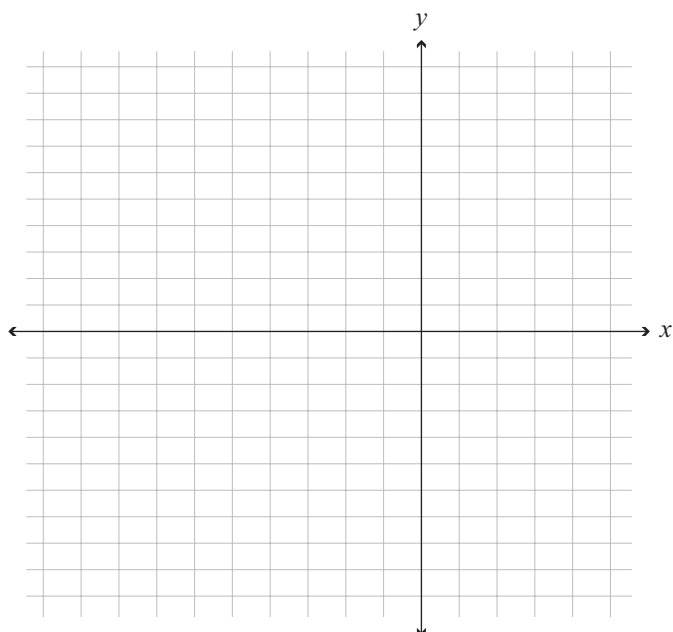
Brad says the equation for the total number of people, p , if there are n tables, is given by the equation $p = 4n + 2$.

Zara plots a graph of the number of people, p , against the number of tables.



Explain how the equation and graph relate to the number of people at the tables.

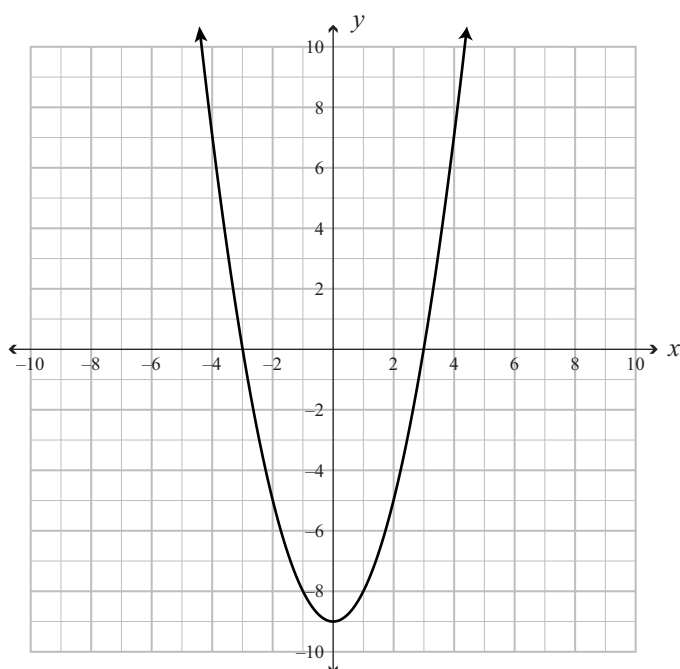
- (b) On the grid below, sketch the graph of $y = -(x - 2)(x + 4)$



If you need to redraw this graph, use the grid on page 13.

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- (c) For the graph below, give:



- (i) the x and y intercepts

- (ii) the equation of the graph.

- (iii) The parabola is moved 1 unit to the right and 2 units up.

Give the equation of the parabola in simplified form in its new position
AND give the y-intercept.

Equation: _____ y-intercept: _____

- (d) (i) In a children's play park, a ball is kicked so that its flight path can be modelled by the equation

$$h = -ax(x - 6)$$

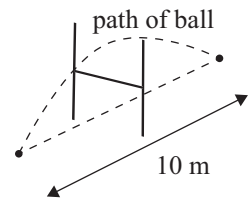
where h metres is the height of the ball when it is x metres from the point from where it is kicked.

If the maximum height of the ball is 2 m, what is the value of a ?

- (ii) A ball is kicked from the ground and lands at a point 10 m away on the opposite side of a goalpost.

The crossbar of the goalpost is 2 m above the ground.

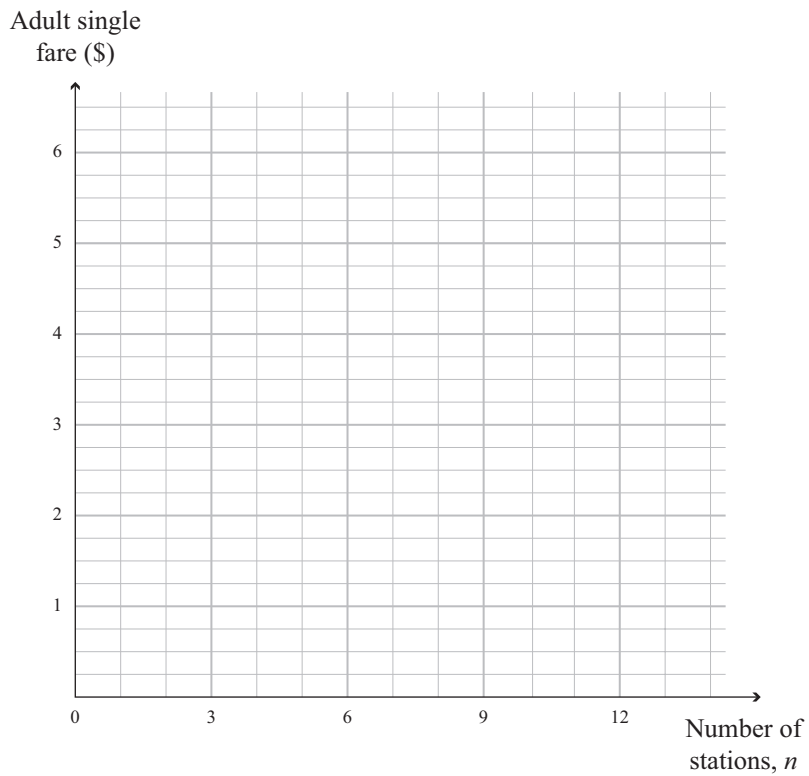
When the ball passes over the crossbar, it is at its maximum height of 2.5 m.



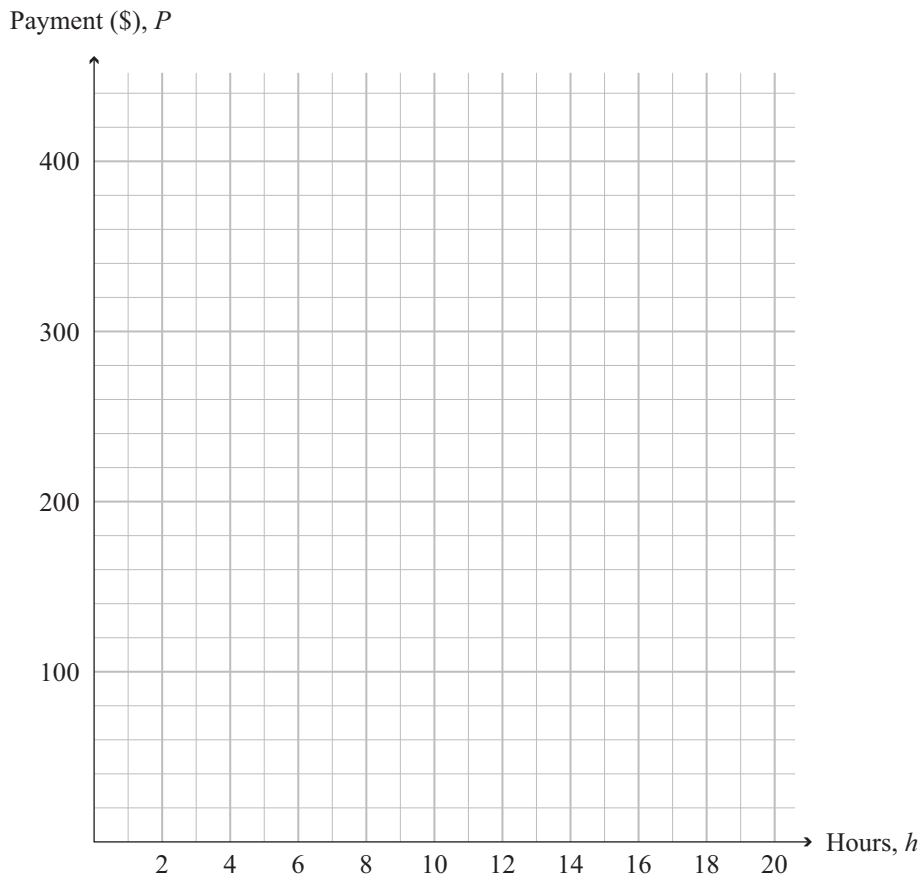
Give the equation for the height, h metres, of the ball above the ground at a distance, x metres, from where it was kicked, if the path of the ball is modelled by a parabola.

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

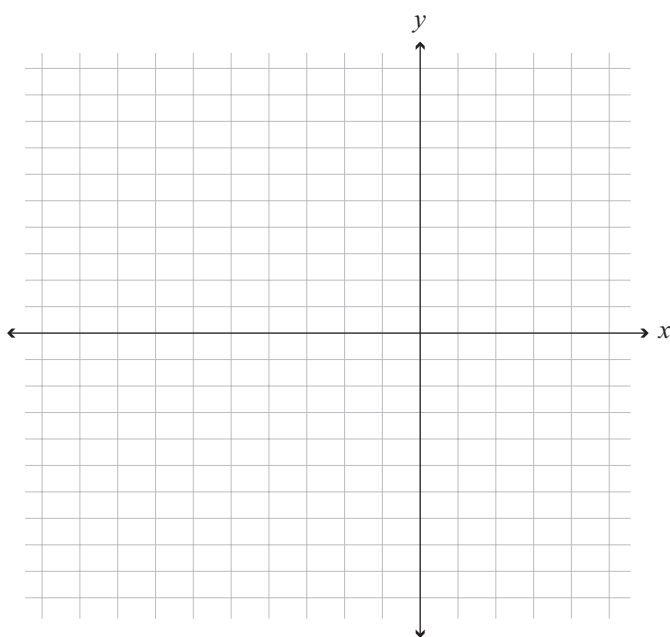
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If you need to redraw the graph from Question Two (a), draw it on the grid below. Make sure it is clear which graph you want marked.



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



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