Some Word Problems

Next week there will be a chance to earn extra credit for the exam. Groups of two or three can choose one of the numbered problems below and present its solution to the class. Each group can earn up to 4% extra credit for the next exam where each earned point comes from the criteria following:

- Mastery of the problem: Do you understand the problem? All of the steps in solving the problem? Could you solve a related but slightly different question?
- Presentation of the problem: You are presenting material to your classmates that will be on their exam next week. Your peers need this time to be *taught* the material (not merely shown a solution). Be sure to *explain* your steps and *why* you take them. Multiple approaches or those using materials from outside the course are encouraged!
- Presentation: Do you interact with your audience or do you just stare at the board? Is it clear that all the members made significant contributions to the solution (consider citing each other!)? Did the group act supportive of each other?
- Fielding questions: Can you understand someone's question about the material and formulate a cohesive answer?

As always, while working in a group make sure you:

- Expect to make mistakes but be sure to reflect/learn from them!
- Are civil and are aware of your impact on others.
- Assume and engage with the strongest argument while assuming best intent.

1. Chemistry unit questions: You may need to research some units.
    - If a raindrop's mass is 65mg on average and 5.1×10^5 raindrops fall on a lawn every minute, what mass in (kg) of rain falls on the lawn in 1 hour and 15 minutes?
    - The density of a liquid is .821 g/mL. How many grams of this liquid will fill a test tube that is shaped like a 10 cm long cylinder with a hemisphere on the bottom (that has a radius of 1cm)?
2. Medical unit questions: You may need to research some units.
    - Amiodarone comes preloaded as 150mg amiodarone HCL in 3 mL of solution. You need to give 65 mg to a pediatric patient. How many mL should you push?
    - You have a syringe with 150 mg of adenosine in 50 mL of solution. The MD has ordered a dose of .1 mg/kg for a 30kg pediatric patient. How many mL should you administer?
3. You have 8oz of mocha which is 25% espresso sitting in a 16oz cup.
    - Write an expression in x whose value gives you the the percentage (as a decimal) of espresso in the cup when x oz of espresso are added to it.
    - Give the domain of this function and justify your answer.

4. "*The Interview* generated roughly $15 million in online sales and rentals during its first 4 days of availability, Sony Pictures said on Sunday. Sony did not say how much of that total represented $6 digital rentals versus $15 sales. The studio said there were about 2 million transactions over all." -New York Times Dec 28th 2014. How much of the total represented $6 digital rentals and how much represented $15 sales.

5. Seismic waves travel at about 4km/s but Megan has (a really fast!) carrier pigeon that travels 7km/s. Assume that Megan's first instinct when feeling a quake is to "tweet" the experience and that process (recognizing it's an earthquake, finding her carrier pigeon, attaching a message to the bird's leg, and the message being broadcast) takes 5 minutes. How far does a Megan follower have to be from Megan to know there is an earthquake before feeling it? (inspired by http://xkcd.com/723)

6. A salesperson find that her sales average 41 cases per store when she visits 20 stores a week. Each time she visits three additional stores per week, the average sales per store decrease by 2 cases. Use methods from this class to figure out how many stores should she visit if she wants to maximize her sales?

7. You have $5500 in a retirement fund and would like a return of 5% (to do slightly better than inflation). There are 5 year CDs (certificate of deposits) being offered with an annual rate of 3.05% and index funds (a collection of stocks from companies included in measures like the S&P 500) that returned 8.2% since the 1990's (Thomson Reuters, 2010 S&P 500 Composite Index total return for the period 12/31/1989 to 12/31/2009). How much money do you relegate to a CD and how much money do you put in an index fund to get an annual return of 5% for the next five years?

8. Potassium ferrate has been considered for use in batteries but costs $100 per gram. You have a battery case that is currently *full* with 50 grams of a mixture that is 10% potassium ferrate. You would like to build the battery but you need a higher concentration of the potassium ferrate (40% should do it). What is the minimum amount of potassium ferrate you have to buy and add to the battery case (after you dumped out some of the original mixture to make room) to get the cathode to work?

9. The Athenians when suffering from the great plague of eruptive typhoid fever in 430BC consulted the oracle at Delos as to how they could stop it. Apollo replied that they must *double the size* of his alter which was in the form of a *cube*. The Athenians constructed a new alter where the *edges* where double that of the old. Apollo made the pestilence worse than before.

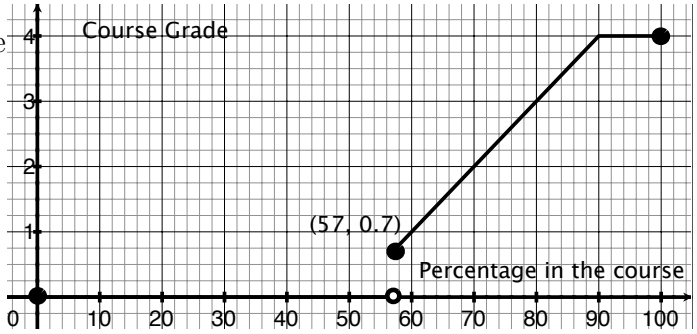
    - By what factor did the Athenians increase the size of Apollo's alter?
    - Give new directions for the construction of Apollo's alter to guarantee Apollo's request that the new alter is twice the volume of his first.

10. Rutabaga Riddle: 100 lbs of rutabaga consist of 99 percent water (since they are purely mathematical rutabagas) . The rutabagas are left outside overnight so that they consist of 98 percent water the next day. What is their new weight?

11. James T. Kirk is in this course and would like to know if it is still possible to earn a 2.0 now that he's taken two exams. He has looked at the grade book on MyMathLab and has computed the averages listed below.

    Assuming James' work does not drastically change in the remaining 3 weeks and his averages remain about the same, find what grade he needs to get on the final to receive a 2.0 in the course. In case you don't remember, the weights specified in the syllabus and the graph of the function f that takes your class percentage x and returns your score on a 4. scale are also provided.

	weight	James' ave
Mini-Quizzes	5%	95%
WebAssign	10%	10%
WrittenHW	15%	0%
Quizzes	15%	70%
2 Exams	30%	100%
Final	25%	

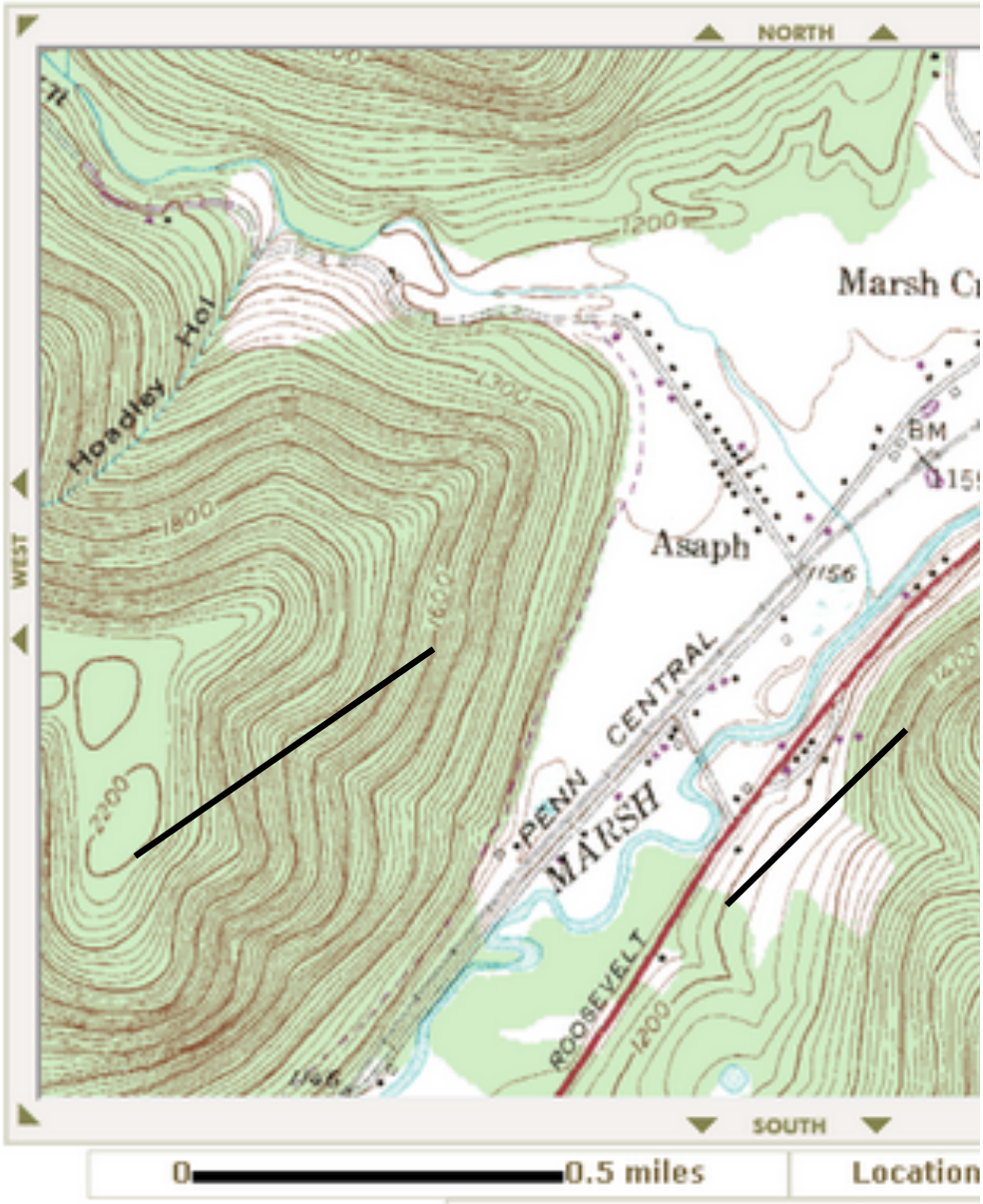


12. You are standing on the top of a 300 ft tower and toss a penny *up* at a velocity of 10ft/sec. At time t seconds after the toss the velocity of the penny is $v(t) = -32t + 10$ and the distance from the sidewalk is given by $p(x) = -16t^2 + 10t + 300$.

    (a) When is the penny at its highest point? What is that maximum height?
    (b) How long is the penny in the air? How fast is it going when it hits the ground?

13. The topographical map below has two paths (that follow straight lines) drawn on it.

    (a) Find how steep the assent (slope/average rate of change) is for each of the paths.
    (b) Which of the two paths is more steep?



14. Create your own problem. You must have this approved by the instructor.