

Math. 250-04
Spring, 1999
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First Examination
Wednesday, February 10, 1999

Instructions: This exam should be done on your own paper. The answers should be written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each part of each problem is worth 10 points.

1. Find the equation of the line through $(1, 2)$ and $(3, 4)$.
2. An airplane flies at a constant speed from Chicago to Denver, a distance of about 1000 miles. The plane flies over Lincoln, Nebraska, which is about 500 miles from Chicago. Sketch a graph of the distance of the plane from Lincoln as a function of time.
3. A farmer with an apiary calculates that, in a year, he can produce q pounds of honey at $p = 400 + 0.20q$ dollars per pound. He also observes that he can sell $q = 5000 - 500p$ pounds of honey in the town adjacent his farm, if he charges p dollars per pound. How many pounds of honey should he produce if he wants to maximize his income and if he wants to sell all the honey in the town adjacent his farm? How much should he charge? How much will he make? (Round the price to the nearest penny.)
4. Various times in history, countries that have suffered excessive inflation have replaced their currency by a new currency one of whose units is worth 1000 or more units of the old currency. For example, during the past decade, Russia replaced its ruble by a new ruble that was worth 1000 old rubles.

Inflation in the United States has been averaging approximately 3% per year in recent years. (That is after a year, it takes 1.03 times as many dollars to buy what 1 dollar bought at the beginning of the year.) At this inflation rate,

- (a) How many dollars would it take in 2010 to buy what cost one dollar in 1998?
 - (b) In how many years will it take 1000 dollars to buy what originally cost one dollar. *Hint: You can either do this by trial and error or use logarithms.*
5. Suppose \$10,000 is invested in an account paying a nominal annual rate of 6.25%. How much is in the account after 20 years if the interest is compounded
- (a) Annually? (b) Quarterly? (c) Continuously?
6. The quantity, Q , of radioactive carbon-14 remaining t years after an organism dies is given by the formula $Q = Q_0 e^{-0.000121t}$, where Q_0 is the initial quantity.
- (a) A skull uncovered at an archeological dig has 15% of the original amount of carbon-14 present. Estimate its age.
 - (b) Show how you can compute the half-life of carbon-14 from this equation.