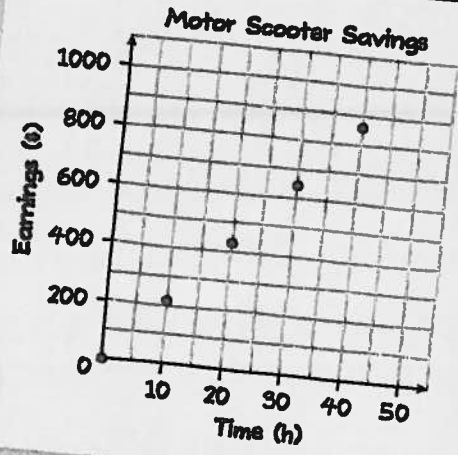


Linear Relations 10



Time (h)	Earnings (\$)
0	0
10	215
20	430
30	645
40	860



Serge is an electrician's apprentice in Inuvik. He earns \$21.50/h. He wants to figure out how many hours he needs to work to buy a scooter. Serge created a table of values and a graph to help him estimate.

A. What patterns do you see in the table?

B. How does the graph show the pattern?

10

Getting Started

1. Describe each pattern.

- a) 101, 98, 95, ... The pattern starts with _____.
Each number is _____ the number before it.
- b) 10, 20, 40, ... The pattern starts with _____.
Each number is _____ the number before it.
- c) 56, 65, 74, ... The pattern starts with _____.
Each number is _____ the number before it.

2. Write the next two terms in each pattern.

- a) 54, 67, 80, 93, _____, _____ c) 352, 176, 88, 44, _____, _____
- b) 15, 16, 18, 21, _____, _____ d) 1, 3, 7, 15, _____, _____

3. Complete the table of values for each relation.

a) $y = x + 2$

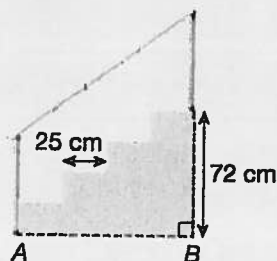
x	0	3	6	10	15
y	2				

b) $y = -2x + 1$

x	0	3	6	10	15
y			-11		

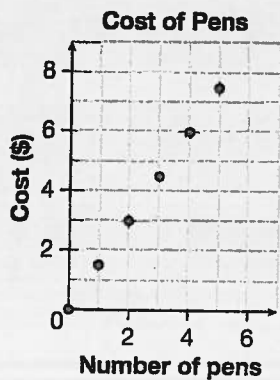
relation

a description of how two variables are connected



4. Lila built a porch that is 72 cm above the ground. She built 4 steps from the ground to the porch.

- a) What is the rise of each step? _____ cm \div 4 = _____ cm
- b) What is the length of AB? 4 \times _____ cm = _____ cm
- c) What is the slope of the handrail? $\frac{\square \text{ cm}}{\square \text{ cm}} = \underline{\hspace{2cm}}$



5. The graph on the left shows the cost of pens at Ethan's store.

- a) What is the rate of change?
Rate of change = \$ _____ / pen
- b) What is the cost of 4 pens? \$ _____
- c) How many pens could you buy for \$4.50? _____

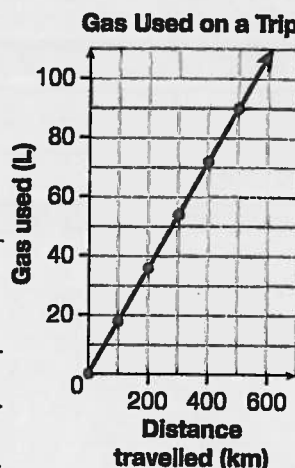
6. The graph on the right shows the gas Ruben used on a trip in Yukon.

a) What is the slope of this graph? _____

b) What does the slope represent?

c) Does this graph show a **linear relation**? Explain.

d) How much gas would Ruben need to drive 500 km? _____



7. What is the value of y when $x = 3$?

a) $-x + y = 2$

b) $4y - 2x - 7 = 0$

linear relation
a relation whose points lie on a straight line

8. What is the slope of the line that passes through each pair of points?

a) (2, 5) and (1, 4) _____

c) (0, 2) and (5, 12) _____

b) (7, 6) and (13, 6) _____

d) (0, 3) and (2, -1) _____

Hint
Slope = $\frac{y_2 - y_1}{x_2 - x_1}$

9. Match each situation with a cost equation.

Situation

It costs \$0.57 to mail a letter.
Jan wants to mail n letters.

A taxi driver charges \$3.50 plus \$0.12 for each kilometre travelled.
The taxi travels n kilometres.

A fruit stand sells pears for \$0.60 each.
The vendor sells n pears.

Equation

$c = 0.60n$

$c = 0.57n$

$c = 0.12n + 3.5$

10.1 Relations

Try these

What is the exponent in each expression?

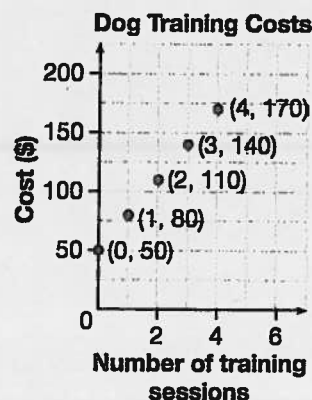
- i) x^2 _____ ii) 7^3 _____ iii) y^1 _____ iv) z _____

Healy is a dog trainer in Gimli. She charges \$50 for a training kit plus \$30 for each session. What are some characteristics of this relation?

dependent variable
the quantity whose values you calculate

independent variable
the quantity whose values you choose

- How does the pattern change?
When the number of lessons increases by _____, the cost increases by \$_____.
- Can you have part of a session? _____
- The _____ depends on the number of sessions. So the **dependent variable** is the _____. The **independent variable** is the _____.

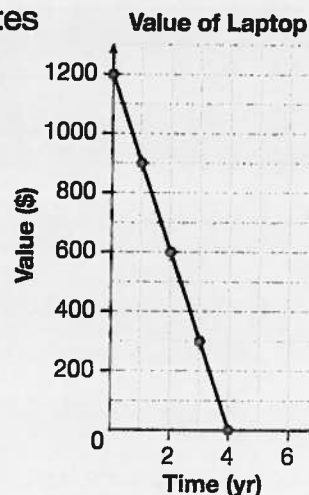


Example 1

Clint bought a computer 4 yr ago. Clint estimates that the relation between the age of the computer in years, t , and its value in dollars, v , is represented by $v = -300t + 1200$. The relation is also represented by this table of values and graph.

Time (yr), t	Value (\$), v
0	1200
1	900
2	600
3	300
4	0

How does each representation show this is a linear relation?



Solution

A. How do the values in the table change?

When the year _____ by __, the value of the computer _____ by \$_____.

B. How does the graph show that this is a linear relation?

The points are _____.

Hint

You need only one representation to show a relation is linear.

C. Circle the description of the rate of change.

constant rate of change

varying rate of change

D. Can you have any part of a year? _____

E. Is this data **discrete** or **continuous**? Explain.

F. Circle the **degree of the equation**.

1

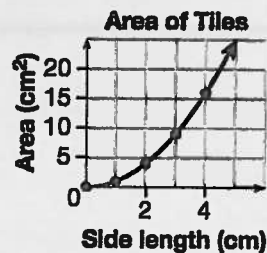
not 1

Example 2

Bonnie installs square ceramic tiles of different sizes. The relation between a tile's side length, s , and its area, A , is represented by a table of values, an equation, and a graph. How does each representation show this is a **non-linear relation**?

Length (cm), s	Area (cm ²), A
0	0
1	1
2	4
3	9
4	16

$$A = s^2$$



discrete
the data cannot be broken into smaller and smaller parts that have meaning

continuous
the data can be broken into smaller and smaller parts that have meaning

degree of an equation
the greatest exponent on the independent variable of an equation; if the exponent is 1, it is often not written; e.g., the degree of $y = 2x + 3$ is 1

non-linear relation
a relation whose graph is not a straight line

Solution

A. How do the values of the dependent variable change in the table?

Each time the length _____ by __, the area _____ by a _____ amount.

B. How does the graph show that this is a non-linear relation?

C. Circle the description of the rate of change.

constant rate of change

varying rate of change

D. Is this data **discrete** or **continuous**? Explain.

E. Circle the **degree of the equation**.

1

not 1

REFLECTING

Why can you join the points on the graphs in Examples 1 and 2, but not on the dog-training graph?

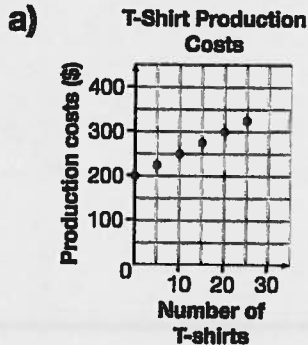
Practice

1. Circle patterns with a constant rate of change. Cross out patterns with a varying rate of change.

a) 2, 4, 8, 16, ... b) 25, 30, 35, 40, ... c) -1, 2, 5, 8, ...

2. Circle linear relations. Cross out non-linear relations.

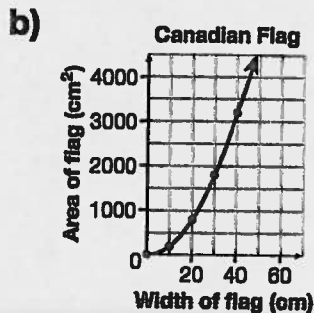
- Record the dependent and independent variables.
- Circle *discrete* or *continuous* for the data.



Independent variable:

Dependent variable:

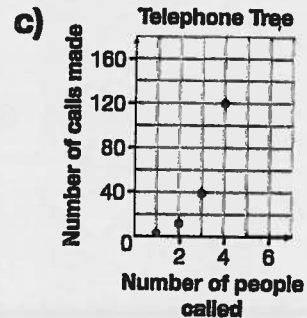
discrete or continuous



Independent variable:

Dependent variable:

discrete or continuous



Independent variable:

Dependent variable:

discrete or continuous

3. Circle linear relations. Cross out non-linear relations.

- Record the dependent and independent variables.
- Circle *discrete* or *continuous* for the data.

a)

Number of toonies	Mass (g)
0	0.0
1	7.3
2	14.6
3	21.9

Independent variable:

Dependent variable:

discrete or continuous

b)

Height (cm)	Women's shoe size
152	5
160	6
165	7
175	8

Independent variable:

Dependent variable:

discrete or continuous

c)

Side length (cm)	Volume of box (cm³)
0	0
1	1
2	8
3	27

Independent variable:

Dependent variable:

discrete or continuous

4. Circle linear relations. Cross out non-linear relations.

a) $y = x^2 + 5$ b) $y = 4x - 2$ c) $V = \frac{4}{3}\pi r^3$

5. a) In Question 4 Part a), what is the independent variable? ____
 b) What is the dependent variable? ____.

6. Eleanor is starting a job as a baker. She will save \$25/week.

a) How much money will she save in 6 wk? _____

b) How much money will she save in 32 wk?

c) What is the independent variable? _____

d) What is the dependent variable? _____

e) Is the slope negative or positive? _____

f) Is the relation between the money Eleanor saves and the number of weeks linear or non-linear? Explain.

REFLECTING

Is the independent variable on the vertical or horizontal axis? In a table of values, is it in the left or right column?

Number of weeks	Savings (\$)
1	25.00
2	50.00
3	75.00
4	100.00

Hint

A negative slope represents a decrease. A positive slope represents an increase.

7. Juan is a pilot. He knows that the air pressure at any point on Earth depends on the altitude.

a) Is the data in the table of values continuous or discrete? Explain.

b) Is the relation between altitude and air pressure linear or non-linear? Explain how you know.

Altitude (km)	Air pressure (kPa)
0	101
1	90
2	79
3	70

8. Is each relation linear or non-linear? How do you know?

a) $C = 200 + 15x$, where C is the cost of a banquet and x is the number of guests

b) $V = l^3$, where V is the volume of a cubic container and l is the side length

10.2 Graphing Linear Relations

Try these

You will need

- grid paper
- a ruler

Evaluate.

i) $2a + 5$, if $a = 3$ _____

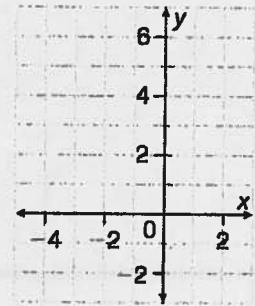
ii) $-3a - 4$, if $a = -2$ _____

x	y
-2	
-1	
0	
1	

- 1 Complete the table of values for $y = 2x + 3$.
When $x = -2$:

$2(-2) + 3 = \underline{\quad}$

- 2 Plot the points from your table of values.
3 Join the points.



Hint

When there is no context, assume the data is continuous.

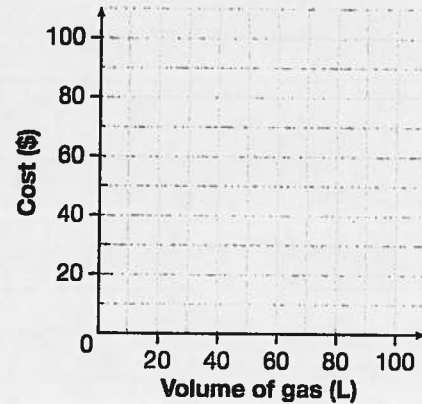
Example 1

Ariane drives a lot selling insurance in Brooks. The relation between volume of gas and cost is shown below.

Volume of gas (L)	0	10	20	30	50	80
Cost (\$)	0	10.80	21.60	32.40	54.00	86.40

What is the cost of 70 L of gas?

Cost of a Truck Fill-Up



Solution

- A. Graph this relation. Should you join the points? _____ Explain. The data is _____, because _____.

- B. Explain how to **interpolate** to estimate the cost of 70 L of gas.
- Start at _____ on the horizontal axis. Go along a vertical line to the graph.
 - Go along a _____ line to the vertical axis.

The cost of 70 L of gas is about \$_____.

Hint

When the data is continuous, join the points on the graph.

C. What is the slope of the graph?

Slope: $\frac{21.60 - \square}{\square - 10} = \frac{\square}{\square}$, _____

D. What does the slope mean?

The slope is the rate of _____ of the relation. It is the cost _____.

E. Use the slope to calculate the amount Ariane paid for 70 L.

$\$ ___ / \text{L} \times ___ \text{ L} = \$ ______ \text{ Ariane paid } \$ ______ \text{ for 70 L of gas.}$

Example 2

Maria is studying to be a welder in The Pas.

- Every Friday, she withdraws the same amount from her bank account.
- Her balance is represented by $b = -120w + 4200$, where b is the balance in dollars, and w is the number of weeks.

Suppose Maria makes no deposits. When will her bank account be empty? Describe the relation.

Solution

A. Complete the table of values.

Number of weeks	Balance (\$)
0	4200
1	
5	
10	
15	

B. The data is _____, because Maria withdraws the same amount every Friday. So the points _____ be connected.

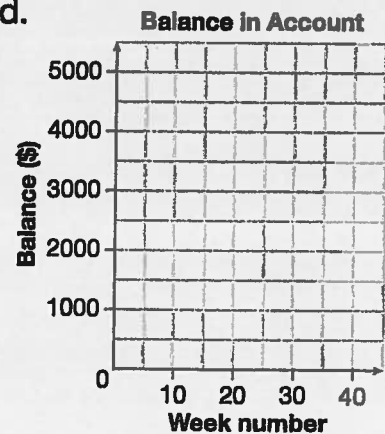
C. Graph this relation.

D. Explain how to **extrapolate** to estimate when Maria's account will be empty.

- Place a ruler on the graph so its edge passes through the _____.
- Slide the ruler to reach the _____ axis. Read the number of weeks.

Her account will be empty in about _____ wk.

E. Is the relation increasing or decreasing? Explain.



REFLECTING

Are the slopes for Examples 1 and 2 positive or negative? Why does this make sense?

Practice

Time (s)	Height (cm)
0	25
4	65
8	105
12	145
16	185

1. Joseph is a mechanic. To check a car's brakes, he lifts the car on a hoist. The table of values on the left shows the height of the car's undercarriage above the floor.

- Graph this relation on grid paper.
- Did you join the points? Why or why not?

-
- What is the car's height after 10 s? about _____ cm
 - Estimate. How long will it take the car to reach a height of 200 cm? about _____ s
 - Estimate. How long will it take the car to be 225 cm high? about _____ s
 - Is the slope positive or negative? _____
 - What is the slope of the graph?

Hint

Use values in the table to calculate the slope.

h) What does the slope mean in this problem?

Distance (km), k	Cost (\$), C
0	
60	
100	
160	
200	

2. Magda is renting a 1-ton moving truck for 1 d.

- Jake's Rental Trucks charges \$100/d, plus 25¢/km.
- Distance is rounded to the nearest kilometre.
- The cost for 1 d is $C = 100 + 0.25k$, where C is the cost in dollars and k is the distance in kilometres.

- Complete the table of values.
- Graph this relation on grid paper.
- Estimate the cost for 120 km. about \$ _____
- Estimate the distance for \$145. about _____ km
- Estimate the distance for \$200. about _____ km
- What is the slope of the graph? $\frac{125 - \square}{\square - 0} = \underline{\hspace{2cm}}$
- What does the slope mean in this problem?

3. Jacob sells tickets at an amusement park in Winnipeg. General admission costs \$6. Each ride costs \$2.

a) Complete the table of values.

Number of rides	0	5	10	15	20
Cost (\$)					

- b) Graph this relation on grid paper.
- c) Estimate the cost of 12 rides. about \$ ____
- d) Estimate the number of rides you can take for \$40. about ____ rides
- e) Did you interpolate or extrapolate for Part d)? Explain.
- f) Estimate the cost of 22 rides, to the nearest \$10. about \$ ____
- g) Did you interpolate or extrapolate for Part f)? Explain.

h) What is the rate of change?

i) What does the rate of change mean in this problem?

Hint

The rate of change is the slope. The change in cost is the rise. The change in the number of rides is the run.

4. Complete each table of values. Use grid paper. Graph each relation on the same grid.

a) $y = 2x$

x	y
-2	
-1	
0	
1	
2	

b) $y = 3x + 1$

x	y
-2	
-1	
0	
1	
2	

c) $x + y = 5$

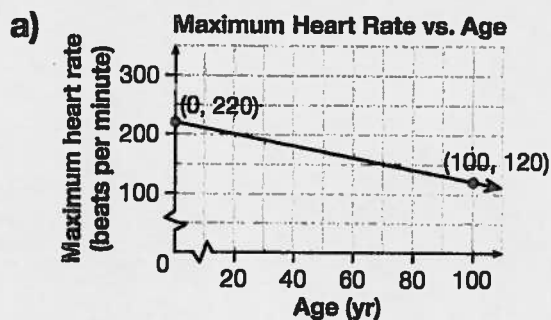
x	y
-2	
-1	
0	
1	
2	

5. a) How are interpolating and extrapolating the same?

b) How are interpolating and extrapolating different?

Mid-Chapter Review

1. Circle linear relations. Cross out non-linear relations. Explain how you know.



c)

x	y
1	2
2	5
3	10
4	17

b) $y = x^2 + 5$

d) $y = 6x + 3$

2. Use the graph in Question 1 Part a).

- a) Is this data continuous or discrete? _____
- b) The independent variable is _____.
The dependent variable is _____.
- c) Estimate the maximum heart rate for a 50-year-old. _____
- d) What is the slope of the line? _____
- e) What does the slope mean in this problem?

3. a) Complete the table of values for $y = -3x + 2$.
- b) Graph the relation on grid paper. Include the equation as a label.
- c) What is the slope of the line?

x	y
-2	
-1	
0	
1	
2	

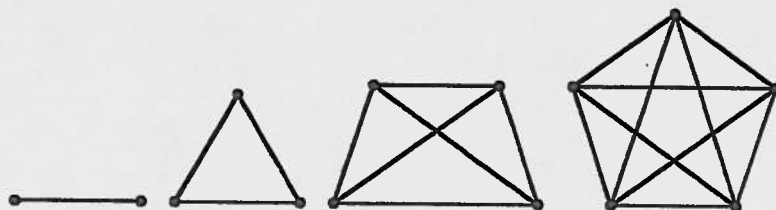
Solving a Dots and Lines Puzzle

10.3

Toni drew diagrams with the number of dots increasing by 1 each time. She joined each pair of dots with a straight line.

You will need

- grid paper
- a ruler



A. How many lines would Toni draw to join 6 dots? _____

B. How many lines would Toni draw to join 10 dots?

What strategies can you use?

Hint

Think of tables of value and scatter plots you have used in this chapter.

C. Is the relation between the number of dots and the number of lines linear or non-linear? Explain.

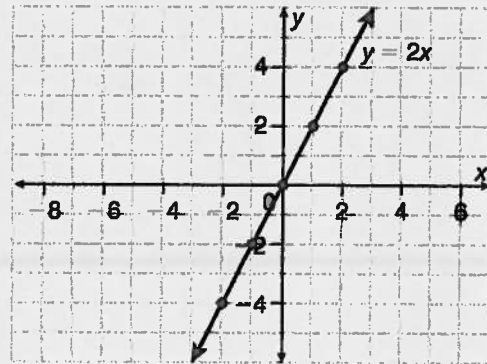
10.4 Direct and Partial Variation

Try These

You will need
• a ruler

How do the values of $5x$ and $5x + 2$ differ?
Substitute $x = 1, 2,$ and 3 to help you explain.

Mike drew this graph of $y = 2x$.



x	y
-2	
-1	
0	
1	
2	

- Complete the table of values for $y = 2x + 3$.
- Graph $y = 2x + 3$ on Mike's grid.
- What are the slopes?

Mike's graph: _____ Your graph: _____

- How are these graphs the same? They have _____ slope.
How are they different? They cross the _____ at _____ points.
- For $y = 2x$, the **y-intercept** is _____.
For $y = 2x + 3$, the **y-intercept** is _____.

y-intercept
the value of the dependent variable when the independent variable is 0; sometimes called the initial value

Example 1

Both computer repair companies charge for any part of an hour. How are the plans alike? How are they different?

Flash
Computer Repair
\$40/h

Lyle's
Computer Repair
Flat fee \$25
plus \$20/h

Solution

A. Complete each table of values.

Flash Computer Repair	
Time (h)	Cost (\$)
0	
1	
2	
3	

Lyle's Computer Repair	
Time (h)	Cost (\$)
0	
1	
2	
3	

B. Graph each relation on this grid. Label each relation.

C. What is the slope of each line?

$$\text{Slope (Flash)} = \frac{120 - 0}{\square - 0} = \underline{\hspace{2cm}}$$

$$\text{Slope (Lyle's)} = \frac{85 - \square}{\square - 0} = \underline{\hspace{2cm}}$$

D. What does the slope mean in this problem?

It is the _____ that each company charges.

E. What is the y-intercept in each relation? What does it mean?

Flash: y-intercept = _____ Lyle's: y-intercept = _____

The y-intercept is _____ that each company charges for a repair.

F. What equation describes each relation?

Flash: $y = mx$

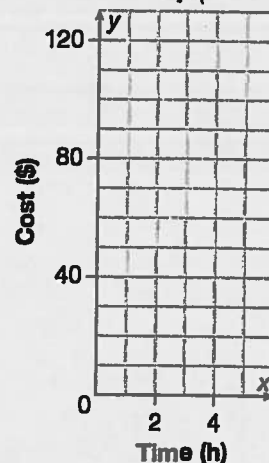
$y = \underline{\hspace{1cm}}x$

Lyle's: $y = mx + b$

$y = \underline{\hspace{1cm}}x + \underline{\hspace{1cm}}$

G. Circle the equation in Part F that represents a **direct variation**.
Cross out the equation that represents a **partial variation**.

Cost of Computer Repairs

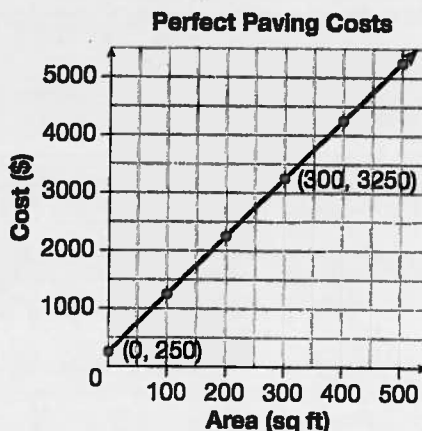


Hint

In equations of the form $y = mx + b$, m represents the slope of the line and b represents the y-intercept.

Example 2

This graph shows the amount Perfect Paving charges to install interlocking stones. What equation describes this relation? What is the cost of installing stones for a 450 sq ft driveway?



direct variation

a relation in which one variable is a multiple of the other; $y = mx$

partial variation

a relation in which one variable is a multiple of the other, plus a constant; $y = mx + b$

REFLECTING

What do the slope and y-intercept mean in this situation?

Solution

A. What are the slope and y-intercept of this linear relation?

Slope = _____ y-intercept = _____

B. What equation describes this relation?

Cost = _____ \times Area + _____, or $y = \underline{\hspace{1cm}}x + \underline{\hspace{1cm}}$

C. What is the cost for a 450 sq ft driveway?

Cost = _____ \times _____ + _____, or \$ _____

The cost of installing the stones is \$ _____.

Practice

Hint

$y = mx + b$ can be expressed as $y = b + mx$.

1. Record the slope and y-intercept of each linear relation.

a) $y = 4x$

Slope = _____

y-intercept = _____

c) $y = 12 - 5x$

Slope = _____

y-intercept = _____

b) $y = -2x + 3$

Slope = _____

y-intercept = _____

d) $y = 0.5x$

Slope = _____

y-intercept = _____

2. Circle direct variations in Question 1. Underline partial variations.

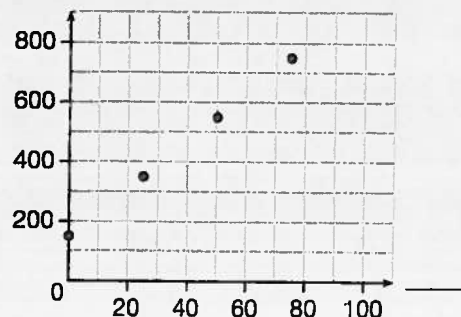
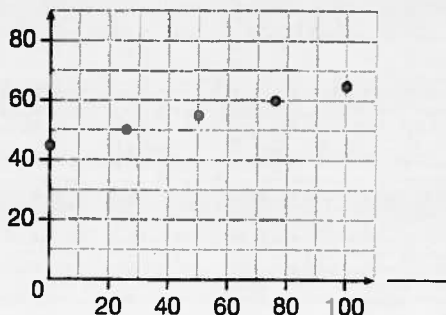
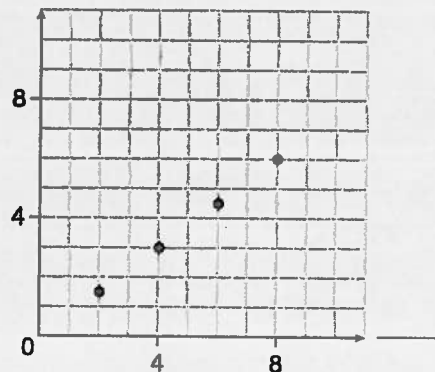
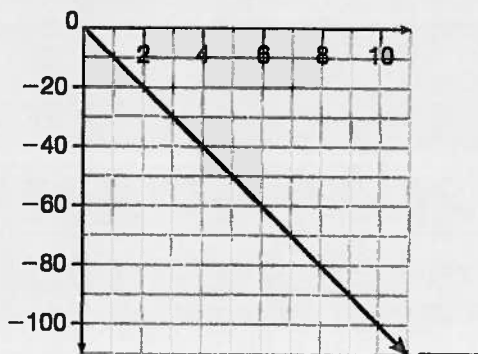
3. For each graph below, record the letter for one of these situations. Label the axes and record a title.

A. Sue buys milk on a school plan. She pays \$0.75/carton.

B. Nik rents a tour bus for a fee of \$150, plus \$8/passenger.

C. Jasmine rents a car for \$45, plus \$0.20/km.

D. A submarine at sea level descends 50 m every 5 min.



REFLECTING

How did you decide which graph goes with each situation?

4. What are the independent and dependent variables for each situation in Question 3? Write an equation for each.

A. x is _____ and y is _____

B. x is _____ and y is _____

C. x is _____ and y is _____

D. x is _____ and y is _____

Hint

On which axis of a graph is the independent variable represented?

5. The distance a spring stretches depends on the mass attached.

- The spring stretches 1.8 cm when a 6.0 kg mass is attached.

- An equation for this relation is $y = 0.3x$.

a) What does y represent?

b) What does x represent?

c) How far will the spring stretch with a 15.0 kg weight attached?

d) The spring stretches 3.0 cm. What is the mass of the weight attached?

6. Trish works at a pizza shop. The cost of a large pizza with cheese and tomato sauce is \$8.00. Each additional topping is \$1.25.

a) Define the independent and dependent variables, and write an equation.

b) What is the cost of a large pizza with three toppings?

c) How many toppings can you have for \$14.25?

10.5 Scatter Plots

Try These

You will need

- grid paper
- a ruler

Circle true statements. Cross out false statements.

- Equations of linear relations have a degree of 0.
- Equations of linear relations have a degree of 1.
- The graph of a linear relation follows a straight line.
- The graph of a linear relation can follow a curve.
- All graphs of linear relations pass through (0, 0).

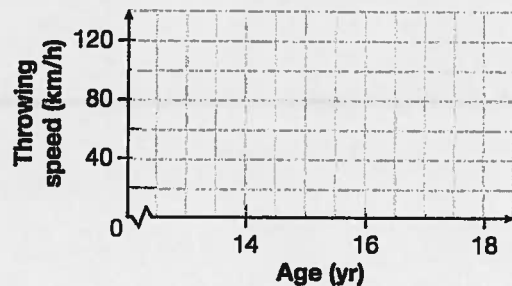
scatter plot

a graph used to determine if a relation between two variables exists by plotting points on a coordinate grid

Students are trying out as pitchers for the school's baseball team.

The coach measured the speed of each student's throw with a radar gun. She displayed her findings in a table and on a scatter plot.

Pitcher Statistics



Age (yr)	14.0	14.5	14.8	15.2	15.6	15.7	15.8	15.9	16.0	16.4
Throwing speed (km/h)	79.4	50.1	66.0	103.2	62.4	40.5	91.5	75.9	56.0	52.6

Are throwing speed and age related?

- Circle the term that best describes the scatter plot.

linear non-linear no trend

- Are throwing speed and age related?

Did you use the table or scatter plot? _____

Why? _____

Season	Number of American players
2003	140
2004	160
2005	177
2006	182
2007	203
2008	216

Example 1

This table shows the number of American hockey players who played in the NHL over several years.

Is there a trend? If so, describe the trend. If not, explain the reason for your answer.

Solution

A. Create a scatter plot.

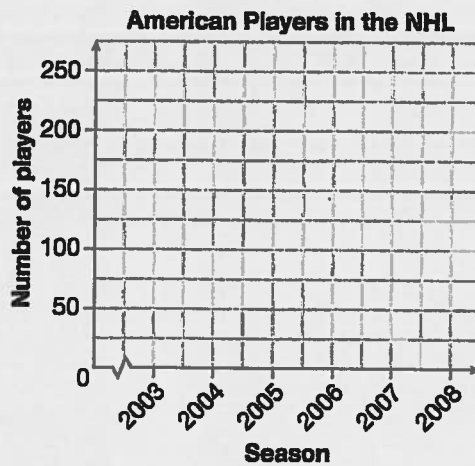
B. Circle the terms that best describe the scatter plot.

linear non-linear no trend

As time increases, the number of American players in the NHL stays the same / changes

without a trend / increases /

decreases



REFLECTING

How can you use a ruler to show a trend?

Example 2

Meg volunteers at a veterinary clinic in Churchill. She researched the resting heart rates for animals of different masses. Is there a trend? If so, describe the trend. If not, explain your reasoning.

Animal	pig	cow	rat	sheep	sea lion	goat	dog	rabbit	horse
Mean mass (kg)	188.0	518.0	0.5	77.1	66.7	41.8	18.4	3.7	466.0
Mean resting heart rate (bpm)	70	58	250	75	116	79	83	267	52

Solution

A. Create a scatter plot.

B. Circle the term that best describes the relation.

linear

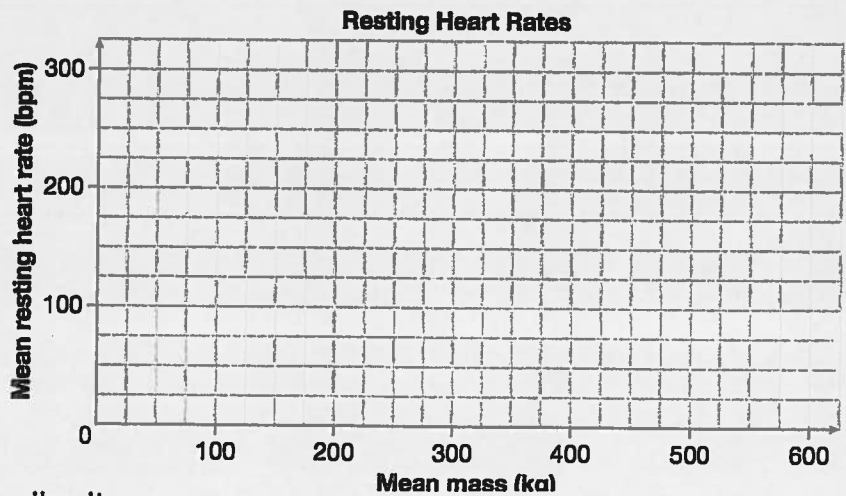
non-linear

no trend

C. If there is no trend, explain why. If there is a trend, describe it.

D. An animal has a mean mass of 300 kg. Estimate its mean resting heart rate. _____

Did you interpolate or extrapolate? Why? _____



Practice

1. Use grid paper.

- Create a scatter plot for each set of data.
- Describe the trend. Use these terms: linear relation, non-linear relation, no trend, increase, and decrease.

a) free-throw scores as percents for a sample of Grade 11 students

Free throws made over year (%)	82	65	68	75	76	80	85	90	91	94
Free throws made in tournaments (%)	60	63	62	78	70	82	90	95	94	80

b) the height of a baseball after it is hit by a bat

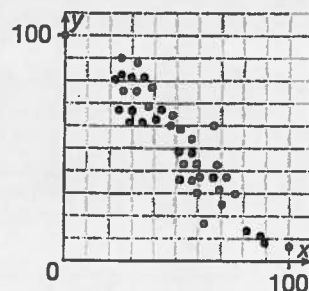
Time (s)	0	1	2	3	4	5	6
Height (m)	1	26	41	46	41	26	1

c) the number of letters in a person's name and their age

Name	Sue	John	Connie	Yasif	Arlene	Dominique	Ben	Elizabeth	Tony
Number of letters	3	4	6	5	6	9	3	9	4
Age (yr)	20	18	22	9	31	50	42	15	25

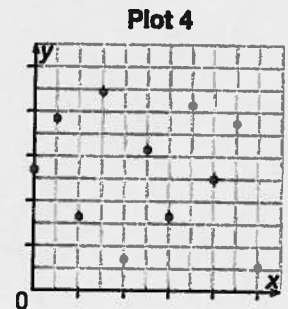
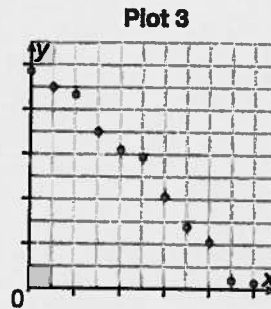
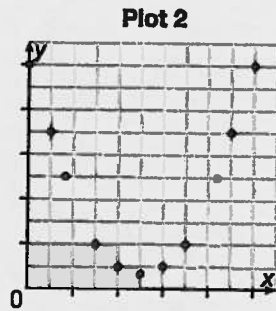
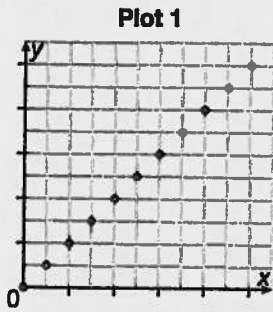
2. Which statement best describes this relation? ____

- There is no relationship between the variables.
- As x increases, y decreases.
- As x increases, y increases.
- As x increases, y stays the same.



3. Which scatter plot is described in each case?

- A. a non-linear trend that decreases then increases: Plot ____
- B. a linear trend that increases: Plot ____
- C. a linear trend that decreases: Plot ____
- D. no trend: Plot ____



4. Match each description to a scatter plot in Question 3. Explain.

- the hours worked and money earned when paid by the hour

Plot ____, because the dependent variable increases at a constant rate as the independent variable increases

- a student's age and the number of minutes spent reading each day

Plot ____, because there is no relationship between the variables

- the distance between the bottom of a lake and a buoy that is pushed under the water and then returns to the surface

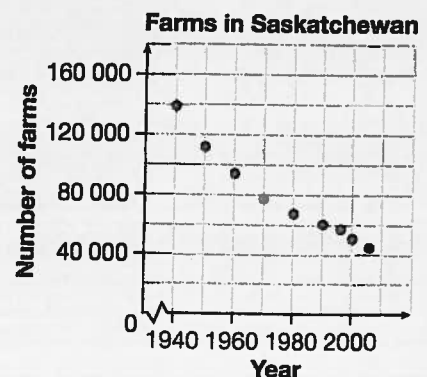
Plot ____, because the distance decreases and then increases as time increases

- the value of a car as it ages

Plot ____, because the value of the car decreases as time increases

5. Jerome is studying trends in farming. He researched this data and plotted it on a scatter plot.

- a) Describe the trend.
- b) Predict the number of farms in Saskatchewan in 2020.
- c) Predict when there will be 20 000 farms.



10.6

Scatter Plots and Technology

Try These

You will need
• graphing software

Circle the trend you would expect between hair length and a person's intelligence quotient (IQ).

linear trend

non-linear trend

no trend

This table shows how the Olympic gold medal times for the women's 100 m sprint have changed. How can you create a scatter plot using technology?

Year	Time (s)
1960	11.0
1968	11.0
1980	11.06
1992	10.82
1996	10.94
2000	11.12
2004	10.93
2008	10.78

- 1 Enter the data into a spreadsheet.
- 2 Select all the data in the spreadsheet.
- 3 Use the graphing feature. Then select the scatter plot option to create the graph.
- 4 Circle the best description.
linear non-linear no trend

Example

The table shows the percent of Manitoba households with Internet access. Describe the trend.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Households with Internet (%)	13.3	21.9	26.7	35.3	42.1	47.0	50.0	54.6	57.6	60.8	66.2	67.3

Solution

- A. Use technology to create a scatter plot for the data.
- B. Describe the trend between year and percent of households.

Practice

Hint

Use technology to check and compare scatter plots in Lesson 10.5.

1. Lisa wants to be an air-conditioning technician. She researched the percent of Alberta households with central air conditioning.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Households with central air conditioning (%)	7.2	6.4	6.7	5.3	7.1	6.7	7.4	8.4	8.2	12.7	12.9	13.9

- Use technology. Create a scatter plot.
 - Describe the trend.
- c) Should Lisa enter an air-conditioning technician program? Explain.

2. The table shows the population of Manitoba over the last century.

Manitoba Population	
Year	Population
1901	256211
1911	461394
1921	610118
1931	700139
1941	729744
1951	776541
1961	921686
1971	988245
1981	1026241
1991	1091942
2001	1119583

- Use technology. Create a scatter plot.
 - Describe the trend.
- c) Do you think the trend will continue in the next century?

3. The coach of a soccer team wants to know the relation between the number of shots his team takes and the number of goals they score. She collected this data.

Shots	11	22	25	26	27	34	16	38
Goals	1	2	2	3	2	3	1	4

- Use technology. Create a scatter plot.
- Describe the trend.

Chapter Review

1. Name three strategies you can use to determine if a relation is linear. Explain how to use each strategy.

2. Complete the table of values for each linear relation. Graph each relation on grid paper.

a) $y = -3x + 4$

x	y
-2	
-1	
0	
1	
2	

b) $2x - y = -2$

x	y
-2	
-1	
0	
1	
2	

3. Yannik works at a clothing store in St. Boniface. An equation that represents his total weekly earnings is $y = 0.05x + 300$, where x represents his total weekly sales in dollars.

a) Is this a direct or partial variation? _____

b) Suppose you graphed the relation. What would the slope be? _____

c) What does the slope represent?

d) Yannick sells \$2500 in clothes in 1 wk. What does he earn?

4. The table on the right shows the urban and rural populations of Canada over the last century.

- Use grid paper or technology. Create a scatter plot to show how the populations changed.
- Describe the trends in the populations.

Year	Urban (%)	Rural (%)
1901	37	63
1911	45	55
1921	49	51
1931	54	46
1941	54	46
1951	62	38
1961	70	30
1971	76	24
1981	76	24
1991	77	23
2001	80	20

5. Ocean pressure is measured in decibars (dbar). Jerry is a salvage diver. He knows that the pressure at any spot in the ocean depends on the depth at that spot, in kilometres.

Depth (km)	Pressure (dbar)
0	0
1	1020
2	2040
3	3060
4	4080
5	5100

- Graph this relation on grid paper. Did you join the points? Explain your reason.

b) Is this a direct or partial variation? Explain.

c) Interpolate the pressure at 2.5 km. about _____ dbar

d) Extrapolate the depth when the pressure is 7140 dbar. about ____ km

e) What is the slope of the graph? _____

f) What does the slope represent?

g) Write an equation for this relation.

h) Use the equation to determine the pressure at 3.5 km.

6. What are the independent and dependent variables in Question 5? Explain how you know.

Chapter Test

1. Sanjay's class is going on a field trip to a planetarium. Each student pays a \$5 admission fee. The cost to rent a bus is \$150.

Number of students, n	Cost (\$), C
0	
10	
20	
30	

- a) Complete the table of values.
 b) Graph the relation on grid paper or with graphing software.
 c) Circle the best description for the relation.

linear, direct variation

linear, partial variation

non-linear, direct variation

non-linear, partial variation

- d) Suppose the cost is \$275. Estimate the number of students. about _____
 e) Use the graph to estimate the cost for 53 students. _____
 f) What is the slope? _____
 g) What is the rate of change? _____
 h) Write an equation for this relation. _____

2. What are the independent and dependent variables in Question 1?

Independent: _____ Dependent: _____



3. Valerie works on a Coast Guard helicopter. She dropped an inflatable rescue raft to a ship. The table on the right shows the height of the raft above the water.

Time (s)	Height (m)
0	320
1	315
2	300
3	275
4	240
5	195

- a) Use grid paper or technology. Create a scatter plot.
 b) Identify the trend and describe it.

- c) How long will it take for the raft to hit the water?