1. An example of a linear equation is \( y = -2x + 7 \).
   
   a. On a piece of graph paper, graph this equation by putting \( x \) on the horizontal axis and \( y \) on the vertical axis.
   
   b. What is the slope of the line?
   
   c. Describe the relationship between \( x \) and \( y \). (Is it positive, negative, or independent?)
   
   d. What does \( y \) equal when \( x \) equals 5?

   What does \( y \) equal when \( x \) equals -2?

   What does \( y \) equal when \( x \) equals 0?

   What do we call the value of \( y \) when \( x = 0 \)?
   
   e. What does \( x \) equal when \( y \) equals 10?

   What does \( x \) equal when \( y \) equals 4?

   What does \( x \) equal when \( y \) equals -8?

2. Here are two linear equations: \( y = 2x + 1 \) and \( y = -3x + 30 \).
   
   a. Draw the graph of these two equations by putting \( x \) on the horizontal axis, and \( y \) on the vertical axis.
   
   b. Find the intersection of the two equations graphically and algebraically.
3. These are some x and y data:

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>15</td>
<td>14</td>
<td>12</td>
<td>9</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

a. Plot the data by putting x on the horizontal axis and y on the vertical axis.

b. Describe the relationship between x and y, is it positive, negative, or independent?

If it is nonlinear, is it
   a. increasing at an increasing rate
   b. increasing at a decreasing rate
   c. decreasing at an increasing rate
   d. decreasing at a decreasing rate?

4. The following are actual data on the number of Iowa farms (source: USDA).

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of farms (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>183</td>
</tr>
<tr>
<td>1965</td>
<td>158</td>
</tr>
<tr>
<td>1970</td>
<td>145</td>
</tr>
<tr>
<td>1975</td>
<td>130</td>
</tr>
<tr>
<td>1980</td>
<td>119</td>
</tr>
<tr>
<td>1985</td>
<td>111</td>
</tr>
<tr>
<td>1990</td>
<td>104</td>
</tr>
<tr>
<td>1995</td>
<td>100</td>
</tr>
</tbody>
</table>

a. Using a computer spreadsheet package (e.g., Excel, Lotus, Quattro) plot the observations on number of Iowa farms over time on a graph labeled Iowa Farm Numbers Over Time #1.

b. Using a computer spreadsheet package (e.g., Excel, Lotus, Quattro) draw a smooth line “fitting” the observations on number of Iowa farms over time on a graph labeled Iowa Farm Numbers Over Time #2.

c. Calculate approximately the slope of the “fitted” curve in graph #1 for year 1965 using the change between 1960 and 1970 as a measure of the slope. Describe in words the meaning of the value obtained.

d. Calculate approximately the slope of the “fitted” curve in graph #1 for year 1965 using the change between 1960 and 1965 as a measure of the slope. Describe in words the meaning of the value obtained.

e. Calculate approximately the slope of the “fitted” curve in graph #1 for year 1965 using the change between 1965 and 1970 as a measure of the slope. Describe in words the meaning of the value obtained.

f. Calculate approximately the slope of the “fitted” curve in graph #1 for year 1990 using the change between 1990 and 1995 as a measure of the slope. Describe in words the meaning of the value obtained.
g. What best describes the relationship between the number of Iowa farms and time: (i) positive linear, (ii) positive and becoming steeper, (ii) positive and becoming less steep, (iv) negative linear, (v) negative and becoming steeper, or (vi) negative and becoming less steep?

h. What conclusions can you draw from the above observations on Iowa farm numbers?

i. If the slope is the same between 1995 and 2000 as between 1990 and 1995, what would you predict for the year 2000 regarding number of farms in Iowa? Explain the logic of your prediction.

j. Suppose that the only information you have on the number of farms is for the years 1960 and 1975. Using a computer spreadsheet package, plot these two observations on a graph labeled #2 and graph a straight line through the two points.

k. Now using the line tool on the drawing toolbar, draw a line that extends the line in part j to the horizontal axis.

l. Using the formula for the equation of a line, calculate the equation of the line in parts j and k.
m. Assuming continuation of a linear trend, how many Iowa farms would you predict for the year 2010 based solely on the information in (i)?

n. Assuming continuation of a linear trend, when would you predict that there would be no farms left in Iowa based solely on the information in (i)?

o. Using linear relationships for prediction purposes is most likely to work best in projecting (i) the near future, or (ii) the distant future? Why?
5. The following experimental data were generated on an Iowa State University research farm. The data show the corn yield response to nitrogen fertilizer. The first row is pounds of nitrogen fertilizer applied per acre. The second row is corn yield in bushels per acre.

<table>
<thead>
<tr>
<th>Fertilizer (lbs/ac)</th>
<th>0</th>
<th>25</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn yield (bu/ac)</td>
<td>74</td>
<td>107</td>
<td>111</td>
<td>134</td>
<td>132</td>
<td>143</td>
<td>138</td>
<td>146</td>
<td>146</td>
<td>140</td>
</tr>
</tbody>
</table>

a. Using a computer spreadsheet package, graph the data with yield on the vertical axis and fertilizer on the horizontal axis. Create the graph in a way that shows both the points and a curvilinear line connecting them.

b. Describe the relationship between the fertilizer and the yield data.

c. If a farmer faces this yield/fertilizer relationship, how much fertilizer should the farmer apply? Explain your reasoning.