

Lesson 10.2 Modeling Linear Associations

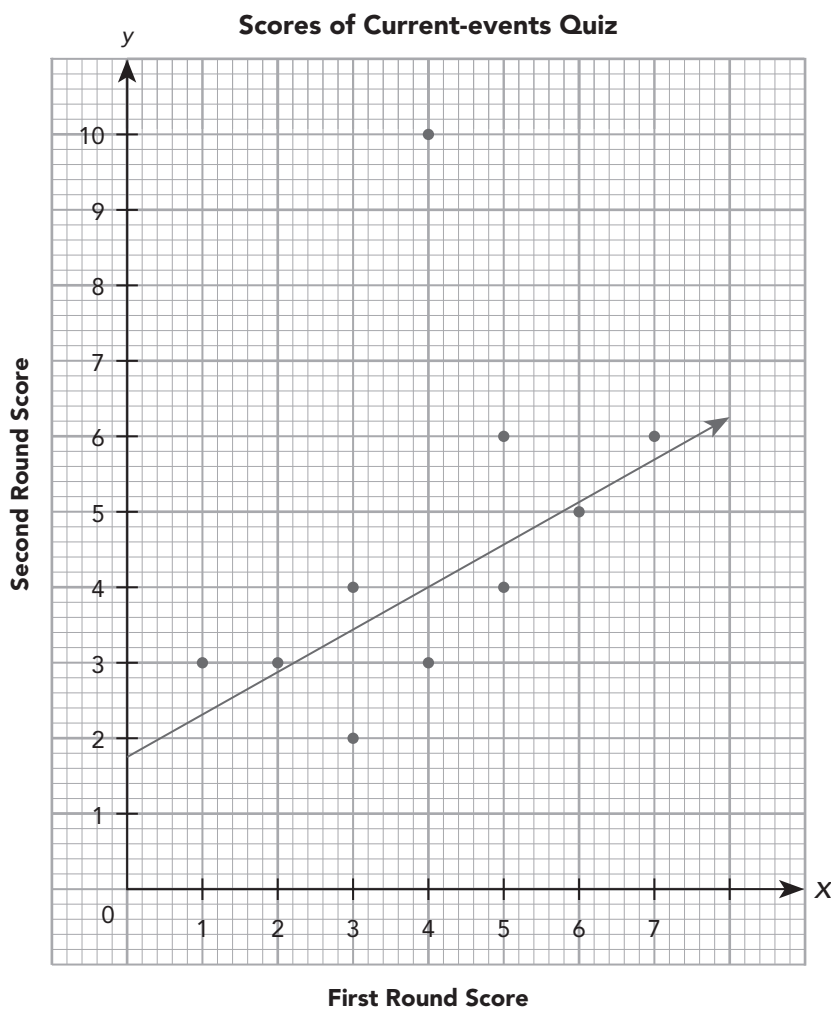
Graph a line of best fit given bivariate data with a linear association.

Example

The scores obtained by 10 teams in two rounds of a current-events quiz competition are given in the table.

First Round Score (x)	5	7	3	6	3	5	1	2	4	4
Second Round Score (y)	4	6	2	5	4	6	3	3	3	10

- a) Construct the scatter plot and sketch a line of best fit to represent the given table of bivariate data.



Name: _____

Date: _____

- b)** Identify the association and describe the meaning of the association in context.

There is a *strong, positive, and linear* association between the first round score and the second round score.

- c)** Identify the outlier and describe the meaning of the outlier in context.

The data point $(4, 10)$ is an outlier representing a second round score of 10 obtained by a team whose first round score was a 4 .

Name: _____

Date: _____

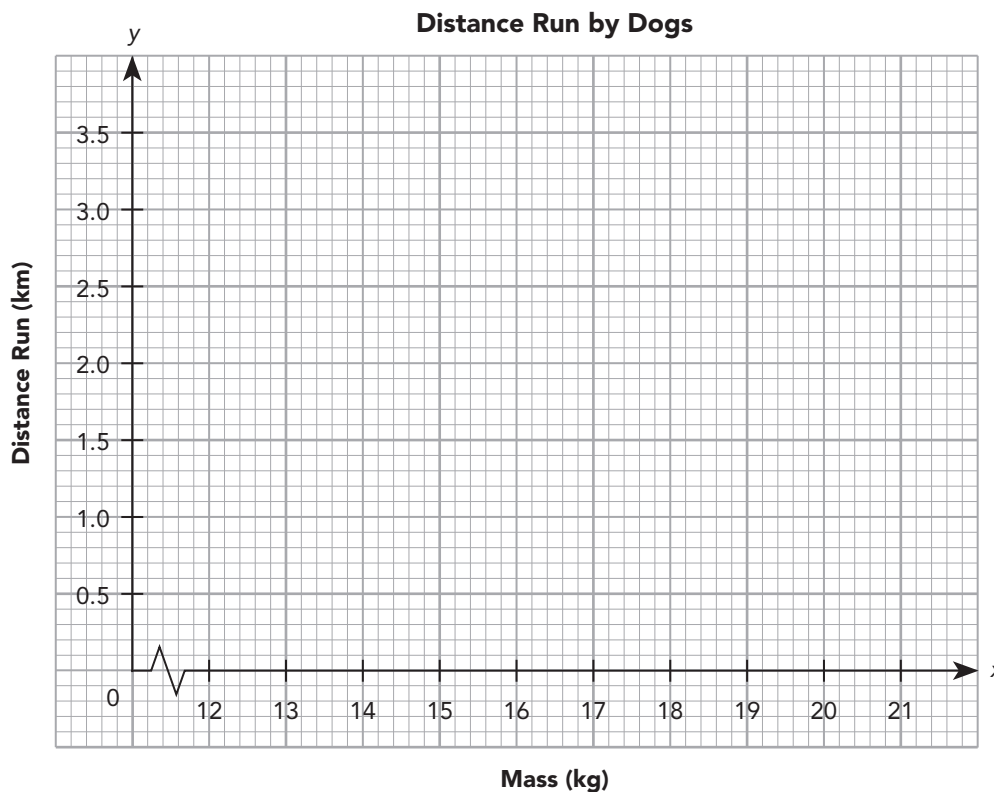
Complete.

1. Data collected to study the association between the mass of a dog and the distance the dog can run in a given period of time is shown in the table.

Mass (x kg)	12	12.6	13.4	15	18	20	14	13.8	14.6	12.8
Distance Run (y km)	3.2	3.0	2.7	2.6	2.2	2.0	2.5	2.4	2.3	3.0

Mass (x kg)	12.6	13	15.6	18	20	14	16.2	15	13.2	13
Distance Run (y km)	3.1	2.9	2.3	2.0	1.8	2.4	2.3	2.4	2.8	1.0

- a) Construct the scatter plot and sketch a line of best fit to represent the given table of bivariate data. Use 1 centimeter on the horizontal axis to represent 1 kilogram for $12 \leq x \leq 21$ and 1 centimeter on the vertical axis to represent 0.5 kilometer.



Name: _____

Date: _____

- b)** Identify the association and describe the meaning of the association in context.

There is a _____, _____, and _____ association between the mass of a dog and the distance its run in a given period of time.

- c)** Identify the outlier and describe the meaning of the outlier in context.

The data point (_____, _____) is an outlier representing only _____ kilometer(s) of distance run when the mass of the dog is _____ kilogram(s).

Name: _____

Date: _____

Solve. Show your work.

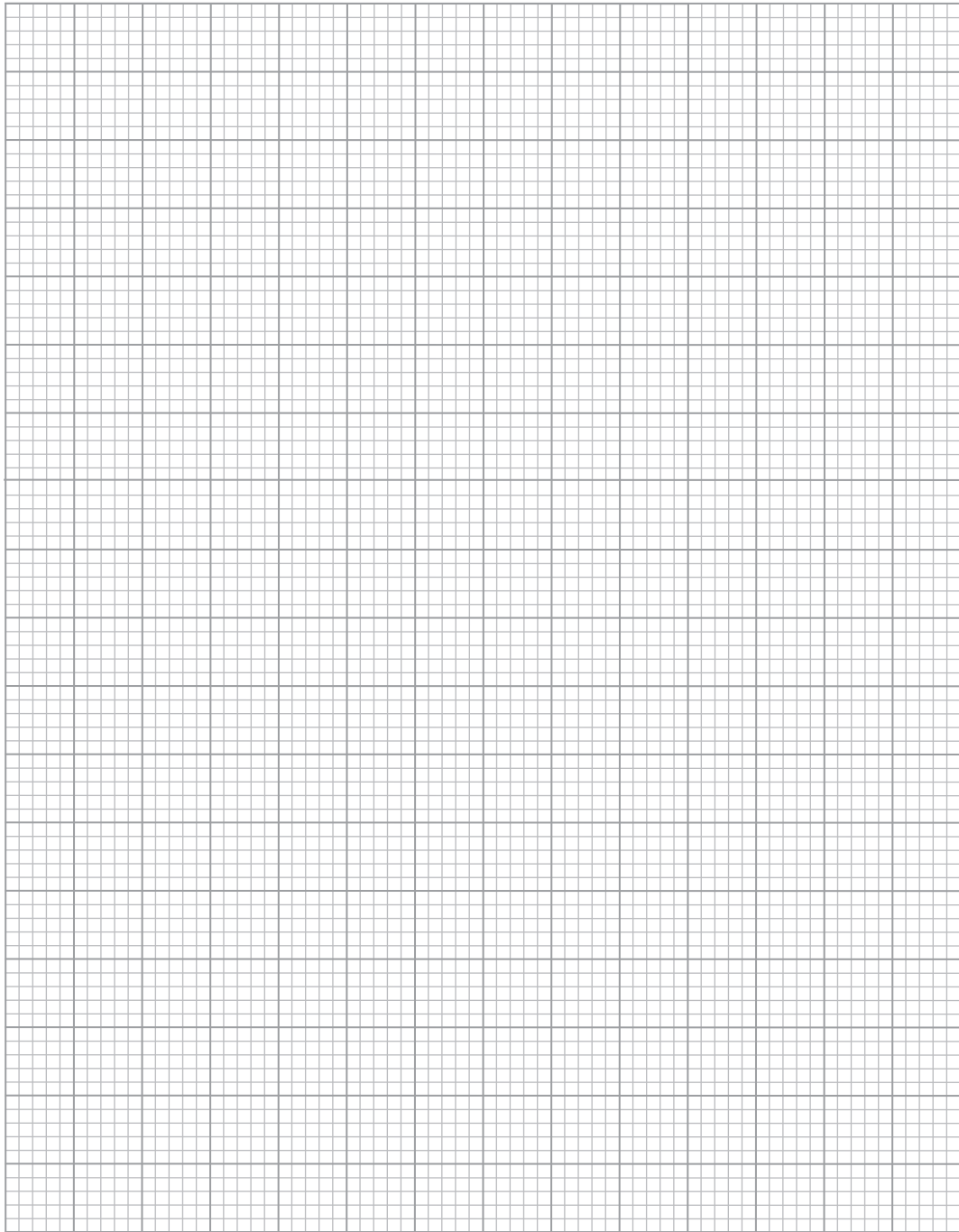
2. Data from a study of the association between the amount of radio advertising time, t minutes, for a particular brand of beverage and the number of unit sales of the beverage, y thousands, are shown in the table below.

Advertising Time (x min)	6	5	8	10	12	9	8	3	5	7
Unit Sales (y thousands)	2.3	2.2	3.2	3.5	3.8	3.0	2.8	1.8	5.0	2.6

- a) Use the graph paper on the next page. Construct the scatter plot and sketch a line of best fit to represent the given table of bivariate data. Use 1 centimeter on the horizontal axis to represent 2 minutes and 2 centimeters on the vertical axis to represent 1 thousand units.
- b) Identify the association and describe the meaning of the association in context.
- c) Identify the outlier and describe the meaning of the outlier in context.

Name: _____

Date: _____



Name: _____

Date: _____

Solve. Show your work.

3. A fitness trainer collected data to investigate the association between the number of training days per week, x , and the time needed for a runner to complete a 2-mile run, y minutes.

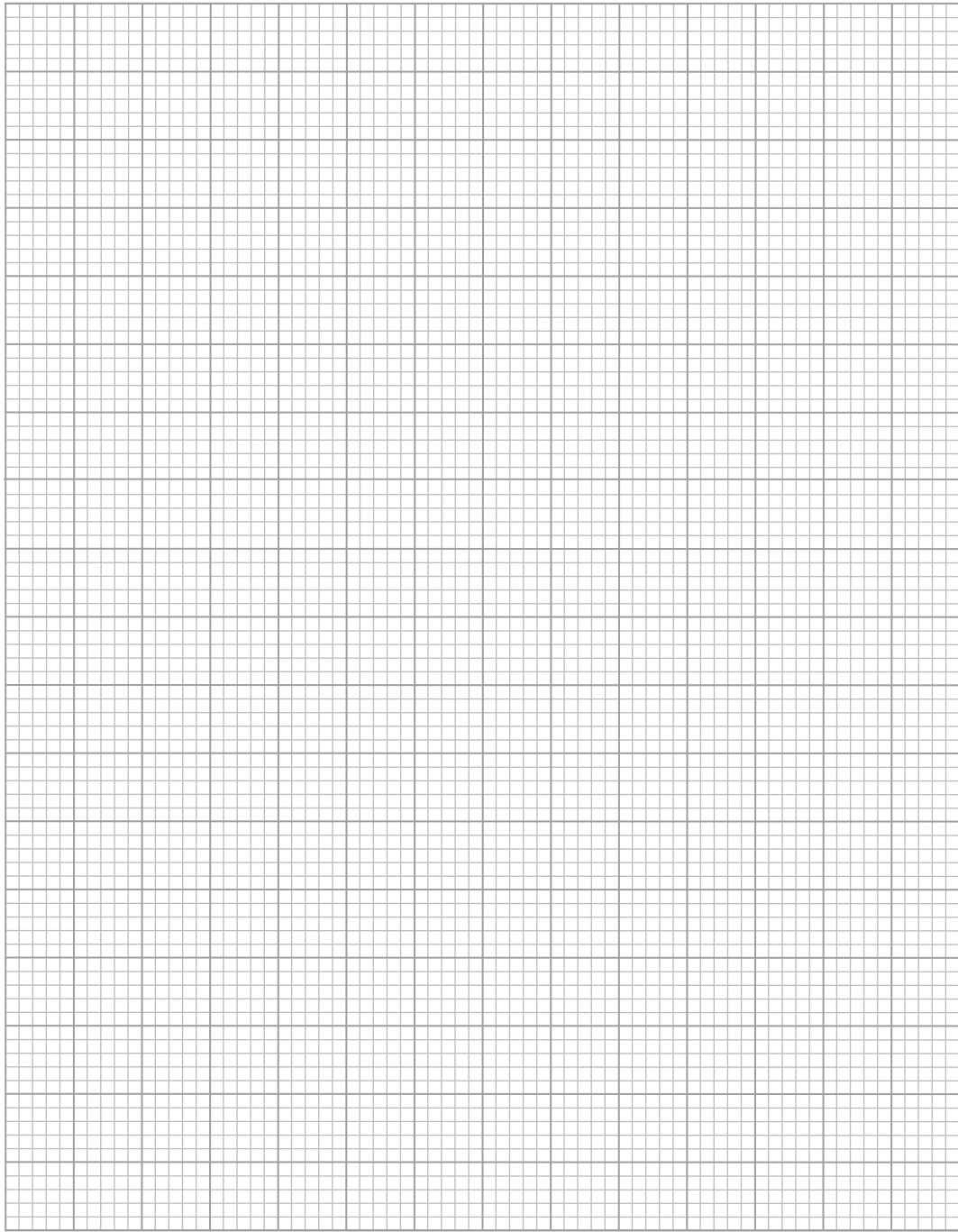
Number of Training Days (x)	0	1	1	2	2	2	3
Time (y minutes)	17.0	16.4	16.0	14.0	14.2	14.6	13.0

Number of Training Days (x)	3	3	4	4	4	5	5
Time (y minutes)	13.6	12.8	11.8	18.0	10.8	9.6	10.0

- a) Use the graph paper on the next page. Construct the scatter plot and sketch a line of best fit to represent the given table of bivariate data. Use 2 centimeters on the horizontal axis to represent 1 day and 1 centimeter on the vertical axis to represent 1 minute for $9 \leq y \leq 18$.
- b) Identify the association and describe the meaning of the association in context.
- c) Identify the outlier and describe the meaning of the outlier in context.

Name: _____

Date: _____



Name: _____

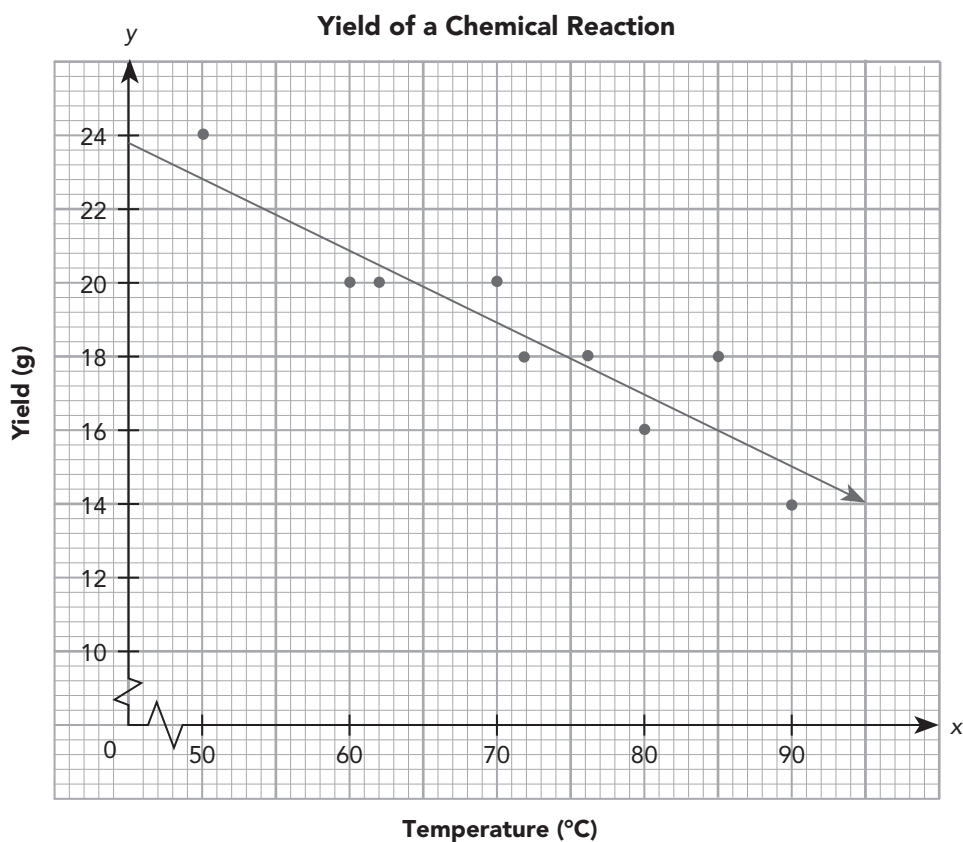
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Write a linear equation for a line of best fit.*Example*

The table below gives the product yield, y grams, when two chemicals react at various temperatures x , in degree Celsius.

Temperature (x °C)	50	60	62	90	76	80	85	72	70
Yield (y grams)	24.0	20.0	20.0	14.0	18.0	16.0	18.0	18.0	20.0

- a) Construct the scatter plot for the given table of bivariate data. Use 2 centimeters on the horizontal axis from 50 to 90 to represent 10 degree Celsius. Use 1 centimeter on the vertical axis from 10 to 24 to represent 2 grams. Sketch a line of best fit and write its equation.



First find the slope of the line of best fit that passes through the points $(55, 22)$ and $(75, 18)$.

$$\begin{aligned} m &= \frac{18 - 22}{75 - 55} \\ &= \frac{-4}{20} \\ &= -0.2 \end{aligned}$$

Do not extend the line to meet the y-axis if there are values omitted on the x-axis.



Next find the y-intercept using the equation in slope-intercept form.

$$y = mx + b$$

Use slope-intercept form.

$$22 = -0.2(55) + b$$

Substitute values for m , x , and

$$22 = -11 + b$$

Multiply.

$$22 + 11 = -11 + b + 11$$

Add 11 to both sides.

$$b = 33$$

Simplify.

Finally, write an equation.

$$y = mx + b$$

$$y = -0.2x + 33$$

Substitute -0.2 for m and 33 for b .

The equation of the line of best fit is $y = -0.2x + 33$.

- b)** Interpret the meaning of the slope and y-intercept in context.

The slope m represents the decreasing yield of product as temperature increases. Specifically, there will be a product yield *decrease* of 0.2 gram with every degree Celsius increase in temperature at which the two chemicals react.

The y-intercept represents the amount of product yield when $T = 0^\circ\text{C}$.

Specifically, the data show that there is a product yield of 33 grams

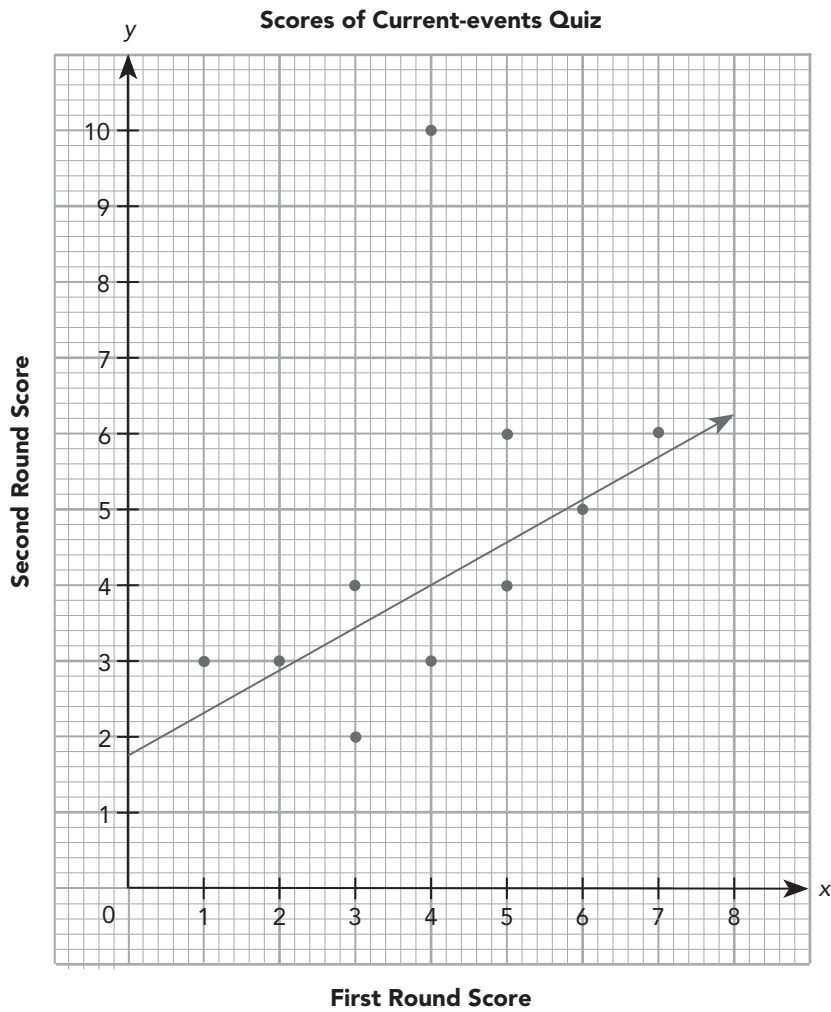
at 0 degree Celsius.

Name: _____

Date: _____

Complete.

4. The diagram below shows the scatter plot of the data from the first example in this lesson. Write an equation of the line of best fit.



Name: _____

Date: _____

The slope of line of best fit that passes through the points (3, _____) and (4, _____) is

$$m = \frac{\boxed{} - \boxed{}}{4 - 3}$$
$$= \underline{\hspace{2cm}}$$

Use slope-intercept form to find y-intercept.

$$y = mx + b$$

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}} (\underline{\hspace{2cm}}) + b$$

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}} + b$$

$$\underline{\hspace{2cm}} - \underline{\hspace{2cm}} = \underline{\hspace{2cm}} + b - \underline{\hspace{2cm}}$$

$$b = \underline{\hspace{2cm}}$$

Use slope-intercept form.

Substitute values for m , x , and y .

Multiply.

Subtract _____ from both sides.

Simplify.

Write an equation.

$$y = mx + b$$

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}} x + \underline{\hspace{2cm}}$$

Substitute _____ for m and _____ for b .

So, the equation of the line of best fit is

_____.