

10-3

Modeling Data With Lines

CONTENT STANDARDS

8.SP.2, 8.SP.3

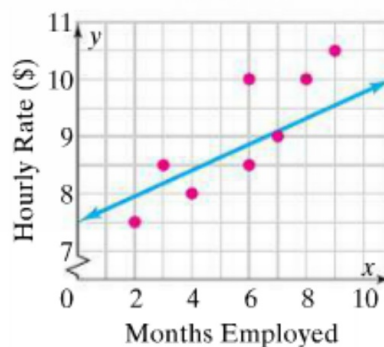
What You'll Learn

To assess the fit of a trend line on a scatter plot and to use trend lines to estimate and make predictions

 **New Vocabulary** trend line

Why Learn This?

When two sets of data have a linear association, such as the data in the scatter plot at the right, you can use a trend line to show the association more clearly. A **trend line** is a line you draw on a graph to approximate the relationship between data sets. If there is no association, you cannot draw a trend line.



You can use a trend line to estimate a value between two given data points. You can also use a trend line to make predictions about data points that do not appear on a scatter plot.

Tree Height and Circumference

Height (ft)	Circumference (in.)
19	10
32	63
57	72
43	111
75	150
97	185
110	214

EXAMPLE

Drawing Trend Lines

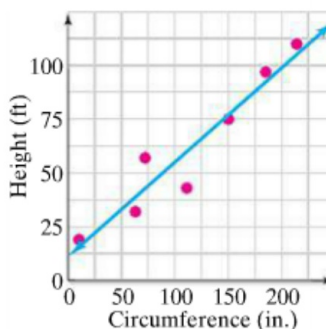
1 The table at the left shows the circumference and height of a variety of trees. Use a scatter plot to predict the height of a tree that has a circumference of 175 in.

Step 1 Plot each data pair.

Step 2 The plotted points go up from left to right. This scatter plot shows a positive, linear association.

Step 3 Draw a line with positive slope. Make sure there are about as many points above the line as there are below it.

Step 4 Find 175 on the horizontal axis. Move up to the trend line. Then move left to the vertical axis.

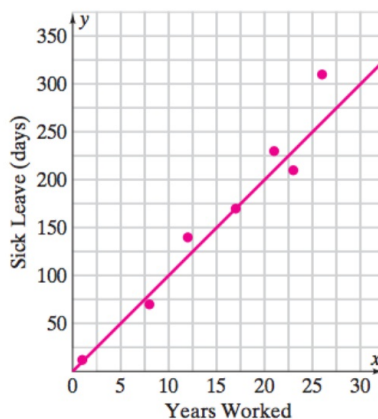


A tree with a circumference of 175 in. should have a height of about 88 ft.

Examples

1 Drawing Trend Lines The table at the left shows the number of years worked and the number of sick leave days available for a sample of employees of a company. Use a scatter plot to predict the number of sick leave days an employee who has worked 30 years will have available.

Years Worked	Sick Leave (days)
1	12
8	70
12	140
17	170
21	230
23	210
26	310



Step 1 Plot each data pair.

Step 2 The plotted points go **up** from **left** to **right**. This scatter plot shows a **positive**, **linear** association.

Step 3 Draw a line with positive slope. Make sure there are about as many points above the line as there are below it.

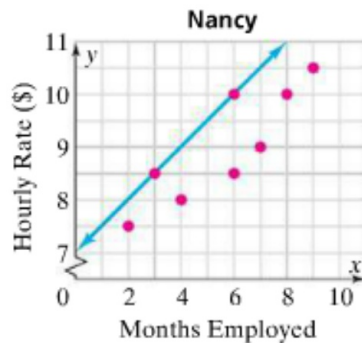
Step 4 Find **30** on the horizontal axis. Move up to the trend line. Then move left to the vertical axis.

An employee who has worked 30 years with the company should have **300** days of sick leave available.

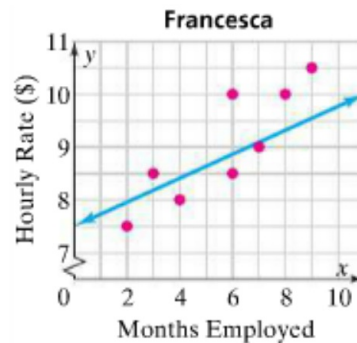
An accurate trend line should fit the data closely. The same number of points should be above the trend line as below it.

EXAMPLE Assessing the Fit of Trend Lines

- 2 In the scatter plots below, Nancy and Francesca each drew a different trend line to approximate the relationship between months employed and hourly rate. Which trend line appears to be the better fit? Explain.



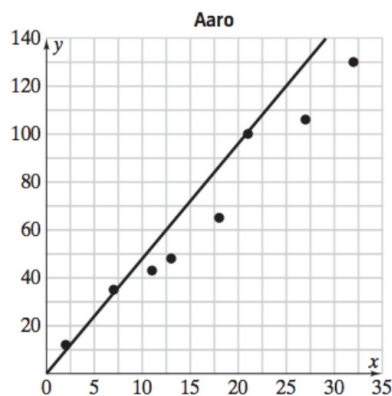
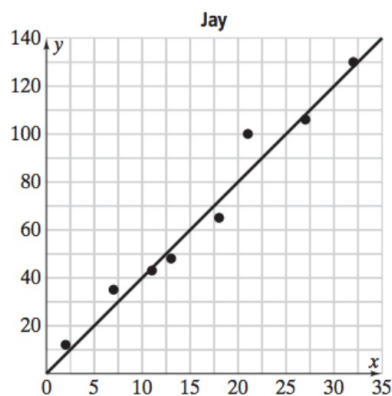
Nancy's trend line passes through two points and has 0 points above it and 6 points below it.



Francesca's trend line has 4 points above it and about 4 points below it.

Francesca's trend line has about the same number of points above it as below it. So Francesca's trend line appears to be a better fit.

- 2 **Assessing the Fit of Trend Lines** In the scatter plots below, Jay and Aaron each drew a different trend line to approximate the relationship between monthly meeting attendance and reward points for their scout group. Which trend line appears to be a better fit? Explain.



Jay's trend line has about the same number of points above it as below it. So **Jay's** trend line appears to be a better fit.

You can also use an equation of a trend line to predict an unknown value.

EXAMPLE Using an Equation of a Trend Line

- 5 Multiple Choice** Make a scatter plot of the data at the right. What is the approximate weight of a 10-month-old puppy?
- Ⓐ 0.8 lb Ⓒ 80 lb
Ⓑ 8.5 lb Ⓓ 88 lb

Weight of a Puppy	
Age (months)	Weight (lb)
0	0.8
1	9.2
2	19.9
3	31.3
4	41.8
5	50.6
6	57.4
7	62.6
8	66.4

Step 1 Make a scatter plot and draw a trend line. Estimate the coordinates of two points on the line.



Two points on the trend line are (2, 19.9) and (7, 62.6).

Step 2 Use two points to find the slope of the trend line.

$$m = \frac{62.6 - 19.9}{7 - 2} = \frac{42.7}{5} = 8.5$$

Step 3 Use (2, 19.9) and the slope to estimate the y-intercept of the trend line.

A change in x of -2 corresponds to a change in y of $-2(8.5) = -17$.
Add: $19.9 + (-17) = 2.9$. So the y-intercept is (0, 2.9).

Step 4 Substitute the slope and y-intercept into the slope-intercept form.

$$y = mx + b \quad \leftarrow \text{Use slope-intercept form.}$$

$$y = 8.5x + 2.9 \quad \leftarrow \text{Substitute 8.5 for } m \text{ and 2.9 for } b.$$

Step 5 Use the equation of the trend line to predict the weight of a 10-month-old puppy.

$$y = 8.5(10) + 2.9 = 87.9$$

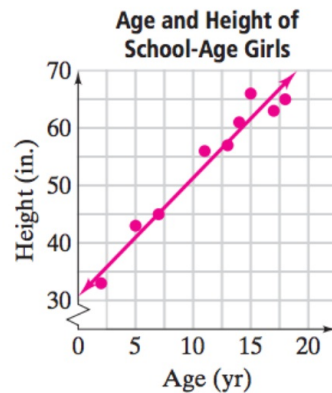
The weight of a 10-month-old puppy is about 88 lb. The correct answer is D.

Quick Check

1. The table shows the age and height of a sample of girls. Use a scatter plot to predict the height of a girl who is 9 years old. **about 50 in.**

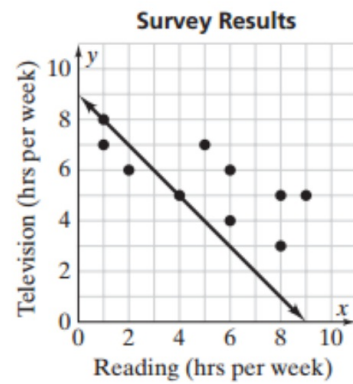
Age and Height of Girls

Age (yr)	2	7	11	13	14	17	15	5	18
Height (in.)	33	45	56	57	61	63	66	43	65

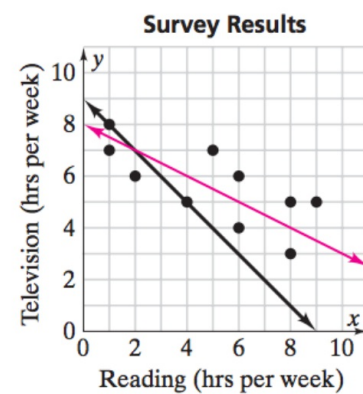


Quick Check

2. The scatter plot shows the results of a survey about the relationship between the number of hours spent reading and the number of hours spent watching television. Draw a trend line that fits the data better than the one shown.

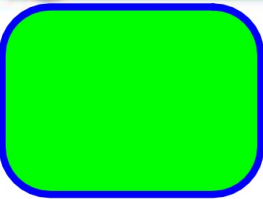


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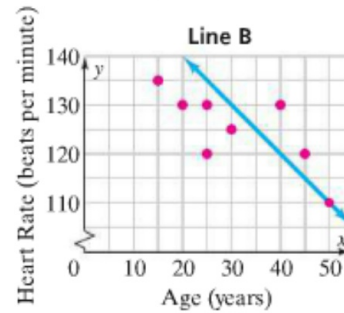
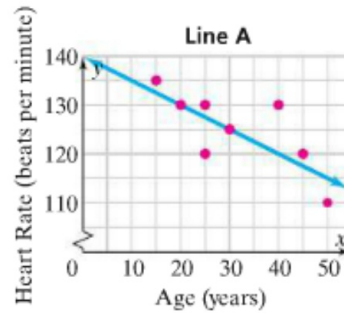
Check Your Understanding

1.

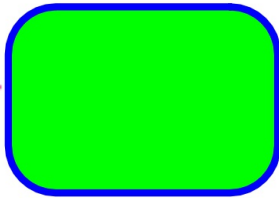


1. **Reasoning** Given a scatter plot for a set of data, how can you draw an accurate trend line? **See left.**

The scatter plots below display the same data about the ages of eight health club members and their heart rates during exercise.



2.



2. Which trend line appears to be a better fit for the data? **See left.**

Name _____ Class _____ Date _____

Practice 10-3

Modeling Data With Lines

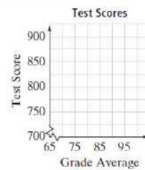
Make a scatter plot for each set of data. If possible, draw a trend line and describe the trend.

1.

Grade Average	70	85	78	92	97	88	82	90
Test Scores	720	805	798	860	889	775	810	870

2.

Years	3	7	10	14	16	20	22	25
Quail per Acre	27	114	185	210	170	198	240	356



Describe the trend:

Describe the trend:

For each scatter plot, find a better trend line than the one shown.

