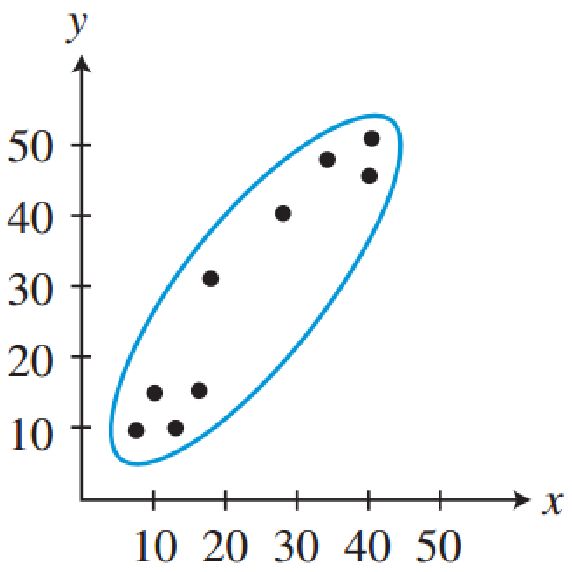
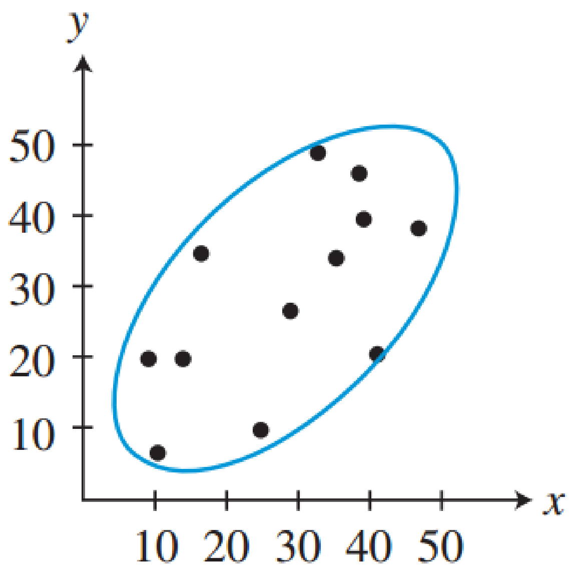
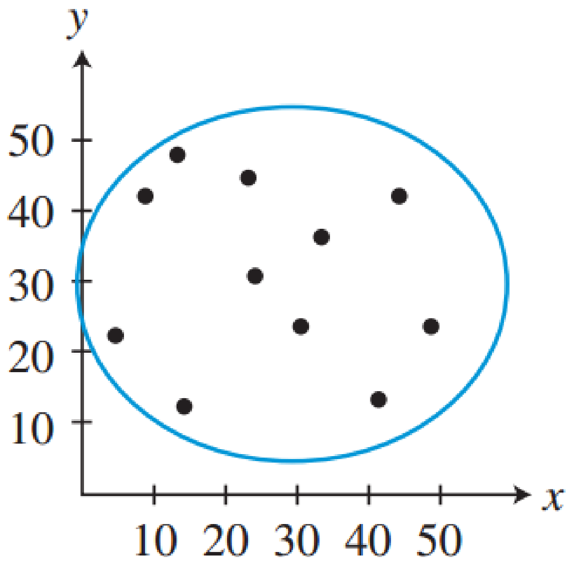


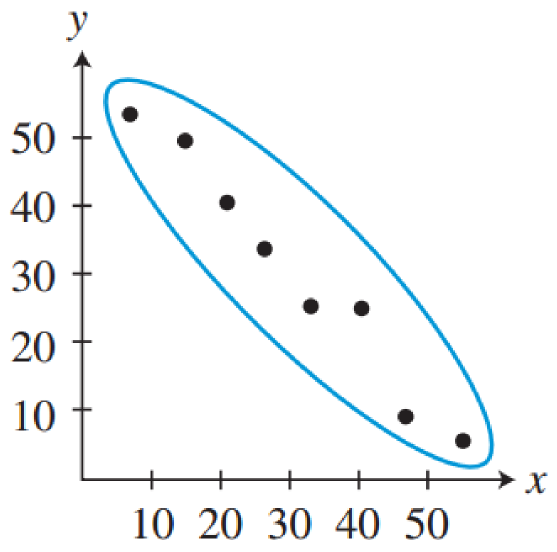
Strong positive linear correlation



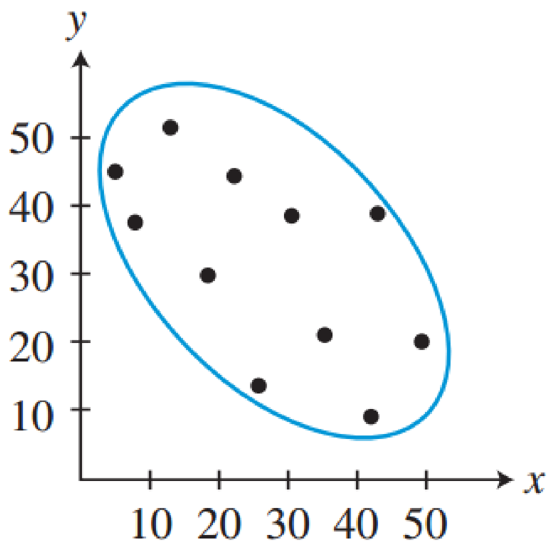
Weak positive linear correlation



Little or no linear correlation



Strong negative linear correlation



Weak negative linear correlation

Properties of the Correlation Coefficient, *r*

1. $-1 \leq r \leq 1$.
2. When $r > 0$, there is a positive linear correlation.
3. When $r < 0$, there is a negative linear correlation.
4. When $|r| \approx 1$, there is a strong linear correlation.
5. When $r \approx 0$, there is weak or no linear correlation.

EXAMPLE 3 Modeling and Predicting Demand

Describe the strength and direction of the linear correlation.

Then use the model to predict weekly cereal sales
if the price is dropped to $2.00 or raised to $4.00 per box.

Table 2.2 Weekly Sales Data Based on Marketing Research

Price per box	Boxes sold
$2.40	38,320
$2.60	33,710
$2.80	28,280
$3.00	26,550
$3.20	25,530
$3.40	22,170
$3.60	18,260

Regression Analysis

1. Enter and plot the data (scatter plot).
2. Find the regression model that fits the problem situation.
3. Superimpose the graph of the regression model on the scatter plot, and observe the fit.
4. Use the regression model to make the predictions called for in the problem.

Predicting Maximum Revenue

Use the model $y = -15{,}358.93x + 73{,}622.50$ from Example 3 to develop a model for the weekly revenue generated by doughnut-shaped oat breakfast cereal sales. Determine the maximum revenue and how to achieve it.

Revenue can be found by multiplying the price per box, x, by the number of boxes sold, y. So the revenue is given by

$$R(x) = x \cdot y = -15{,}358.93x^2 + 73{,}622.50x,$$

Vertical Free-Fall Motion

The **height** s and **vertical velocity** v of an object in free fall are given by

$$s(t) = -\frac{1}{2}gt^2 + v_0t + s_0 \quad \text{and} \quad v(t) = -gt + v_0,$$

where t is time (in seconds), $g \approx 32 \text{ ft/sec}^2 \approx 9.8 \text{ m/sec}^2$ is the **acceleration due to gravity**, v_0 is the *initial vertical velocity* of the object, and s_0 is its *initial height*.

Table 2.3 Rubber Ball Data from CBR™

Time (sec)	Height (m)
0.0000	1.03754
0.1080	1.40205
0.2150	1.63806
0.3225	1.77412
0.4300	1.80392
0.5375	1.71522
0.6450	1.50942
0.7525	1.21410
0.8600	0.83173

When will the ball hit the ground?

When will the ball reach its maximum height?

What is the maximum height?