

Warm Up

Lesson Presentation

Lesson Quiz

Warm Up

Write the equation of the line passing through each pair of passing points in slope-intercept form.

1. $(5, -1), (0, -3)$

2. $(8, 5), (-8, 7)$

Use the equation $y = -0.2x + 4$. Find x for each given value of y .

3. $y = 7$

4. $y = 3.5$

Objectives

Fit scatter plot data using linear models with and without technology.

Use linear models to make predictions.

Vocabulary

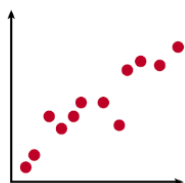
regression

correlation

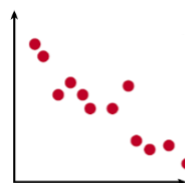
line of best fit

correlation coefficient

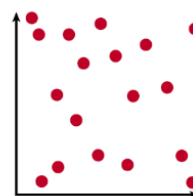
A *scatter plot* is helpful in understanding the form, direction, and strength of the relationship between two variables. **Correlation** is the strength and direction of the linear relationship between the two variables.



Positive correlation,
positive slope



Negative correlation,
negative slope



Relatively no
correlation

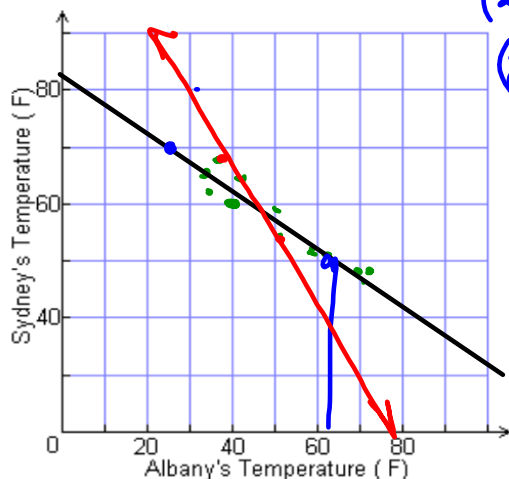
If there is a strong linear relationship between two variables, a **line of best fit**, or a line that best fits the data, can be used to make predictions.

Helpful Hint

Try to have about the same number of points above and below the line of best fit.

Example 1: Meteorology Application

Albany and Sydney are about the same distance from the equator. Make a scatter plot with Albany's temperature as the independent variable. Name the type of correlation. Then sketch a line of best fit and find its equation.



Average Minimum Temperature (°F)		
Month	Albany	Sydney
Jan	31	65
Feb	34	66
Mar	41	63
Apr	50	58
May	59	53
Jun	67	49
Jul	70	46
Aug	70	48
Sep	62	52
Oct	51	56
Nov	40	60
Dec	35	63

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Example 1 Continued

$$y = mx + b$$

Identify two points on the line.

For this data, you might select $(35, 64)$ and $(85, 41)$.

Find the slope of the line that models the data.

$$m = \frac{41 - 64}{85 - 35} = \frac{-23}{50} = -0.46$$

Use the point-slope form.

$$y - y_1 = m(x - x_1) \quad \text{Point-slope form.}$$

$$y - 64 = -0.46(x - 35) \quad \text{Substitute.}$$

$$y = -0.46x + 80.1 \quad \text{Simplify.}$$

An equation that models the data is $y = -0.46x + 80.1$.

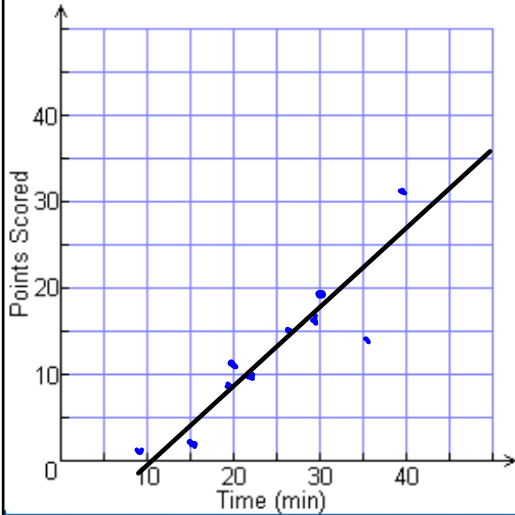
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Check It Out! Example 1

Points Scored in Ten Games

Minutes Played	28	35	8	20	39	23	19	27	15	30
Points Scored	16	13	2	12	31	10	9	15	4	19



$$y = .775x - 5.8$$

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The **correlation coefficient** r is a measure of how well the data set is fit by a model.

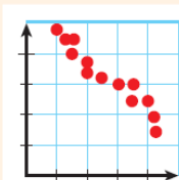
Properties of the Correlation Coefficient r

r is a value in the range $-1 \leq r \leq 1$.

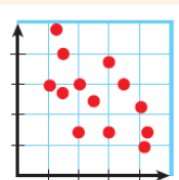
If $r = 1$, the data set forms a straight line with a positive slope.

If $r = 0$, the data set has no correlation.

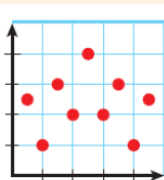
If $r = -1$, the data set forms a straight line with a negative slope.



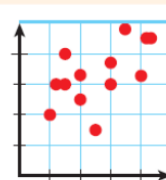
$r \approx -0.95$



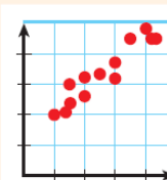
$r \approx -0.6$



$r \approx 0$



$r \approx 0.6$



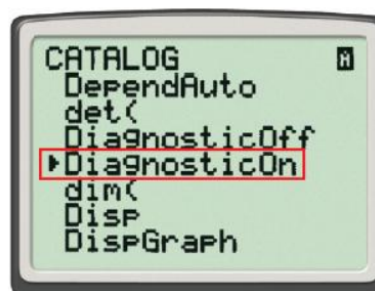
$r \approx 0.95$

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You can use a graphing calculator to perform a linear regression and find the correlation coefficient r .

To display the correlation coefficient r , you may have to turn on the diagnostic mode. To do this, press **2nd** **0**, and choose the **DiagnosticOn** mode.



Example 2: Anthropology Application

Femur Length and Height (cm)	
Length	Height
36	160
32	143
46	187
29	142
35	161
38	164
30	140
27	131

Enter the data into lists **L1** and **L2** on a graphing calculator. Use the linear regression feature by pressing **STAT**, choosing **CALC**, and selecting **4:LinReg**. The equation of the line of best fit is $h \approx 2.91l + 54.04$.

```
LinReg
y=ax+b
a=2.914534042
b=54.04152583
r^2=.9721555855
r=.9859795056
```

Example 2 Continued

A man's femur is 41 cm long. Predict the man's height.

The equation of the line of best fit is $h \approx 2.91l + 54.04$. Use the equation to predict the man's height.

For a 41-cm-long femur,

$$h \approx 2.91(41) + 54.04 \quad \textit{Substitute 41 for l.}$$

$$h \approx 173.35$$

The height of a man with a 41-cm-long femur would be about 173 cm.

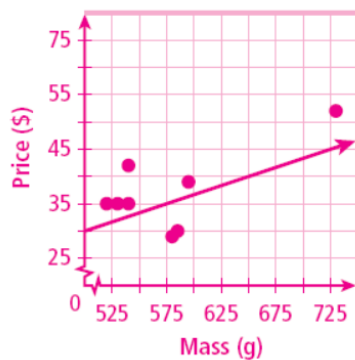
Reading Math

A line of best fit may also be referred to as a *trend line*.

Lesson Quiz: Part I

Use the table for Problems 1–3.

1. Make a scatter plot with mass as the independent variable.



Bicycle Tires	
Mass (g)	Price (\$)
530	35
520	35
585	30
580	29
540	42
540	35
595	39
730	52

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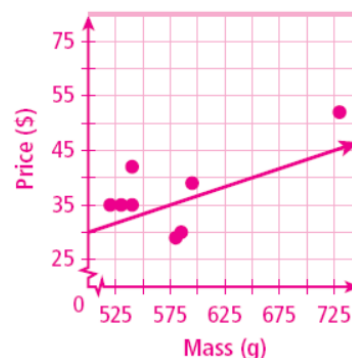
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Lesson Quiz: Part II

2. Find the correlation coefficient and the equation of the line of best fit on your scatter plot. Draw the line of best fit on your scatter plot.

$$r \approx 0.67 ;$$

$$y = 0.07x - 5.24$$



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Lesson Quiz: Part III

3. Predict the weight of a \$40 tire. How accurate do you think your prediction is?

≈ 646 g; the scatter plot and value of r show that price is not a good predictor of weight.