

Last Word Practice

Next week there will be a chance to earn extra credit for the exam. Groups of 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?

1. Alisha went to Europe last summer. They discovered that when they exchanged their U.S. dollars for euros, they received 25% fewer euros than the number of dollars they exchanged. When they returned to the United states, they got 25% more dollars than the number of euros they exchanged.

- (a) Write each conversion function
- (b) Are the two functions inverses?

2. *Brightness*: Given two stars of magnitudes m_1 and m_2 have apparent brightness b_1 and b_2 respectively, then

$$m_2 - m_1 = 2.5 \log \left(\frac{b_1}{b_2} \right)$$

Find the magnitude m of a star that is 650 times as bright as one of magnitude 7.25.

3. Chad just graduated but does not have a job lined up yet. In his last year of graduate school he made ends meet by using his credit card and now has a balance of \$7,000. His credit card compounds monthly with an annual interest rate of 19.9%. Assume the worst and that Chad won't find a job for the next two years and will have to move in with his parents. He won't be able to make any payments on his credit card bill.

Just before graduation, Chad received an ad for a State Farm Good Neighbor Visa Credit Card. The card will transfer his balance (with a 2.90% balance transfer fee) and then give him a lower annual interest rate of 10.24% that is still compounded monthly. Should he take this option instead of staying with his first credit card?

4. You have four ten-year subsidized loans you took out to pay for college. Below is a table of the loans taken and their respective effective annual interest rates (AIR):

loan (\$)	8,000	9,000	10,000	12,000
AIR (%)	3.51	4.22	5.01	6.31

After graduation you are given the option of consolidating (that is take out one loan to pay off *all* the balances on your current loans). Assume all loans are continuously compounded once interest start accruing. You do not have a job lined up yet so you doubt you will be able to make any payments for the three years, what rate would you need to consolidate your loans at to be in a better position three years from now?

5. An advertisement for real estate published in the 26 July 2004 electronic edition of the New York Times states:

Did you know that the percent increase of the value of a home in Manhattan between the years 1950 and 2000 was 721%? Buy a home in Manhattan and invest in your future.

Suppose instead of buying a home in Manhattan in 1950, someone had invested money in a bank account that compounds interest once per month. What annual interest rate would he bank have to pay to equal the growth claimed in the above ad?

6. Browsing cars in a car-lot you see a sign in the window of a \$15,000 car that offers you a choice between two deals. \$1,000 back now (which you would use towards the principal) or 1.5% reduced interest rate for the first year. The standard rate for a loan between \$12,000 and \$20,000 is 5.29% for 5 years compounded continuously. If you plan to not make any payments for the first two years, which plan is a better choice?
7. Entropy S is a function of the number of possible states W , that are accessible to a system with a given amount of energy. We can explicitly compute entropy by $S = k \ln(W)$ where k is Boltzmann's constant. If liquid A has 100,000 times more possible states than liquid B, which liquid has a higher entropy and by how much more?
8. In 2009, according to PayDay Loan's website, a Californian take up to a \$255 loan for 31 days for a one-time 18% charge. If you are in California and you use PayDay Loans to take out a \$100 loan for a year (that is, at the end of 31 days, you have to take out another (or two!) PayDay Loan(s) to pay off the previous PayDay Loan):
- (a) how much money will you owe by the end of the year?
 - (b) what is the effective annual interest rate?
9. Assume that the vinegar in this problem has a pH level of 3.1 and your stomach acid has a pH level of 1.6. Note that the pH level of an object is computed by $-\log[H^+]$ where $[H^+]$ is the concentration of hydrogen ions (in Moles) per liter.
- (a) How many times stronger is the stomach acid concentration than the vinegar concentration?
 - (b) If you found a substance X whose $[H^+]$ was three times as intense as vinegar, what would its pH measure be?