Name: _____

Problem	1 / 2	3	4 / 5 / 6	7 / 8	Total
Possible	28	20	32	20	100
Received					

DO NOT OPEN YOUR EXAM UNTIL TOLD TO DO SO.

You may use a 3 × 5 card of handwritten notes and a calculator.

FOR FULL CREDIT, SHOW ALL WORK RELATED TO FINDING EACH SOLUTION.
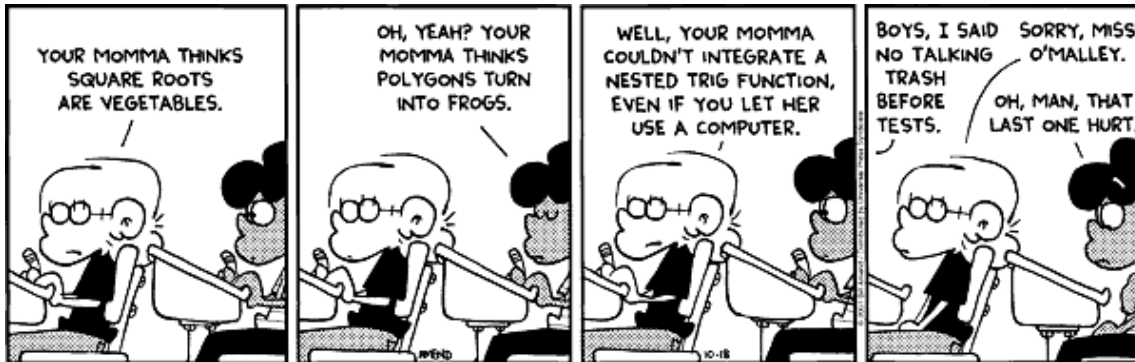

Frank and Ernest
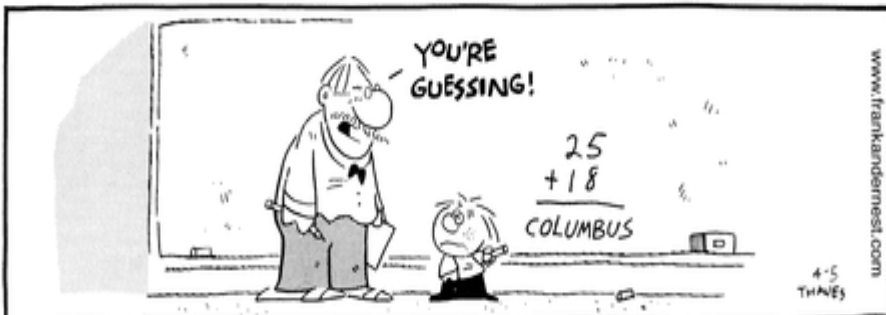
"Sit and stay were no problem but she's hit a wall with multivariable calculus."

12 points   1. Find the **three** numbers whose sum is as small as possible and whose product is 1000. **Don't just guess/give the answer. Show all pertinent work. Use the method of Lagrange Multipliers to find your solution.**

16 points   2. Suppose that $f(x, y) = -2x^2 + 4xy - 3y^2 - 12x - 8y$. Find the value(s) of x and y at which f has relative minimums and/or maximums and determine type of each point (min, max, neither, etc.).

20 points   3. We want to build a fence. Three of the sides will be of wood which is \$10/foot and the fourth side will be of stone which is \$30/foot. So the total cost (see the diagram at right) would be $C(x, y) = 40x + 20y$. Find the dimensions x and y which maximize the area enclosed by these fences if we have a total of \$400 to spend. **Show all pertinent work. Use the method of Lagrange Multipliers to find your solution.**

y

x
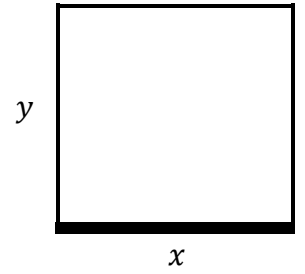
9 points   4. Suppose that $f(7,8) = 100$ and $\frac{\partial f}{\partial x}(7,8) = 5$ and $\frac{\partial f}{\partial y}(7,8) = 10$.

Estimate each of the following.

/3 $f(10,8) \approx$

/3 $f(7,6) \approx$

/3 $f(10,6) \approx$

15 points 5. Suppose level of production is $f(x,y) = 60x^{1/2}y^{1/2}$ for x units of labor and y units of capital. Find and interpret each of the following:

/3 $f(4,9) =$

/5 $\frac{\partial f}{\partial x}(4,9) =$

/5 $\frac{\partial f}{\partial y}(4,9) =$

/2   What is the marginal productivity of capital at $(x,y) = (4,9)$.

8 points   6. Suppose demand D for a certain production is a function of its price p, its quality q, the price c of a product in competition with your product, and the amount of advertising money a you spend on marketing the product. Circle one of > 0 or $= 0$ or < 0 for each of the following derivatives of D.

/2 $\frac{\partial D}{\partial p}$ should be > 0 or $= 0$ or < 0

/2 $\frac{\partial D}{\partial q}$ should be > 0 or $= 0$ or < 0

/2 $\frac{\partial D}{\partial c}$ should be > 0 or $= 0$ or < 0

/2 $\frac{\partial D}{\partial a}$ should be > 0 or $= 0$ or < 0

4

10 points 7. Suppose that a least squares line is found using past sales data which relates sales S (in number of units sold per month) to amount of advertising money spent A (in *thousands* of dollars spent per month):

$$S = 100 + 1.5A$$

/4 What do the values of 100 and 1.5 represent? (Don't just say slope and y-intercept—tell me what they mean in this problem.)

According to the above model:

/3 How much should be spent on advertising in order to sell 140 units per month?

/3 What number of sales would result from spending $10 thousand dollars per month on advertising?

10 points 8. Find the following:

/4 $\dfrac{\partial}{\partial x} e^{e^{e^{xy}}} =$

/3 $\dfrac{\partial}{\partial x} x^3 y^5 =$

/3 $\dfrac{\partial^2}{\partial y \partial x} x^3 y^5 =$