Date: _____

CHAPTER 3

Linear Relations

Get Set

Answer these questions to check your understanding of the Get Ready concepts on pages 98–99 of the *Foundations of Mathematics 10* textbook.

Common Factors

1. Find the greatest whole number that divides evenly into each pair of numbers below.

a) 8 and 12: _____ **b)** 15 and 45: _____ **c)** 11 and 121: _____

Operations With Fractions and Decimals

2. State each fraction in lowest terms.

a) $\frac{4}{8} =$ **b)** $\frac{2}{10} =$ **c)** $\frac{3}{12} =$ **d)** $\frac{21}{35} =$

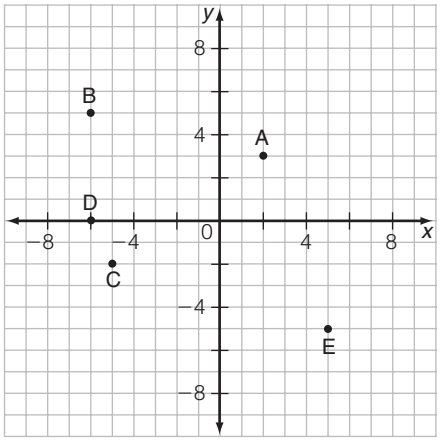
Operations With Integers

3. Evaluate the following.

a) $-6 - 7$ **b)** $-14 - (-9)$ **c)** $\frac{-7 - (-8)}{12 - (-4)}$

Graphing on a Coordinate Grid

4. Write the coordinates of each point.



Working With Variables

5. Solve for x.

a) $2x - 1 = 5$ **b)** $3x - 1 = 8$ **c)** $-x + 7 = 11$

6. Evaluate each expression for $y = -7$.

a) $\frac{y - 5}{3}$ **b)** $\frac{y - 4}{-1}$ **c)** $8y - 3$

Date: _____

3.1 Slope as a Rate of Change

Textbook pp. 100–110

Warm-Up

1. Fractions

Write each fraction in lowest terms.

a) $\frac{12}{18}$

b) $\frac{14}{35}$

c) $\frac{8}{14}$

d) $\frac{15}{30}$

2. Number Sense

Find each difference.

a) $3 - (-5)$

b) $-7 - 6$

c) $-2 - (-1)$

d) $6 - 4$

3. Tables of Values

Complete the table of values for $y = 2x + 5$.

x	y
0	
1	
2	
3	
4	

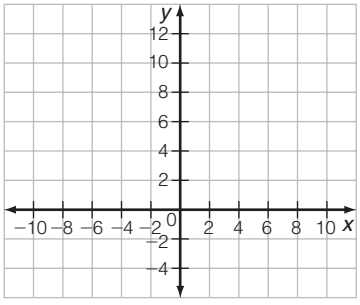
4. Mental Math

Carmindy earns $9/h. What are her total earnings if she works 7 h?

5. Graph a Linear Relation

Create a table of values for $y = 3x + 4$. Then, graph the line.

x	y
−2	
−1	
0	
1	
2	



6. Math Literacy

Given the equation of a linear relation, describe how you would make a table of values for the relation.

Date: _____

Practise: Slope as a Rate of Change

Section 3.1

1. Use the tables below to create a table of values for each given equation. The x-values are provided. Determine the y-values and the rate of change in the y-values for each equation.

a) $y = -2x + 2$

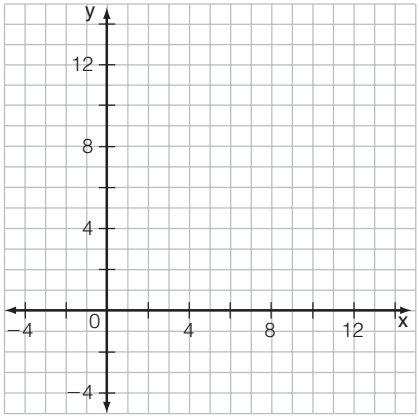
x	y	Rate of Change
-2		
-1		
0		
1		
2		

b) $y = 5x - 1$

x	y	Rate of Change
-2		
-1		
0		
1		
2		

2. Study the table of values below.

x	y	Rate of Change
-1	5	
0	7	
1	9	
2	11	
3	13	



a) Graph the values from the table on the grid.

b) Use your table to find the rate of change in the y-values.

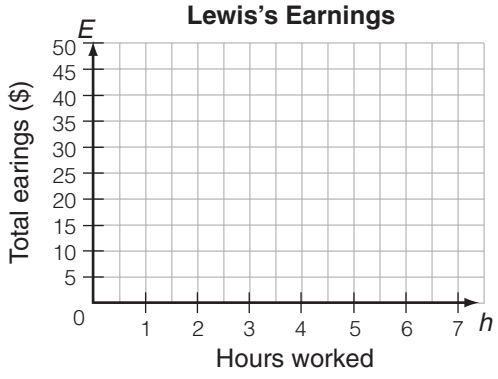
3. Lewis works at a bookstore in the local mall, where he earns \$8.25/h. A typical shift lasts 6 h.

a) Create a table of values to show his total earnings for up to 6 hours of work.

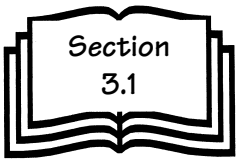
b) Determine the rate of change in Lewis's total earnings.

c) Graph your table of values. Connect the points with a straight line.

Hours Worked	Total Earnings (\$)	Rate of Change
0		
1		
2		
3		
4		
5		
6		



Date: _____



d) Choose any two points on the line. Find the rise and run between them.

First point (_____,_____) Second point (_____,_____)

rise: _____ run: _____

e) Find the slope of the line using the rise and run from part **d)**.

$\text{slope} = \frac{\text{rise}}{\text{run}}$

$= $ _____

$= $ _____

f) The rate of change is _____. This represents _____

_____.

4. The equation of a straight line is $y = 2x + 2$.

a) Create a table of values for this equation.

b) Graph your table of values.
Draw a straight line through the points.

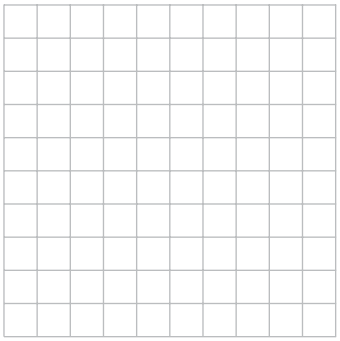
c) Choose any two points on the line.
Find the rise and run between them.

First point (_____,_____)

Second point (_____,_____)

rise: _____ run: _____

x	*y*



d) Find the slope of the line.

$\text{slope} = \frac{\text{rise}}{\text{run}}$

$= $ _____

$= $ _____

5. Amy works on an assembly line packing dolls into boxes to sell in stores. Amy can pack 15 dolls in 1 hour.

a) Create a table of values to show how many dolls Amy packs in 6 hours of work.

b) Find the rate of change in the number of dolls Amy packs.

c) What does the rate of change represent?

_____

Hours Worked	Number of Dolls Packed	Rate of Change
0		
1		
2		
3		
4		
5		
6		

Date: _____

3.2 Investigate Slope and y-Intercept Using Technology

Textbook pp. 111–117

Warm-Up

1. Math Literacy

What is the rate of change of a linear relation? Explain.

2. Number Sense

Find each difference.

a) $-10 - 3$

b) $-14 - (-6)$

c) $8 - (-3)$

d) $-1 - (-4)$

3. Simplify Expressions

Simplify each expression.

a) $\dfrac{5 - 2}{-3 - 6}$

b) $\dfrac{-8 - (-4)}{-2 - 10}$

4. Rate of Change

David earns \$6.50/h. Last night he worked 5 h and earned \$32.50. What is the rate of change in David's earnings?

_____.

5. Calculate

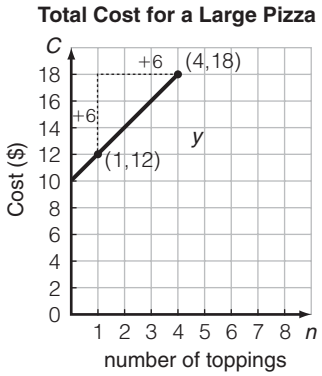
The graph shows the total cost for a large pizza with different numbers of toppings. If x represents the number of toppings and y represents the total cost in dollars, find the slope of the line.

$m = \dfrac{\text{rise}}{\text{run}}$

$=$ _____

$=$ _____

$=$ _____



6. Interpret Slope

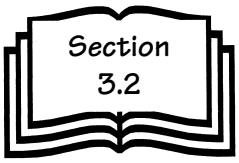
What does the slope of the line in question 5 represent?

_____

_____

Date: _____

Practise: Investigate Slope and y-Intercept Using Technology



1. Graph the following equations using a graphing calculator with the standard window settings. Then, using the graph, calculate the slope and y-intercept of each line.

a) $y = 2x$

slope: _____

y-intercept: _____

b) $y = 4x - 5$

slope: _____

y-intercept: _____

c) $y = -x + 6$

slope: _____

y-intercept: _____

d) $y = -\frac{1}{2}x + \frac{5}{2}$

slope: _____

y-intercept: _____

Hint: Make sure each equation is stated in the form $y = mx + b$.

2. Write the equation of each line using the information given.

a) slope $= \frac{7}{2}$ and y-intercept $= 9$ equation: _____

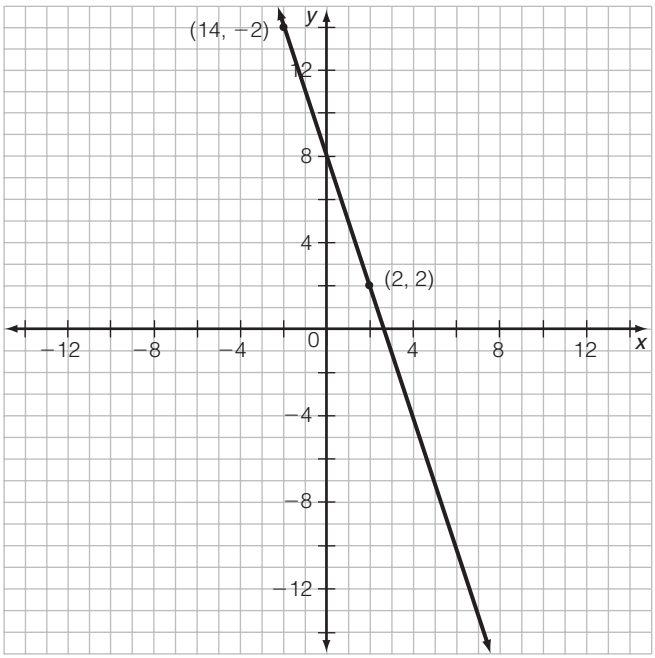
b) $m = -3$ and $b = 3$ equation: _____

c) $m = 0$ and $b = -3$ equation: _____

d) $m = 7$ and $b = 0$ equation: _____

3. Write the equation for each graph below. First determine the slope and y-intercept.

a)



slope: _____

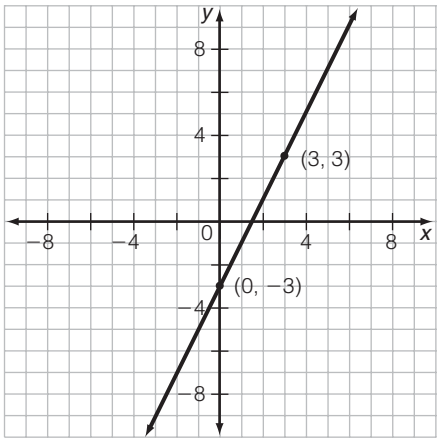
y-intercept: _____

equation: _____

Date: _____

Section 3.2

b)

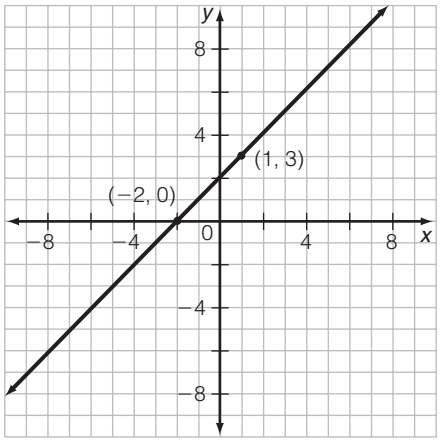


slope: _____

y-intercept: _____

equation: _____

c)



slope: _____

y-intercept: _____

equation: _____

4. The cost to rent a hall for a hockey banquet is modelled by the equation $C = 35n + 3000$, where C represents the total cost in dollars and n represents the number of people attending the banquet.

a) Use a graphing calculator to graph this equation with the standard window settings.

b) Since no line appears on your display screen, describe what you need to do to make the graph appear.

_____

c) What does the number 35 in the equation represent?

_____

d) What does the number 3000 in the equation represent?

_____

e) How much will the banquet cost if the organizers expect 200 people?

_____

Date: _____

3.3 Properties of Slopes of Lines

Textbook pp. 118–127

Warm-Up

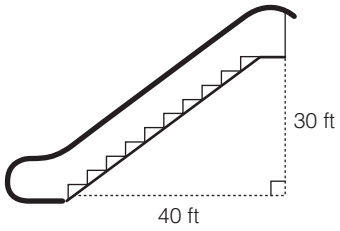
1. Positive Slopes

Determine the slope of the escalator. Express your final answer as a fraction in lowest terms.

$m = \frac{\text{rise}}{\text{run}}$

$= \_\_\_\_\_$

$= \_\_\_\_\_$

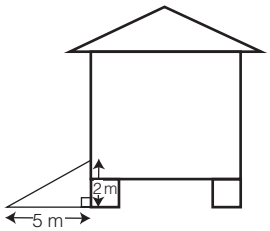


2. Number Sense

Determine the slope of the ramp for the chicken coop.

$m = \frac{\text{rise}}{\text{run}}$

$= \_\_\_\_\_$



3. Math Literacy

Given the graph of a line, describe how to calculate the slope of the line.

4. Mental Math

Simplify each expression.

a) $\frac{12}{-4}$

b) $\frac{8}{18}$

c) $\frac{-15}{10}$

d) $\frac{9}{3}$

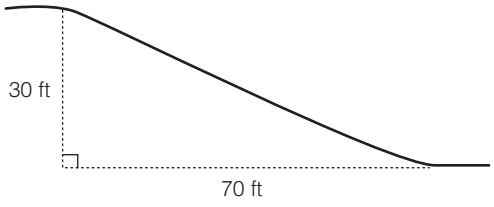
5. Slope

Determine the slope of the toboggan run. Write your final answer in lowest terms.

$m = \frac{\text{rise}}{\text{run}}$

$= \_\_\_\_\_$

$= \_\_\_\_\_$



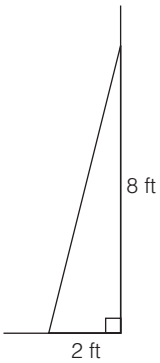
6. Slope

Determine the slope of the ladder. Write your final answer in lowest terms.

$m = \frac{\text{rise}}{\text{run}}$

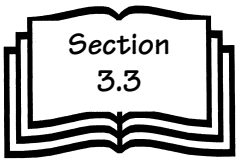
$= \_\_\_\_\_$

$= \_\_\_\_\_$



Date: _____

Practise: Properties of Slopes of Lines



1. Consider the following linear equations:

i) $y = 3x + 4$ **ii)** $y = 4$ **iii)** $y = -\frac{1}{2}x + 5$

iv) $y = x - 2$ **v)** $y = -x - 5$ **vi)** $y = -1$ **vii)** $y = \frac{1}{3}x + 5$

a) On each equation above, circle the slope value.

b) Based on the slope values, write the equation of each line in the appropriate column in the table below.

Positive Slope	Negative Slope	Zero Slope

2. Write an equation of a line that is

a) parallel to $y = 4x + 2$ _____

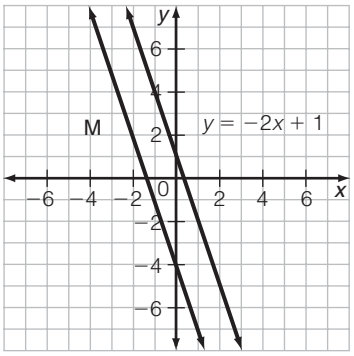
b) steeper than $y = -x + 7$ _____

c) less steep than $y = 3x - 1$ _____

d) parallel to $y = -\frac{1}{2}x - 6$ _____

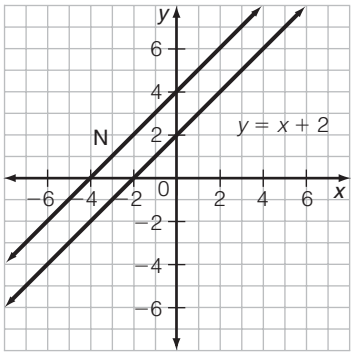
3. Write the equation of the line that is parallel to each line.

a)



The equation for line M is _____.

b)

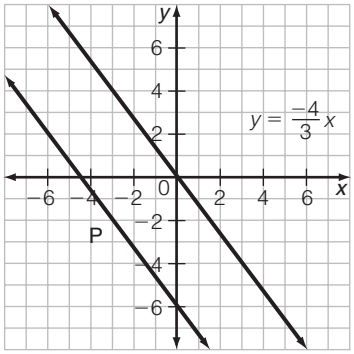


The equation for line N is _____.

Date: _____

Section 3.3

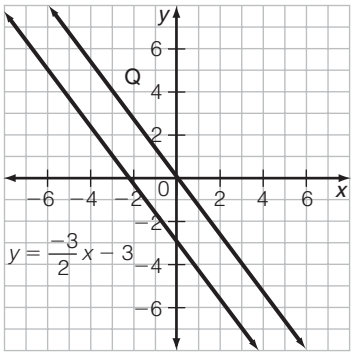
c)



The equation for line P is

_____.

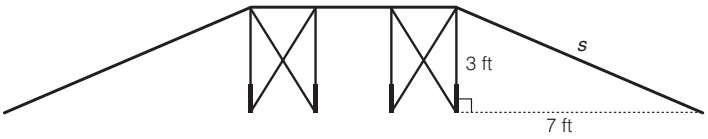
d)



The equation for line Q is

_____.

4. Maddigan is preparing his dog Pepper for an agility competition. He puts together a dog walk, consisting of two ramps, two bases, and a top plank. Determine the slope of the ramp.

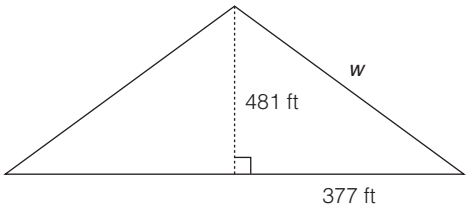


$s = \frac{\text{rise}}{\text{run}}$

$= $ _____

The slope of the ramp is _____.

5. The Great Pyramid of Egypt was originally approximately 481 ft tall with a base of approximately 754 ft wide. Half of the base is approximately 377 ft. Determine the slope of the side of the Great Pyramid. Express your final answer as a fraction in lowest terms.



$w = \frac{\text{rise}}{\text{run}}$

$= $ _____

$= $ _____

The slope of the Great Pyramid is _____.

Date: _____

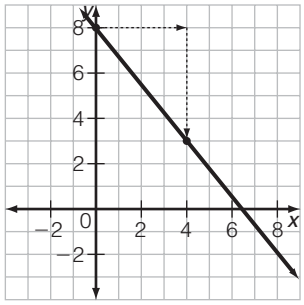
3.4 Determine the Equation of a Line

Textbook pp. 128–137

Warm-Up

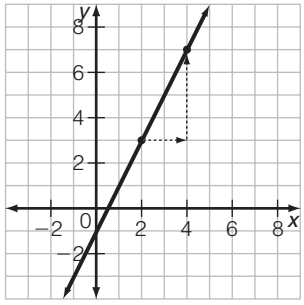
1. Linear Relations

Determine the slope and y-intercept of this line.



2. Linear Relations

Determine the slope and y-intercept of this line.



3. Rate of Change

Complete the table of values for the relation $y = -3x + 5$.

x	y	Rate of Change
0		
1		
2		
3		
4		

4. Rate of Change

Complete the table of values for the relation $y = \frac{1}{2}x - 3$.

x	y	Rate of Change
0		
1		
2		
3		
4		

5. y-Intercept

Refer to the table of values. What is the y-intercept for this relation?

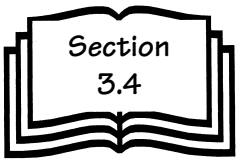
x	y
−2	−4
−1	0
0	4
1	8
2	12

6. Interpret the Slope

Refer to the relations in questions 3 and 4. Which relation represents a line with a negative slope?

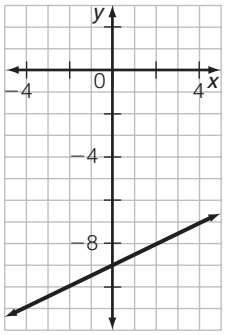
Date: _____

Practise: Determine the Equation of a Line



1. For each graph below, state **i)** the slope as a fraction in lowest terms, **ii)** the y-intercept, and **iii)** the equation.

a)

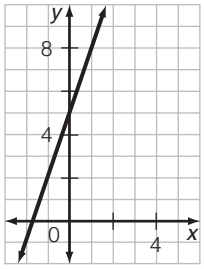


slope: _____

y-intercept: _____

equation: $y =$ _____

b)

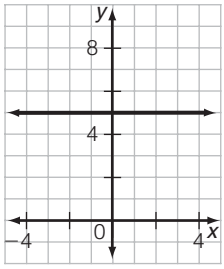


slope: _____

y-intercept: _____

equation: $y =$ _____

c)



slope: _____

y-intercept: _____

equation: $y =$ _____

2. Use the given information to write the equation of each line in the form $y = mx + b$.

a) slope $= -\frac{1}{3}$ and y-intercept $= 2$ _____

b) $m = 4$ and $b = -3$ _____

c) parallel to $y = 3x - 5$ and y-intercept $= 8$ _____

d) parallel to $y = 5$ and y-intercept $= -3$ _____

3. Use the given information to write the equation of each line.

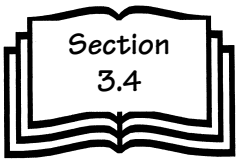
a) slope $= -2$, through the point $(0, 0)$ _____

b) $m = \frac{1}{3}$, through the point $(6, -2)$ _____

c) $m = -4$, through the point $(4, 8)$ _____

d) slope $= \frac{1}{2}$, through the point $(-4, 5)$ _____

Date: _____



4. Find the equation of the line that passes through this pair of points.

(4, 3) and (2, 9)

5. Brian takes a beaker and measures its mass. Then, he pours glycerol into the beaker, 50 mL at a time. The masses he measures are given in the table of values below:

Volume of Glycerol (mL)	Mass (g)
0	412
50	525
100	638
150	751
200	864
250	977

a) Use a graphing calculator to graph this data.

b) What is the equation of the line you graphed? _____

c) State the *y*-intercept of the line. Explain what it represents.

_____

d) State the slope of the line. _____

Date: _____

3.5 Graph Linear Relations by Hand

Textbook pp. 138–145

Warm-Up

1. Evaluate Expressions

Given the relation $y = -x + 3$, find the value of y for each value of x.

a) $x = -4$

b) $x = 1$

2. Interpret Slope

Which of these relations has the steepest slope? How do you know?

a) $y = -2x + 1$

b) $y = -\frac{1}{2}x + 3$

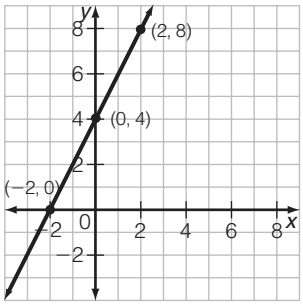
c) $y = \frac{1}{2}x - 2$

3. Linear Relations

Determine if $x = 3$ and $y = -1$ of the point (3,1) satisfy the equation $y = \frac{2}{3}x - 1$.

4. Linear Relations

Identify the slope and y-intercept for this relation.



5. Linear Relations

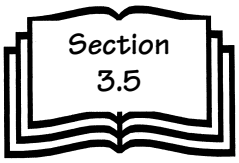
Identify the slope and y-intercept for the relation $y = 3x - 1$.

6. Math Literacy

Explain how to determine the slope and y-intercept of the relation $y = 4x - 1$.

Date: _____

Practise: Graph Linear Relations by Hand



1. For each relation, state the slope and y-intercept.

a) $y = -\frac{1}{4}x + 11$

slope: _____

y-intercept: _____

b) $y = 5x - 9$

slope: _____

y-intercept: _____

c) $y = \frac{4}{5}x$

slope: _____

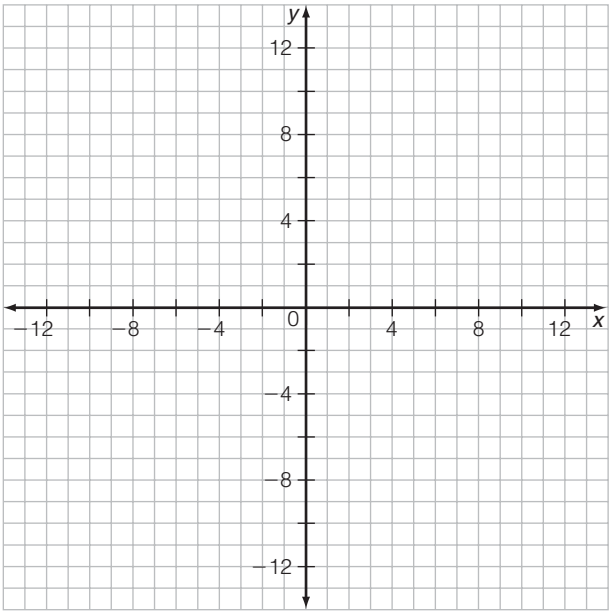
y-intercept: _____

d) $y = -3x + \frac{9}{2}$

slope: _____

y-intercept: _____

2. Graph each line in question 1.

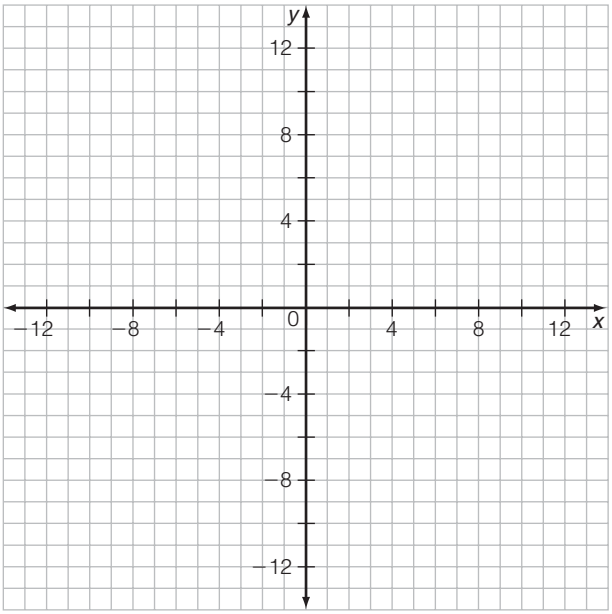


3. Graph each line from the given information.

a) through the points (2, 4) and (6, 9)

b) $m = \frac{2}{5}$ and $b = -4$

c) $m = -\frac{1}{2}$ and through the point (2, 3)



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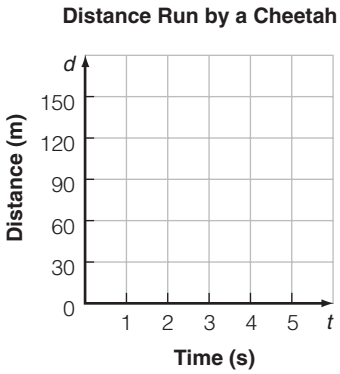
Section 3.5

4. A cheetah can run 33 m in one second.

a) Use this information to create a table of values starting at $t = 0$ and going to $t = 4$ s.

Time (s)	0	1	2	3	4
Distance (m)					

b) Plot the data in the table and draw a line passing through the points.



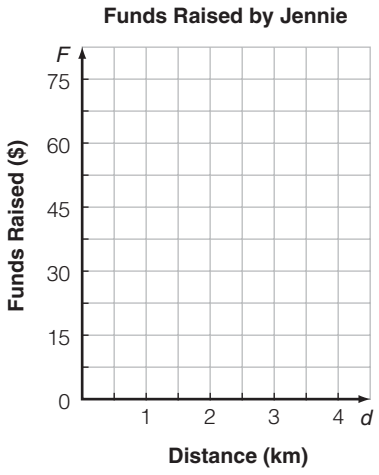
c) Find the equation of the line you drew in part **b)**. _____

5. Jennie plans to enter a walkathon at school, to raise money for a children's charity. Her neighbour sponsored her for $15.00 per kilometre.

a) Create a table of values for the 4-km walkathon.

Distance (km)	0	1	2	3	4
Funds Raised ($)					

b) Plot the points, then join them with a line.

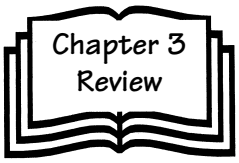


c) Find the equation for the line.

The equation for the line is _____.

Date: _____

Chapter 3 Review



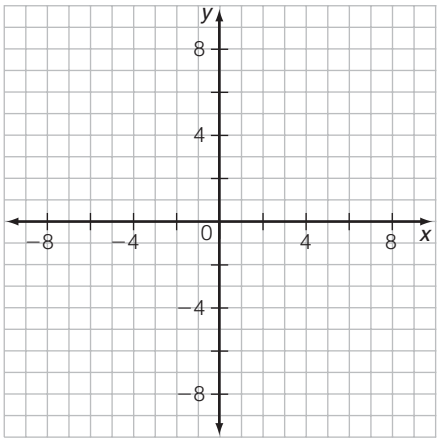
3.1 Slope as a Rate of Change, textbook pages 100-110

1. **a)** The following table of values contains coordinates from points on a straight line. Determine the rate of change in the y-values and fill in the missing x- and y-values.

b) Graph the data in the table.

Hint: Begin by filling in the second and third empty rate of change boxes. What values must be entered in the other rate of change boxes?

x	y	Rate of Change
-1	9	
0	6	
1		
2	0	
3		
	-6	



c) What is the slope of the line? _____

3.2 Investigate Slope and y-Intercept Using Technology, textbook pages 111–117

2. Set the **TBLSET** function on a graphing calculator to start at 0 and go up in increments of 1. Use the **G-T** function and the standard window settings to graph the following linear relations. Sketch the calculator display below.

a) $y = x$

b) $y = -\frac{1}{3}x + 2$

3.3 Properties of Slopes of Lines, textbook pages 118–127

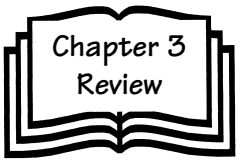
3. For each line, write an equation for another line parallel to it.

a) $y = 6x - 5$ _____

b) $y = -2x + 3$ _____

c) $y = \frac{1}{2}x + 6$ _____

Date: _____



3.4 Determine the Equation of a Line, textbook pages 128–137

4. Determine the equation of each line given the following information.

a) $m = 3$, y-intercept $= -1$ _____

b) slope $= -2$, $b = 3$ _____

c) $m = 0$, $b = 4$ _____

d) slope $= 2.5$, y-intercept $= -1$ _____

5. Determine the equation of each line.

a) $m = -6$, passing through the point (1, 7) _____

b) $m = \frac{1}{2}$, passing through the point (2, 9) _____

c) $m = -\frac{1}{3}$, passing through the origin _____

d) $m = \frac{5}{8}$, passing through the point (16, 6) _____

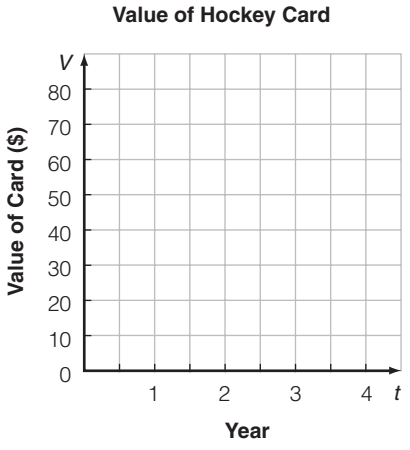
3.5 Graph Linear Relations by Hand, textbook pages 138–145

6. Jordan owns a mint-condition rookie card of a famous hockey player. Four years ago, he bought it for $23. Since then, the card has grown in value by $12 each year.

a) Create a table of values to show the card's growth in value over the past 4 years.

Year					
Value of Card ($)					

b) Graph the data from your table of values in part a).



c) Write the equation that models the card's growth in value. _____

d) What is the card's value at the end of 4 years? _____