

Math-71 Sections 02, 03, 60

Exam #2

Name: \_\_\_\_\_

This exam is closed book and notes. You may use a scientific calculator; however, no other electronics are allowed. A cheat sheet is provided on the last page. Show all work; there is no credit for guessed answers. Simplify your answers unless told otherwise. In particular, all answers should contain no negative exponents. If the problem starts with a radical then it must end with a radical. All numerical answers should be in exact form unless you are specifically asked for a decimal value.

1. (10 points) You plan an experiment to test the power of word-of-mouth communication. You start by giving 100 test subjects a secret message and an email address. You instruct your test subjects to email the secret message to the email address, and then try to get as many of their friends as possible to do so as well. After 7 days you have received a total of 1000 such emails. Assuming that the growth is exponential and will continue, predict how many total messages you will have received after 14 days.

2. (20 points) You buy a new home for \$500,000 on the first day of the month. You put down \$50,000 and finance the rest with a mortgage at 6% annual interest compounded monthly on the last day of the month. Your monthly payments, including principal and interest, are \$2500. Your payments are due on the first of the month, starting next month. What is your loan balance after your third monthly payment?

3. (10 points) You are testing the duration of certain fuses for a pyrotechnic company. The manufacturer states that the duration (from ignition to explosion) follows a normal distribution as follows, where the mean and standard deviation are expressed in seconds:

$$p(t) = \frac{1}{2\sqrt{2\pi}} e^{-\frac{(t-10)^2}{8}}$$

- (a) What is the mean of the fuse duration?
  
  
  
  
  
  
  
  
  
  
- (b) What is the standard deviation of the fuse duration?
  
  
  
  
  
  
  
  
  
  
- (c) At what  $t$  value does the corresponding bell curve have its absolute maximum?
  
  
  
  
  
  
  
  
  
  
- (d) At what  $t$  values does the corresponding bell curve have its points of inflection?
  
  
  
  
  
  
  
  
  
  
- (e) What is the probability that a fuse duration will be between 7 and 13 seconds?

4. (20 points) Consider the follow function of two variables:

$$f(x, y) = \ln \left[ \frac{5x^2y^3}{\sqrt{x^2 + 1}e^{(x^2+y^2)}} \right]$$

Determine the following partials:

a)  $f_x$

b)  $f_y$

c)  $f_{yy}$

d)  $f_{xy}$

5. (20 points) Use the second partial derivative test to find the the  $(x, y, z)$  coordinates *and* type of the absolute extremum on the following surface:

$$z = x^2 + 4x + y^2 - 2y + 10$$

6. (20 points) Use the Lagrange multiplier technique to find the  $(x, y, z)$  coordinates of the absolute extremum on the surface in problem 5 given the following constraint:

$$2x - y = 0$$