Problems	1	2	3	4	5	6	Total		Grade
Points								%	
Out of	6	36	21	21	10	6	100		

Relax. You have done problems like these before. Even if these problems look a bit different, just do what you can. If you're not sure of something, please ask! You may use your calculator. Please show all of your work and write down as many steps as you can. Don't spend too much time on any one problem. Please leave the following grading key blank for me to use. Do well. And remember, ask me if you're not sure about something.

A few formulas from our book:

Percentage Change Formula

To get the result of increasing an amount by $r\%$, multiply by $1 + \frac{r}{100}$.

To get the result of decreasing an amount by $r\%$, multiply by $1 - \frac{r}{100}$.

The Growth Factor Formula

If an amount is growing exponentially and the amount changes from from P to A in T time periods, then the growth factor g is given by the formula

$$g = \left(\frac{A}{P}\right)^{\left(\frac{1}{T}\right)}$$

Log Divides Formula

The equation $b^T = v$ has solution

$$T = \frac{\log(v)}{\log(b)}$$

1. (a) Calculate $\dfrac{1.21 \times 10^{27}}{3.70 \times 10^{-34}}$. Express your answer in scientific notation. Be sure to use parentheses in both the numerator and denominator when you calculate this result!

(b) From your previous answer and using the connection between logarithms and scientific notation, what is an approximate value for $\log\left(\dfrac{1.21 \times 10^{27}}{3.70 \times 10^{-34}}\right)$? *Be sure to explain your answer with a sentence.*

(c) Now use your calculator to determine $\log\left(\dfrac{1.21 \times 10^{27}}{3.70 \times 10^{-34}}\right)$. Please report your answer to 5 decimal places. Does it agree with your approximation?

2. Biologists in Florida have found a direct link between human population increases and a decline in local black bear populations. In 1953 the black bear population was 11,000. From that time it had been decreasing at a rate of 6% per year. From the initial estimate of 11,000 the black bear population has decreased to B bears in Y years since 1953 where

$$B = 11000(0.94)^Y$$

(a) Make a table of values showing the bear population 10, 20, 30, 40, and 50 years after 1953.

(b) Draw a graph illustrating the dependence. *Be sure to include all the information given and space your axes evenly.*
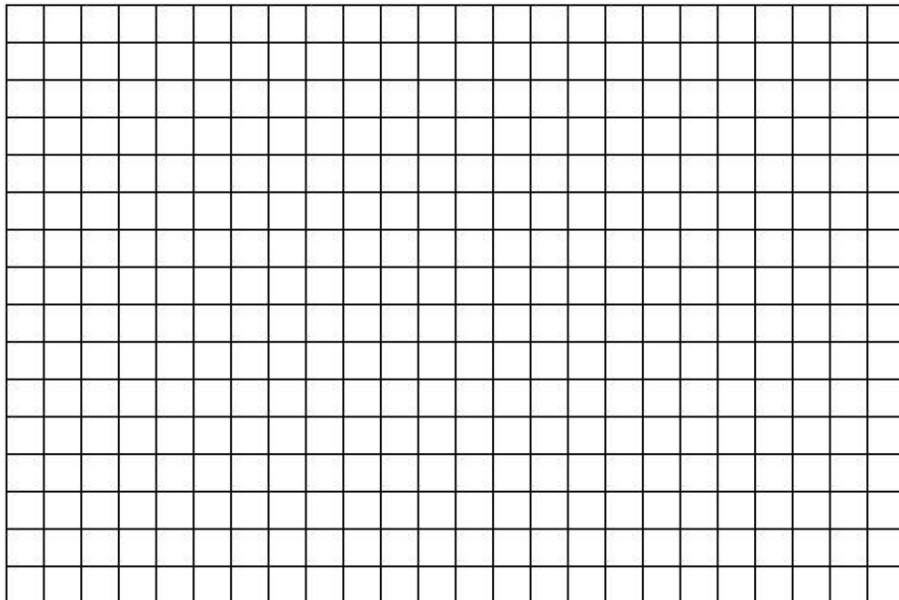
The problem continues . . . .

(c) When will the bear population drop below 750 bears? Approximate the answer from your graph and then refine your answer by successive approximation to the nearest year.

(d) Now show how to *exactly* solve the equation to determine when the bear population will be below 750 bears.

3. In December 2010, the popular mobile app game Angry Birds had 50 million downloads. Six months later (May 2011), the game had 200 million downloads.

Let D denote the number of downloads of Angry Birds (in millions) and M the months since December 2010. Suppose that the number of downloads have been increasing at a *constant rate each month*.

(a) By how many downloads per month has this increased?

(b) Write an equation illustrating this model.

(c) According to this equation, how many downloads will occur by November 2011 (when $M = 11$)?

(d) What type of equation is being used here?

4. Remember from the previous problem that In December 2010, the popular mobile app game Angry Birds had 50 million downloads. Six months later (May 2011), the game had 200 million downloads. Let D denote the number of downloads of Angry Birds (in millions) and M the months since December 2010. Suppose that the number of downloads have been increasing at a *fixed percentage each month*.

(a) What is the monthly growth factor for Angry Birds downloads?

(b) Write an equation illustrating this model.

(c) According to this new equation, how many downloads will occur by November 2011 (when $M = 11$)?

(d) What type of equation is being used here?

5. Emily is reading an article in the paper about atoms, which are building blocks for elements and are very, very small. From her physics textbook she discovered that the size of an atom is 0.000000142 millimeters.

   (a) Write the size of an atom in scientific notation.

   (b) Using your answer from the previous question, express the size of an atom as a conversion factor. In other words, complete the following:

   $$1 \text{ atom} = \underline{\hspace{3cm}} \text{ millimeters}$$

   (c) On a whimsy, she would like to know how many atoms fit inside a period (" . "). She knows that the size of a period is 0.5 millimeters. Using your above conversion factor, how many atoms are inside a period (" . ")? I have started the unit conversion for you below. Be sure to express your answer in scientific notation.

   $$\frac{0.5 \text{ millimeters}}{1}$$

6. In 2011 the population of Brazil is 203,429,773. It is expected that the population would increase 1.134% annually. Assuming this increase is exponential, what would the population of Brazil be in 2021? *Test-taking tip: Be sure to name variables and identify all formulas used.*