Homework Exercises which relate directly to what we did in class...
(I suggest strongly that you read my calendar notes first.)

(1) In class, we said that the graph of the US's GDP looks pretty much "straight". We decided that straightness of this graph indicates that the GDP goes up by the same amount every 4 years (or, really, every year.) We then looked at the data table for the US - GDP. From 1984 to 1988 the US - GDP went up by 1000 billion dollars (1 trillion dollars).
(a) Checking the data table for the US-GDP: Does this happen? Does the US-GDP appear to go up by 1 trillion dollars every 4 years? Report your response in a few words.

(b) Here is a copy of the US - GDP graph:

[Graph image]

Draw a graph of the US GDP into this picture, if it really DID go up by 1 trillion $ every four years. (The US-GDP in 1984 was 6.5 trillion dollars). How did you do this? (in words)

(c) Does the "imitation" of the GDP (grow by 1 trillion $ every 4 years) match the reality/projection shown in the original graph pretty well? Respond in words. Add a little detail.

(d) Let's invent the quantity "t" to measure time: "t" is how many years we are past 1984. (So t = 0 means we are in the year 1984, t = 2 means we are in the year 1986, etc.)
Produce a formula which calculates the US-GDP for the year indicated by "t" directly from the value of "t", assuming that the US-GDP grows by 1 trillion dollars every four years. (Careful: "t" getting bigger by 1 means that one year expired. What happens to the GDP?)
(2) On the way home, you stop for gas. The price per gallon is $2.09.

(a) Below, show the relationship between "the number of gallons you pumped"
    \( g = 0,1,2,3,4,... \) and the other quantity, "amount of money you pay", \( P \) in a table

<table>
<thead>
<tr>
<th>gallons (g)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (P, in $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Produce a scatterplot of the relationship between "g" and "P" you outlined in the table.
    Does the scatterplot appear to form a straight line? Why is that? (Explain in words.)
    (Use your ruler, and label the axes, put scales on the axes... Make a NICE picture.)

(c) Find a formula which calculates the price \( P \) from the number of gallons pumped \( g \).
In the next exercise, we begin with a formula that expresses a relationship between two quantities: "t", how many years have expired since 1996, and "B" the number of Chapter 12 bankruptcy filings in the year corresponding to "t".

(2) The yearly number of Chapter 12 bankruptcy filings in the US for the years from 1996 to 2000 can be "captured" by the formula \[ B = 1063 - 83.9 \cdot t \], where "B" is the number of bankruptcy filings, and "t" is the number of years past 1996. (So, for the year 1996: \( t = 0 \), for the year 1997: \( t = 1 \), etc.)

(a) Show the relationship between \( t \) and \( B \) in a well labeled table.

(b) Produce a well-labeled scatterplot (graph) of the relationship between \( t \) and \( B \). You should base this graph on your table from (a).

(c) What does the "1063" in the formula tell us about US bankruptcy filings?
   (You should answer this in a sentence or two.)

(d) What does the " - 83.9 \cdot t"-part in the formula tell us about the number of bankruptcy filings in the US during the time period 1996 - 2000? (Answer in a sentence or two.)
The following problems are re-worded from the text, p. 42, Sec. 1.4. I will number the problems here with the same numbers they have in the text.

(4) On a certain tomato farm, the quantity of tomatoes harvested in any given year is given by 
\[ T = 6 + 5 \cdot R, \] 
where \( R \) is the amount of rainfall during the growing season in inches, and \( T \) is the total tomato harvest measured in hundreds of pounds.

(a) Interpret the numbers which appear in this formula (6 and 5) in the context of tomato harvest and rainfall. You should write at least one sentence for each of the numbers: What does the "6" in the formula tell you about the relationship between rainfall and Tomato Harvest?? What does the "5" in the formula tell you about the relationship between rainfall and Tomato Harvest??

(b) Since the formula calculates "\( T \)" from "\( R \)" , "\( T \)" is the dependent variable. \( T \) depends on "\( R \)". In a graph (see part (c)), the dependent variable is usually marked on the vertical axis. Make a quick table of some \((R,T)\)-pairs for this relationship.

<table>
<thead>
<tr>
<th>R (rainfall in inches)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T (tomato harvest in 100 lb units)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(c) Graph a few \((R, T)\) - pairs. Do they lie on a straight line? Which of the two numbers in the formula (5 or 6) influences how steep the line is? How does this "influence" work?
(6) Under overcrowding conditions at an assembly line for BMW-sunroofs, productivity of the assembly line is \( S(x) = 1700 - 20x \), where "\( x \)" is the number of workers above the number of workers needed to operate the assembly line, and "\( S \)" is the number of sunroofs produced in a day. (Before you start, think about what's going on here until you understand.)

(a) How many sunroofs are produced in a day if \( x = 0 \)? What does "\( x = 0 \)" mean here?

(b) Graph a few (input, output)-pairs, that is \((x, S)\)-pairs. Why is the straight line on which these points lie go downhill from left to right? Explain why that happens. How much does the height of the line drop when you increase the input \((x)\) by 1? What does it mean (in the context) "to increase the input \((x)\) by 1"? What does the "drop" in height mean?

(c) In a few, clear sentences, explain what the formula says about the assembly line's productivity. Be as exact as possible. Avoid vague statements that could be made less vague. Don't talk about "slope" and "y-intercept". Talk about sunroofs and workers.
In the next two exercises, use the information given to find a function (formula) which expresses the connection between the two quantities of interest. Decide which of the two quantities should be viewed as "dependent variable", or "output" of the formula. (The other one is then input, or "independent variable/quantity"). Give good names to the variables/quantities. Whenever you report a formula for such a relationship, state explicitly what quantity is indicated by what letter-name, and in what units the quantity is being measured.

(8) The population of some country was 175 million in 2004, and has since increased by 150,000 people each year.

(11) Fabric sheeting is manufactured on a loom at a rate of 4.75 square feet per minute. The first six square feet of the fabric is unusable. (We care about "usable fabric" only.)