

# Test 3 - MTH 1310

Dr. Graham-Squire, Summer 2012

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

ID Number: \_\_\_\_\_

I pledge that I have neither given nor received any unauthorized assistance on this exam.

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(signature)

## DIRECTIONS

1. Show all of your work and use correct notation. A correct answer with insufficient work or incorrect notation will lose points.
2. Clearly indicate your answer by putting a box around it.
3. Cell phones and computers are not allowed on this test. Calculators are allowed on the first part of the test, however you should still show all of your work. Calculators are not allowed on the second part of the test. If you finish the second part of the test and want to come back to the first part, you can do so.
4. Give all answers in exact form, not decimal form (that is, put  $\pi$  instead of 3.1415,  $\sqrt{2}$  instead of 1.414, etc) unless otherwise stated.
5. If you need to use the quadratic formula, it is  $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .
6. Make sure you sign the pledge and write your ID on both pages.
7. Number of questions = 8. Total Points = 70.

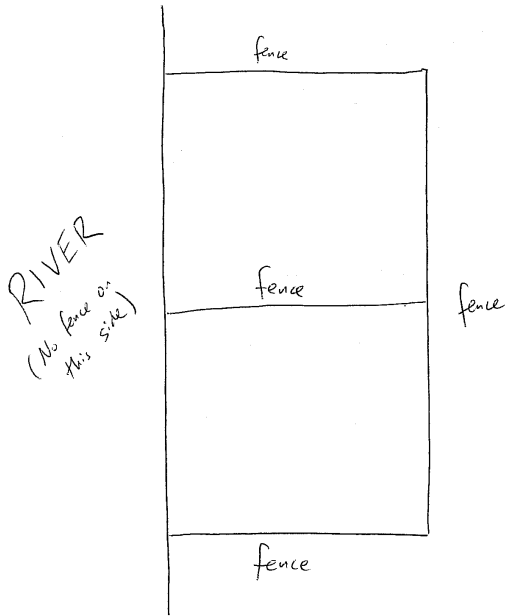
**Calculators Allowed**

1. (10 points) Use calculus to find the absolute maximum and absolute minimum values of  $g(t) = t^3 - 75t$  on the interval  $[-3, 9]$ .

absolute maximum is \_\_\_\_\_ when  $t =$  \_\_\_\_\_

absolute minimum is \_\_\_\_\_ when  $t =$  \_\_\_\_\_

2. (10 points) Farmer Jane wants to build a rectangular pen to hold his llamas and goats. Since fencing is expensive, she is going to make one side of the pen be a river with a straight bank, so she only needs to build three sides of the rectangle. She also will put fencing down the middle of the pen to keep the llamas and goats apart (because we all know that llamas and goats don't get along). A diagram is below. If Jane wants the pen to have a total area of  $1000 \text{ ft}^2$ , find the *minimum* total amount of fencing she will need. Round your answer to the nearest 0.1 feet.



3. (7 points) The concentration of a drug in an organ at any time  $t$  (in seconds) is given by

$$x(t) = 0.08(1 - e^{-0.02t})$$

where  $t \geq 0$  and  $x(t)$  is measured in grams/cm<sup>3</sup>. Round your answers to the nearest 0.0001.

- (a) What will be the concentration of the drug after 20 seconds?
- (b) When will the concentration be 0.05 grams/cm<sup>3</sup>?
- (c) What will be the concentration in the long run?

4. (6 points) Use logarithmic differentiation to calculate  $y'$  when  $y = 5^x$ .

5. (8 points) Phosphorus 32 (P-32) has a half-life of 13.4 days. If 100 g of this substance are present initially, find:

(a) An equation giving the amount present after  $t$  days.

(b) The amount left after 9 days. Round your answer to the nearest 0.1 grams.

6. (12 points) Calculate the indefinite integrals.

(a)  $\int \left( 2e^x - 3 + \frac{4}{x} \right) dx$

(b)  $\int x^3 \left( x^{10} + x^{-2} - \frac{1}{x^5} \right) dx$

7. (12 points) Calculate the derivative of each function.

(a)  $f(x) = (e^{x^3-2x})^3$

(b)  $f(x) = \ln(7x^3 - 2x + 1)$

(c)  $f(x) = \ln \frac{e^{(x^7)}(3x^2 - x)}{x^5}$



8. (5 points) Simplify the expression by using logarithm rules to combine the different terms:

$$3 \ln(x) + \ln(4) - 2 \ln(x^2 + 5) - \frac{1}{2} \ln(4x - 1)$$

**Extra Credit**(2 points) Calculate  $f'(x)$  if  $f(x) = \ln e^e$ .