MATH 123　　　　Second Midterm

October 29, 2015

Name: _____　　**ID:** _____　　**Rec:** _____

There are 13 problems in this exam, printed on 5 pages (not including this cover sheet). Make sure that you have them all.

The exam is in two parts: Part 1 consists of questions which should be *easy*. **You cannot get a grade of C or higher on this midterm unless you pass Part 1.**

Part I:

Question:	1	2	3	4	5	6	7	8	Total
Points:	2	2	2	2	2	2	2	2	16
Score:									

Part II:

Question:	9	10	11	12	13	Total
Points:	8	8	8	8	8	40
Score:						

Do all of your work in this exam booklet, and cross out any work that the grader should ignore. You may use the backs of pages, but indicate what is where if you expect someone to look at it. **Books, calculators, extra papers, and discussions with friends are not permitted.** If you have a time machine, feel free to go ahead in time and look at the solutions to the exam as posted on the class web page. However, you must also give me the time machine to go back and change the questions.

Leave all answers in exact form (that is, do *not* approximate π, square roots, and so on) unless explicitly told otherwise. Algebraic simplification is typically not necessary, unless it is.

You have **90 minutes** to complete this exam. If you finish before that, it is advisable to use the remaining time to look back over your answers and make sure you still agree with them. If you *still* have more time, review all the choices you have made in your life up to this point, and make sure you still agree with them.

2 points   1. Represent $\log_3(27)$ as an integer, fraction, or radical.

1. _____

2 points   2. What is the largest domain on which the function $\ln(2x+1)$ is defined?

2. _____

2 points   3. Find x if $8^{4x+1} = 64$.

3. _____

2 points   4. Write the equation of the line that passes through the points $(1, 2e)$ and $(e, 2)$.

4. _____

2 points   5. If $\log x = 4$ and $\log y = 6$, simplify $\log\left(\dfrac{x^2}{\sqrt[3]{y}}\right)$ as much as possible.
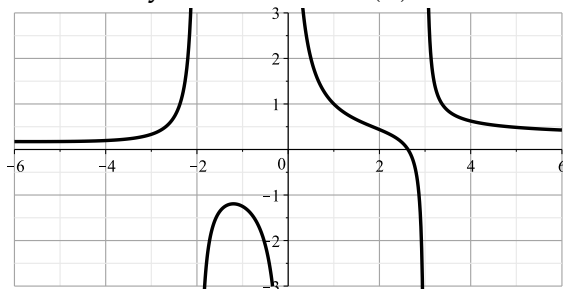
5. _____

2 points   6. Write the equation of a circle with center at $(5, -2)$ and radius 6.

6. _____

2 points   7. Represent $\log_8(32)$ as an integer, fraction, or radical.

7. _____

2 points   8. Let $R(x)$ with domain $[-6, 6]$ have the graph below.
How many solutions to $R(x) = -1$ are there?

8. _____

8 points   9. Using polynomial division, write the following quotient as a polynomial plus a remainder term where the numerator has degree less than the denominator (there may be no remainder).

$$\frac{x^4 + 2x^3 + x^2 + 37x + 4}{x + 4}$$

8 points   10. Find all real values of y that solve the equation below. Give an **exact** answer– that is, do not try to approximate logarithms, powers of e, $\sqrt{2}$, etc.

$$2^{3x-1} = 5^x$$

11. In your secret laboratory in the tunnels near Harriman, you are brewing a batch of goop (which is delicious on udon noodles!). The growth of goop is fueled by bacteria, and so it grows exponentially. You start your batch with 5 kg. of goop, and after 6 hours you have 12 kg.

4 points   (a) Give an equation for $G(t)$, the amount of goop (in kg.) that you will have t hours after you begin your brew.

4 points   (b) You will need 100 kg. of goop within one day of when you started. Will you have enough? You must justify your answer for full credit.

Part 2: other questions   **Name:** _____

12. Answer the questions below for the function $Q(r) = \dfrac{5r^2 - 25}{r^2 + 2r - 3}$.

| 2 points |

   (a) What is the largest domain on which $Q(r)$ is defined?

(a) _____

| 2 points |

   (b) What value (if any) does $Q(r)$ approach as r approaches infinity? (If there is none, write "DNE")

(b) _____

| 2 points |

   (c) What, if any, are the zeroes of $Q(r)$? (if there are none, write "none")

(c) _____

| 2 points |

   (d) At what y value (if any) does the graph of $y = Q(r)$ cross the y-axis? (if there is no such y, write "none")

(d) _____

8 points 13. Your friend gives you a cache of the radioactive element unstablium, which you take it back to your secret lab in the tunnels. Unstablium decays at an exponential rate into boringite. Initally, you have 80 grams of unstablium. Three hours later, you have 60 grams. What is the half-life of unstablium?