Practice Exam 1 Problems – MATH 1170, Fall 2007

Show all your work. Simplify as much as possible.

1. Draw a graph of the following. Soil is wet at dawn, quickly dries out and stays dry during the day, and then becomes gradually wetter again during the night.

2. Port wine is a sweet Portuguese dessert wine made by a complicated process of distilling and fortification in oak barrels. Say a port's alcohol content (A given in percentage) is a function of age (Y given in years) according to $A(Y) = 10 + \frac{Y}{2}$. Now, for simplicity, say the price (P given in dollars) of a bottle of port is given as a function of its alcohol content according to $P(A) = 20 + 6A$. Calculate the general function $P(Y)$ (price as a function of years) using composition. Now, find how much a bottle of 30 year old port will cost using this function.

3. Find the volumes of a tree of the following decription, with height 10m. The tree has a cylindrical trunk with radius 1m, and the trunk is 90 % of the tree's height. The remaining 10 % is a *cube*.

4. Find the equation in slope-intercept form for a line passing through the points (5,1) and (2,7). Sketch a graph indicating the original point from point-slope form.

5. Solve $3(2(x-1)+4) = 2(2(x+5)-3)$ for x.

6. Solve $mx + b = 2x + 5$ for x, treating all other letters as parameters. Are there any values of b or m for which this has no solution?

7. Consider the data in the following table, describing the number of active immune memory cells for people of a certain age:

Age	Number of immune memory cells (in millions)
50	100
55	90
60	80
65	70
70	60
75	50

a. Graph these data. Do the points lie on a line?
b. Find the equation for the line through the first two data points.
c. How many millions of immune memory cells would this equation predict for a person of age 110? Is this realistic?

d. Immune memory cells recognize invading viruses and such. What does this equation imply about what happens to people's immune system as they get older?

8. A population of bacteria *triples* every hour, but 2×10^6 individuals are removed *before* reproduction to be converted into biological by-products. The population begins with $b_0 = 4 \times 10^6$ bacteria.
a. Find the population after 1, 2, 3 hours.
b. How many bacteria were harvested total?
c. Write the discrete-time dynamical system.

9. Graph the updating function associated with the following discrete-time dynamical system,

$$m_{t+1} = -m_t + 4$$

and cobweb for five steps, starting at $m_0 = 0$.