Section 4.2

Linear Models: Building Linear Functions from Data

1 Draw and Interpret Scatter Diagrams

EXAMPLE Drawing and Interpreting a Scatter Diagram

The data listed in Table 6 represent the apparent temperature versus the relative humidity in a room whose actual temperature is 72° Fahrenheit.

Relative Humidity (%), x	Apparent Temperature °F, y	(x, y)
0	64	(0, 64)
10	65	(10, 65)
20	67	(20, 67)
30	68	(30, 68)
40	70	(40, 70)
50	71	(50, 71)
60	72	(60, 72)
70	73	(70, 73)
80	74	(80, 74)
90	75	(90, 75)
100	76	(100, 76)

EXAMPLE Drawing and Interpreting a Scatter Diagram

(a) Draw a scatter diagram by hand treating relative humidity as the independent variable.

(b) Use a graphing utility to draw a scatter diagram.*

(c) Describe what happens to the apparent temperature as the relative humidity increases.

Relative Humidity (%), x	Apparent Temperature °F, y	(x, y)
0	64	(0, 64)
10	65	(10, 65)
20	67	(20, 67)
30	68	(30, 68)
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60	72	(60, 72)
70	73	(70, 73)
80	74	(80, 74)
90	75	(90, 75)
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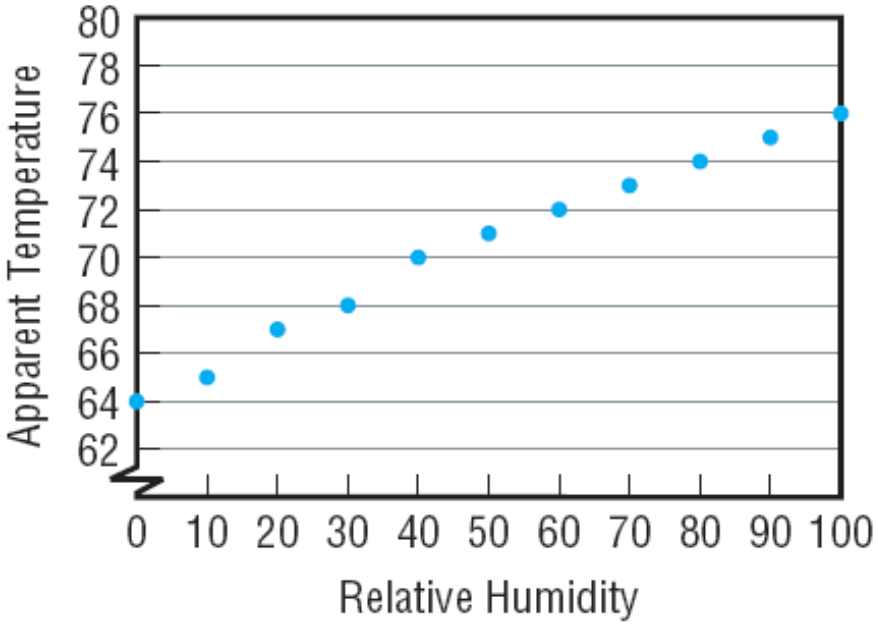
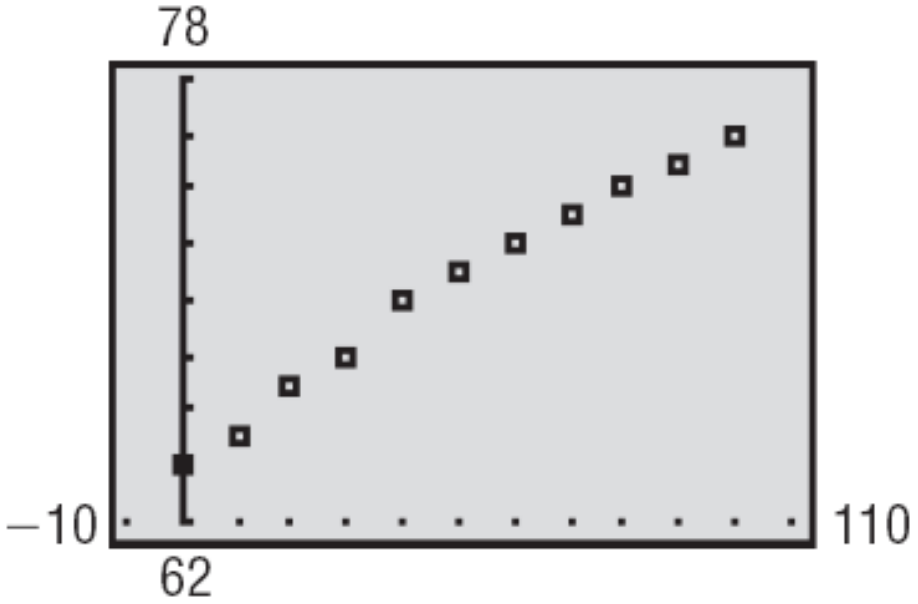
(a) Draw a scatter diagram by hand treating relative humidity as the independent variable.

(b) Use a graphing utility to draw a scatter diagram.*

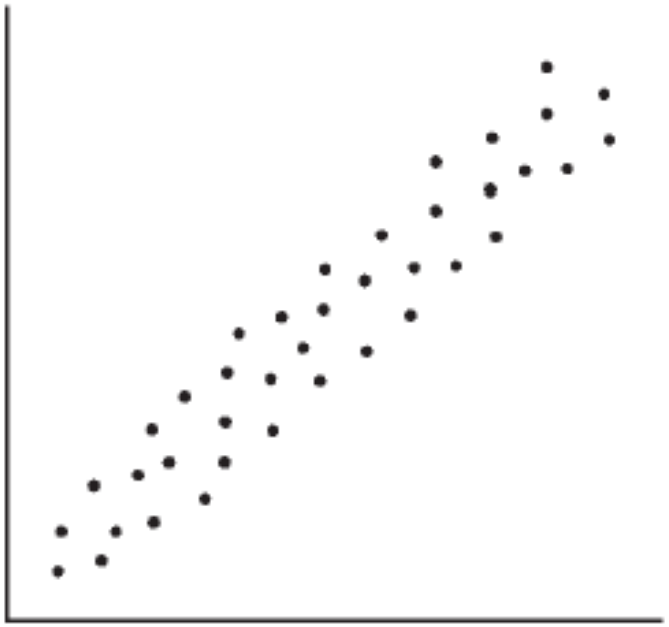
(c) Describe what happens to the apparent temperature as the relative humidity increases.



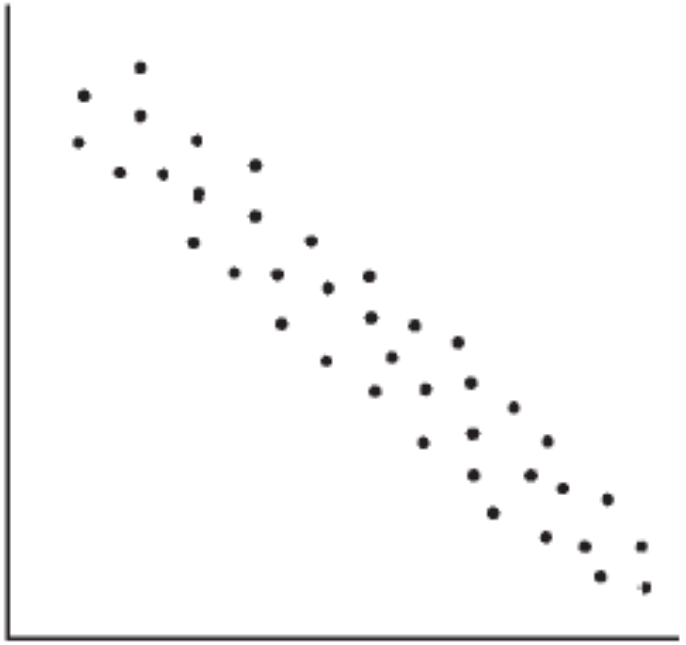


As the relative humidity increases, the apparent temperature also increases.

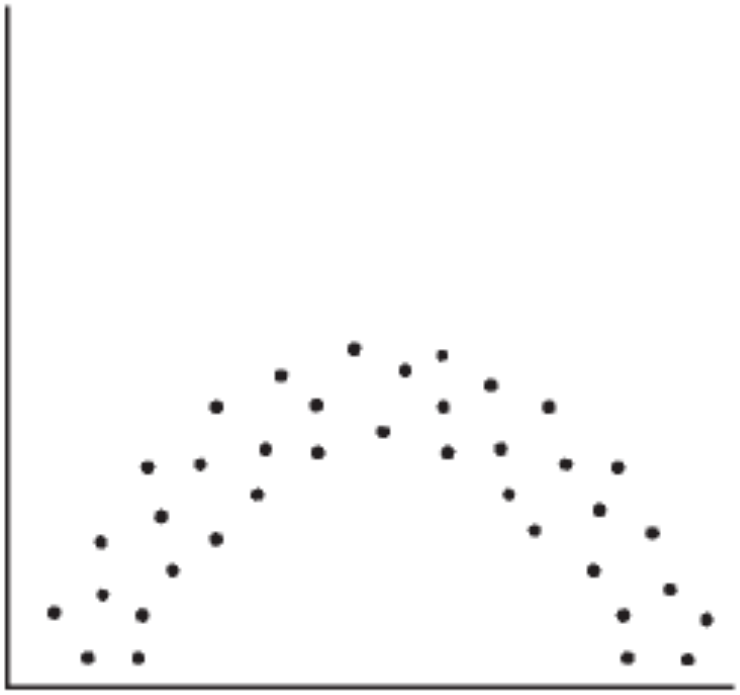
2 Distinguish between Linear and Nonlinear Relations



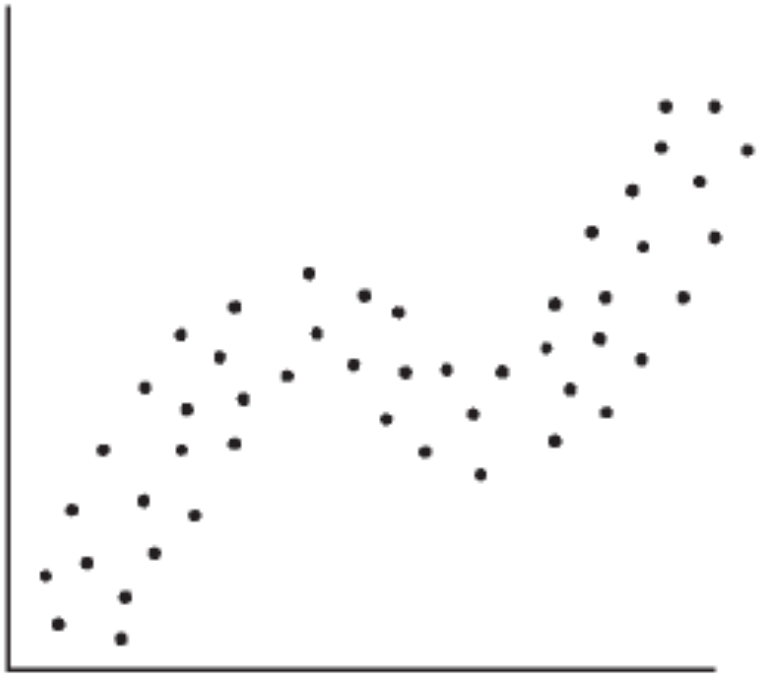
(a) Linear
$y = mx + b, m > 0$



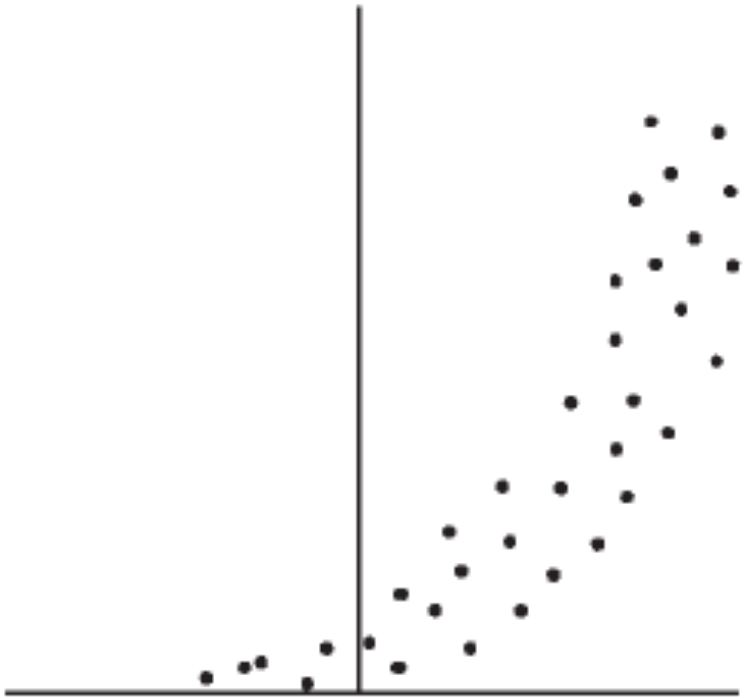
(b) Linear
$y = mx + b, m < 0$



(c) Nonlinear



(d) Nonlinear

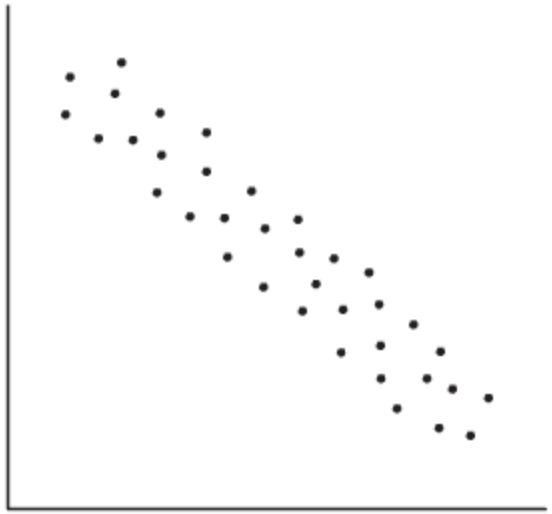


(e) Nonlinear

EXAMPLE

Distinguishing between Linear and Nonlinear Relations

Determine whether the relationship between the two variables is linear or nonlinear.



(a)

Linear

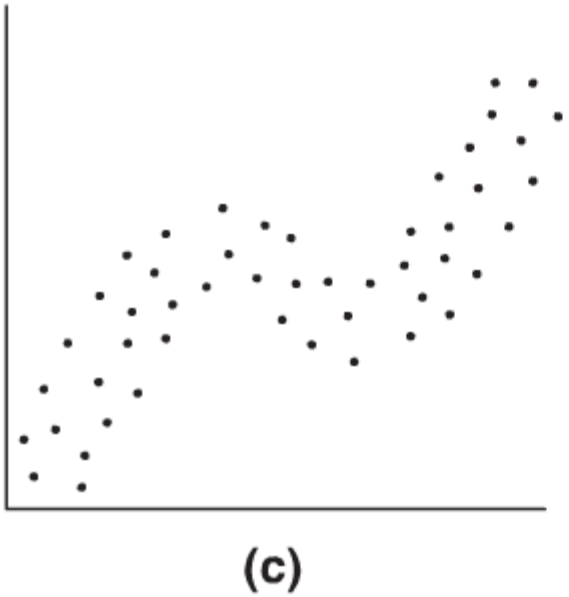
(b)

Nonlinear

EXAMPLE

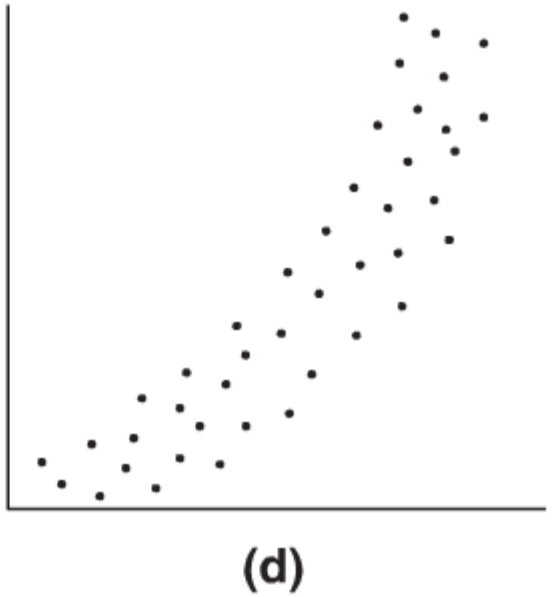
Distinguishing between Linear and Nonlinear Relations

Determine whether the relationship between the two variables is linear or nonlinear.



(c)

Nonlinear



(d)

Nonlinear

EXAMPLE Finding a Model for Linearly Related Data

(a) Select two points and find an equation of the line containing the points.

Relative Humidity (%), x	Apparent Temperature °F, y	(x, y)
0	64	(0, 64)
10	65	(10, 65)
20	67	(20, 67)
30	68	(30, 68)
40	70	(40, 70)
50	71	(50, 71)
60	72	(60, 72)
70	73	(70, 73)
80	74	(80, 74)
90	75	(90, 75)
100	76	(100, 76)

$$m = \frac{74-65}{80-10} = \frac{9}{70}$$

$$y - y_1 = m(x - x_1)$$

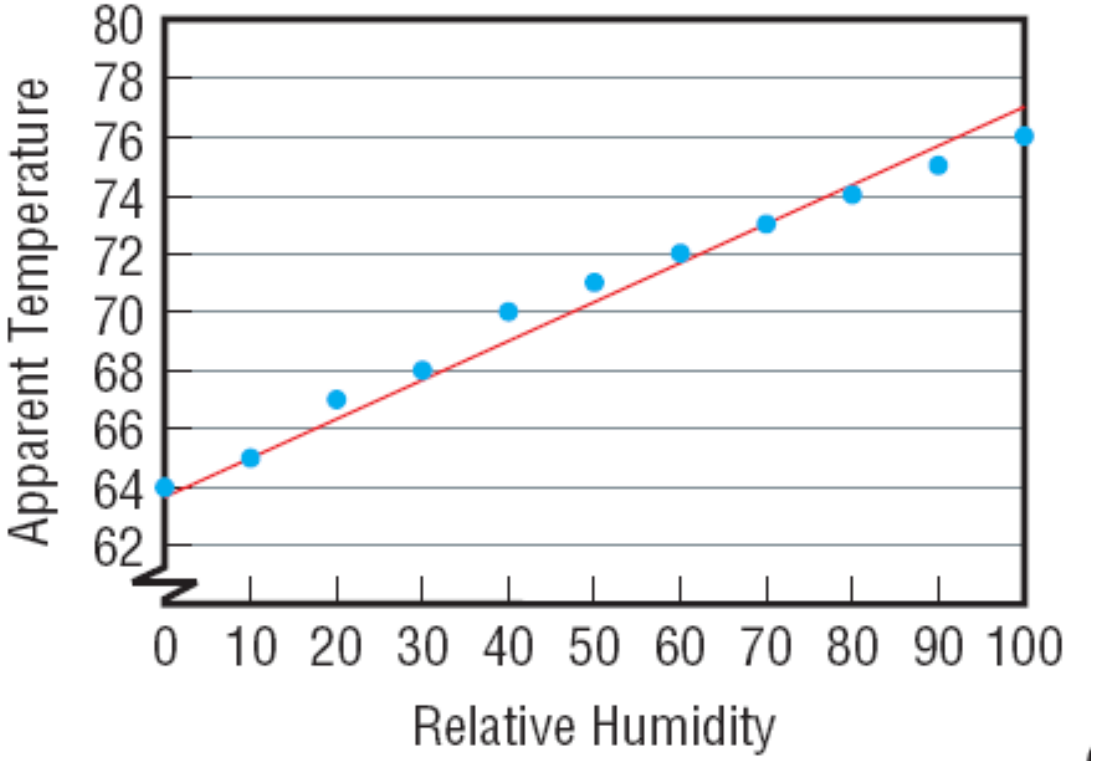
$$y - 65 = \frac{9}{70}(x - 10)$$

$$y = \frac{9}{70}x + \frac{446}{7}$$

EXAMPLE

Finding a Model for Linearly Related Data

$$y = \frac{9}{70}x + \frac{446}{7}$$



3 Use a Graphing Utility to Find the Line of Best Fit

EXAMPLE

Finding a Model for Linearly Related Data

Using the data from the previous example:

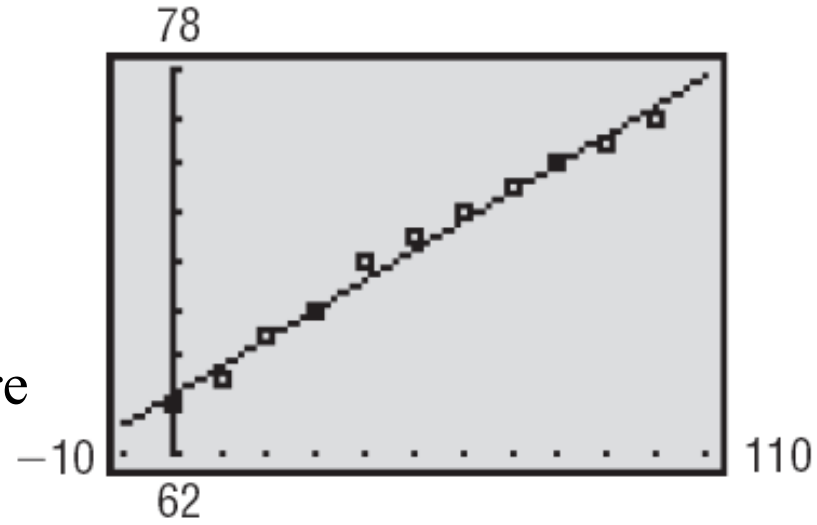
(a) Find the line of best fit using a graphing utility.

(b) Graph the line of best fit on the scatter diagram

(c) Interpret the slope.

```
LinReg
 y=ax+b
 a=.1209090909
 b=64.40909091
 r²=.9882122905
 r=.9940886734
```

The slope is .1209 which means the apparent temperature rises .1209° for every 1% increase in relative humidity.



(d) Use the line of best fit to predict the apparent temperature when actual temperature is 72° F and relative humidity is 45%.

$$y = 0.1209(45) + 64.409 \approx 69.8°\text{F}$$