Name: ______________________________ Section: __________

Math 112

Group Activity: Multivariable Functions

So far, in Math 111/112, we've investigated functions that have only one input variable, like $TR(q) = 25q - 0.5q^2$, which has one input variable, quantity q. For the remainder of the quarter, we'll study functions with more than one input variable. These are known as **multivariable functions.**

1. The balance in a savings account with continuously-compounded interest is given by the formula

$$A(P, r, t) = Pe^{rt},$$

where P is the principal (the amount initially invested), r is the annual interest rate expressed as a decimal, and t is time in years that the account has been accruing interest.

(a) Compute $A(5000, 0.06, 8)$ and write a sentence or two describing what it represents.

(b) Suppose you have exactly \$10,000 to use as principal and the only account available pays 4% interest, compounded continuously. Then the only variable that can change is time t.

For each of the following, translate into functional notation and compute.

i. the change in the balance from $t = 4$ to $t = 9$ years

ii. the average rate at which the balance changes (in dollars per year) from $t = 4$ to $t = 9$ years

(c) Suppose you've found an investment that promises 5% annual interest, compounded continuously, for a term of exactly 10 years. Then, the only variable that can change is the principal P.

i. You have \$1000 of your own to invest. Your friend offers to give you another \$500. How much would adding your friend's \$500 to the principal increase the pay-off amount of the investment?

ii. By how much will the pay-off amount increase if you increase the principal by one dollar: from P to $P + 1$?

2. In a certain math course, the final grade is determined by computing a weighted average of homework, participation, two midterm exams, and a final exam. The total number of points available for each component and its weighting is given in the following table.

Component	Points Earned	Points Possible	Weighting
Homework	h	600	15%
Participation	p	16	5%
Exam I	x	50	22%
Exam II	y	50	22%
Final	z	100	36%

At the end of the quarter, a student's total percentage is given by:

$$C(h,p,x,y,z) = \left(\frac{h}{600}\right)15 + \left(\frac{p}{16}\right)5 + \left(\frac{x}{50}\right)22 + \left(\frac{y}{50}\right)22 + \left(\frac{z}{100}\right)36,$$

which simplifies to

$$C(h,p,x,y,z) = 0.025h + 0.3125p + 0.44x + 0.44y + 0.36z.$$

This percentage is then converted into a grade as follows:

- If $C \geq 97$, then the student receives a 4.0 in the course.
- If $94 \leq C \leq 96$, then the student receives a 3.9 in the course.
- If $70 \leq C \leq 92$, then the student's grade is $0.1C - 5.5$.

(a) Terry earns 567 homework points, has a perfect participation score, and scores 43, 39, and 85 on the exams.

i. Compute Terry's total percentage: $C(567, 16, 43, 39, 85)$. (Round to the nearest whole number.)

ii. What grade does Terry receive in the course?

(b) Chris needs to earn at least a 2.7 in the course to keep a scholarship.

i. What total percentage C must Chris earn to receive a 2.7 in the course?

ii. Before the final, Chris has earned 576 homework points, 15 participation points, and midterm scores of 41 and 40. What must Chris earn on the final in order to receive a 2.7 in the course? (Round to the nearest whole number.)

(c) Pat requests a regrade on Exam II and receives 2 additional points on that exam. If no other scores change, how much will Pat's total percentage C increase?

(d) Which will lead to the largest increase in a student's total percentage: a 50-point increase in homework or a 5-point increase on the final exam?