

This assignment is due on **October 15, 2013**.

Goals:

- 1) To practice the art of communicating a written solution to a math problem. You must clearly present the key concepts and the logical sequence of steps taken to arrive at a solution. Just answers are not good enough! Illustrations of solutions by graphing or drawing diagrams are often part of your presentation.
- 2) To encourage the use of the math textbook as a resource for you to learn from and get explanations of concepts and sample solutions.
- 3) To encourage a dialog between students of concepts and processes to achieve solutions to mathematical problems.

Format requirements:

This assignment will be graded so you must show at least one (most of these questions require many more than one) step of work for each question. If I cannot see clearly what you have done I cannot give you the marks. There is only one accepted format for this and all future assignments.

- 1) You will choose **3 of the 5** given questions to complete. (It is still to your advantage, however, to know how all of them are done.) All questions are worth the same number of marks. The questions must be in the same order that they are presented to you. If you do more than 3 questions, only the first 3 will be marked.
- 2) Each step
for each question
must be
on the next line
down, not to the right.
- 3) Students are encouraged to help each other with understanding the assignments but must submit their own work.
- 4) Any explanations must be done in complete sentences with proper mathematical notation as necessary.

Marks will be deducted if these requirements are not met. Students will be penalized 20% per day when assignments are turned in late and be worth 0 (zero) on the day they are handed back to the students.

Copied assignments will not be marked.

Questions:

1. Prime numbers are integers that are only divisible by 1 and themselves. A few select prime numbers have the distinction of being called *Mersenne* primes, if they can be written using the formula $2^p - 1$, where p is also a prime number.
 - a) State three Mersenne primes, both as regular numbers and as their $2^p - 1$ expressions.
 - b) One of the most recently discovered Mersenne primes (In January 2013, in fact) can be written as $2^{57885161} - 1$. If this number were to be expanded, how many digits would it have? Show your work.
 - c) Describe a method that allows you to find the number of digits in any number a^n , where a and n are any integers greater than 1. This may be presented as a formula or as a list of steps.
2. In Chemistry you learn that the pH of a solution is defined as $\text{pH} = -\log[\text{H}^+]$, where $[\text{H}^+]$ is the hydrogen ion concentration in moles per litre. A pH value of less than 7 indicates an acidic solution, a pH value greater than 7 indicates a basic solution, and a pH of 7 indicates a neutral solution.
 - a) Explain in words how, given the pH of a solution, you can find its hydrogen ion concentration.
 - b) Magic beans grow best in soil with a pH range of 6.2 to 7.8. Determine the range of the concentration of hydrogen ions that is best for growing magic beans.
 - c) Acidosis, or acid overload in the human body, can occur when the hydrogen concentration exceeds 4.5×10^{-8} moles per litre. What pH range does this correspond to?
3. Solve for x : $\log_m(ax + b) + \log_m(cx + d) = n$
4. Consider the function $f(x) = x^x$.
 - a) State the domain and range of $f(x)$.
 - b) Sketch the graphs of $f(x)$ and its inverse on the same grid.
 - c) Determine the coordinates of any point(s) where $f(x)$ and its inverse intersect.
5. Let $x = \log 225$ and $y = \log 256$. Write algebraic expressions in terms of x and/or y for:
 - a) $\log 2$
 - b) $\log 3$
 - c) $\log 5$(Make sure no logarithms are in your final answers.)