Week in Review # 1  
Section 1.1, 1.2, and Focus on Modeling

1. Let \( f(x) = 4x^2 - 49 \)
   
   (a) \( f(5) = 4(5)^2 - 49 = 51 \)

   (b) What values of \( x \) give \( y \) a value of 15?

   \[
   f(x) = 15 \\
   15 = 4x^2 - 49 \\
   64 = 4x^2 \\
   16 = x^2
   \]

   \( x = 4 \)  
   \( x = -4 \)

   (c) What is the horizontal intercept and the vertical intercept?

   \( x \)-intercept: plug in 0 for \( y \)
   
   \[
   0 = 4x^2 - 49 \\
   49 = 4x^2 \\
   12.25 = x^2
   \]

   \( x = \pm 3.5 \)

   \( y \)-intercept: plug in 0 for \( x \)

   \[
   \text{Vert.} = -49 \\
   (0, -49) \]
2. A gas tank 6 meters underground springs a leak. Gas seeps out and contaminates the soil around it. Graph the amount of contamination as a function of the depth (in meters) below the ground.

3. In a mountain range, the number, $N$, of species of birds is a function of the elevation, $H$, in feet above sea level.

(a) Which function notation is correct for the given information?

$N = f(H)$
$H = f(N)$

(b) Interpret the statement $f(1500) = 30$ in terms of bird species.

at a height of 1,500 ft there are 30 species of birds
4. Find the equation of the line that passes through the points \((-5, 10)\) and \((13, 55)\) in both point-slope form and slope-intercept form.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{55 - 10}{13 - (-5)} = \frac{45}{18} = 2.5
\]

**Point slope:** \[y - y_1 = m(x - x_1)\]

\[
y - 10 = 2.5(x - (-5))
\]

\[
y - 10 = 2.5(x + 5)
\]

**Slope intercept:** \[y = mx + b\]

\[
y - 10 = 2.5x + 12.5
\]

\[
y = 2.5x + 22.5
\]
5. Find the equation of the line with a horizontal intercept of 10 and a vertical intercept of 22.

\[
\begin{align*}
(10,0) & \quad (0,22) \\
\text{Slope intercept} & \quad y = mx + b \\
\text{Slope} & = \frac{22 - 0}{0 - 10} = -2.2 \\
y & = -2.2x + 22
\end{align*}
\]
6. For the line \(5y + 8x + J = 0\), where \(J\) is some number, answer the following:

(a) slope = \(-\frac{8}{5}\) = \(-1.6\)

\[
5y = -8x - J \\
\frac{y}{5} = -\frac{8}{5}x - \frac{J}{5}
\]

(b) vertical intercept = \(-\frac{J}{5}\)

(c) horizontal intercept = \(-\frac{J}{8}\)

\[
5y + 8x = -J \\
8x = -J \\
x = -\frac{J}{8}
\]

(d) Find the change in \(y\) when \(x\) in increased by 2.

\[
\text{slope} = \frac{{\text{rise}}}{{\text{run}}} = \frac{a}{b}
\]

\[
\text{increase } x \text{ by } b \text{ means increase } y \text{ by } a
\]

\[
\text{increase } x \text{ by 2 means } y \text{ drops by } 2(1.6) \text{ or } 3.2
\]
7. The value of a truck \( V \), in thousands, is a function of the age of the truck in years, \( a \).

(a) Interpret the statement \( f(5) = 14 \).

\[ f(age) = \text{value} \]

A 5 year old truck has a value of $14,000.

(b) The value of Chevy Truck is approximated by \( f(a) = 31.45 - .75a \). Interpret the slope and the vertical intercept of the function.

Vert. int. is 31.45

A brand new chevy truck (ie age 0) is worth $31,450

Slope is -.75

For each year older the truck gets its value goes down by $750. (ie. .75 thousand dollars)

Basic idea

\[ \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} \]

For this prob.

\[ M = \frac{\Delta \text{value}}{\Delta \text{age}} \]
8. The following graph shows the daily average retail price of regular gasoline in the Corpus Christi area. If the retail price, $p$, is a function of the number of days, $t$, since December 22 (i.e. $t = 1$ represents December 23, $t = 5$ represents December 27), then $p = f(t)$.

(a) What is the value of $p$ when $t$ is 6? $\$2.16$

(b) What is $f(14)$? $\$2.09$

(c) For what value(s) of $t$ is the price $\$1.99$? Interpret the meaning of these values of $t$.

$t = 22 \rightarrow$ Jan 13

$t = 24 \rightarrow$ Jan 15
9. Find the best fitting line: linear regression, for the data.

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>6</th>
<th>10</th>
<th>12</th>
<th>15</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>63</td>
<td>45</td>
<td>27</td>
<td>17</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

Least squares regression

Linear regression

Step 1: Put data in the calc.

Stat [enter]

Step 2: If you want a scatter plot

Press \( 2^\text{nd} \) [y=] to set up system

Set plot 1 to on

First pic in Row 1 of type

X List: L_1

Y List: L_2

Turn scatter plot on/off by y= menu

Zoom Stat to graph

Step 2: If you just want regression line

\[ \text{Stat} \rightarrow \text{Calc} \]  

Choice Y

Answer

\[ y = -3.6057 x + 63.6584 \]
10. A sample of nine adult men gave the following data on their heights and weights.

<table>
<thead>
<tr>
<th>Height (inches)</th>
<th>63</th>
<th>66</th>
<th>67</th>
<th>68</th>
<th>68</th>
<th>70</th>
<th>70</th>
<th>72</th>
<th>76</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (pounds)</td>
<td>140</td>
<td>145</td>
<td>185</td>
<td>180</td>
<td>165</td>
<td>195</td>
<td>215</td>
<td>220</td>
<td>240</td>
</tr>
</tbody>
</table>

(a) For the data, find the linear regression equation where weight is a function of height.

\[ y = 8.5421x - 401.2325 \]
\[ W = 8.5421h - 401.2325 \]

(b) Interpret the significance of the slope.

\[ \frac{\Delta y}{\Delta x} = \text{pounds per inch} = 8.5421 \text{ lbs/inch} \]

For each inch taller, the weight goes up by 8.5421 lbs.

(c) Using the regression equation, predict the weight of a man that is 67 inches tall.

Plug in 67 for \( x \) and solve for \( y \).

\[ y = 171.0852 \text{ lbs} \]

(d) Using the regression equation, predict the height of a guy that weighs 235 pounds.

Plug in 235 for \( y \) and solve for \( x \).

\[ 235 = 8.5421x - 401.2325 \]
\[ 636.2325 = 8.5421x \]
\[ x = 74.4820 \text{ inches} \]