Section 11.4

1. As the weight increases, the distance decreases. The distance decreases quickly at first, then the rate of decrease slows.

3. a. Variation constant = 120 pound-feet
   b. Independent Variable = Weight
   c. Dependent Variable = Distance
5. a. time * velocity is a constant of 3600.

<table>
<thead>
<tr>
<th>Time</th>
<th>Velocity</th>
<th>Time*Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>240</td>
<td>3600</td>
</tr>
<tr>
<td>20</td>
<td>180</td>
<td>3600</td>
</tr>
<tr>
<td>24</td>
<td>150</td>
<td>3600</td>
</tr>
<tr>
<td>30</td>
<td>120</td>
<td>3600</td>
</tr>
<tr>
<td>36</td>
<td>100</td>
<td>3600</td>
</tr>
</tbody>
</table>

b. Velocity = \(\frac{3600}{\text{Time}}\)

c. The general variation equation is \(y = \frac{a}{x^3}\)

\[100 = \frac{a}{4^3}\]

\[100 = \frac{a}{64}\]

\[6400 = a\]

So the specific equation is \(y = \frac{6400}{x^3}\)

When \(x = 8\),

\[y = \frac{6400}{8^3} = \frac{6400}{512} = 12.5\]

7. \(50 = \frac{a}{8}\)

\(a = 400\)

\(R = \frac{400}{l}\)

9. force = \(\text{constant distance}^2\)

\(F = \frac{a}{d^2}\)

\(F\) represents the force between the two bodies separated by a distance of \(d\) meters.

11. \(F = \frac{5000}{2^2} = \frac{5000}{4} = 1250\) newtons

13. a. The general variation equation is \(y = \frac{a}{x^2}\)

\[5 = \frac{a}{2^2}\]

\[5 = \frac{a}{4}\]

\[20 = a\]

So the specific equation is \(y = \frac{20}{x^2}\)

When \(x = 10\),

\[y = \frac{20}{10^2} = \frac{20}{100} = \frac{1}{5} = .2\]

b. The general variation equation is \(y = \frac{a}{x}\)

\[4 = \frac{a}{9}\]

\[36 = a\]

So the specific equation is \(y = \frac{36}{x}\)

\[3 = \frac{36}{x}\]

\[3x = 36\]

\[x = 12\]

15. a. The general variation equation is \(P = \frac{a}{V}\)

\[1.03 = \frac{a}{3.5}\]

\[1.03 \times 3.5 = a\]

\[3.605 = a\]

So the specific equation is

\(P = \frac{3.605}{V}\)

\(P = \frac{3.605}{4}

\(P = .90125\) atmosphere

b. \(P = \frac{3.605}{V}\)

\[1.05 = \frac{3.605}{V}\]

\[1.05V = 3.605\]

\(V = \frac{3.605}{1.05} \approx 3.43\) L

Skills and Review 11.4

17. The basic reciprocal graph is shifted up 6 units.

19. The decay factor is \(b = 1 - \frac{1}{10} = \frac{9}{10}\) as a decimal

this is \(b = .9\).

The initial value \(y_0\) is 200.

Let \(x\) represent time in years

Then \(y = 200 \left(\frac{9}{10}\right)^x\) or \(y = 200(0.9)^x\)
21. a. \( \sqrt{4x} = x - 3 \)

\[
\left( \sqrt{4x} \right)^2 = (x - 3)^2
\]

\[
4x = x^2 - 6x + 9
0 = x^2 - 10x + 9
0 = (x - 1)(x - 9)
0 = x - 1 \text{ or } 0 = x - 9
x = 1 \text{ or } x = 9
\]

b. No, \( x = 1 \) is an extraneous solution because when substituted into the original equation, we get a false statement:

\[
\sqrt{4 \cdot 1} = 1 - 3
\]

\[
\sqrt{4} = -2
\]

\[2 = -2\]

25. a. \( y = \frac{60}{x^2} \)

b. \( f(x) = \frac{60}{x^2} \)

c. \( f(2) = \frac{60}{(2)^2} = \frac{60}{4} = 15 \)

d. \( \frac{5}{3} = \frac{60}{x^2} \)

\[5x^2 = 180\]

\[x^2 = 36\]

\[x = \pm 6\]