Autumn 2016

Form A

Name (Print): ____________________

Signature: ____________________

OSU name.#: ____________________

Lecturer: ____________________

Recitation Instructor: ____________________

Recitation Time: ____________________

Math 1148: Final Exam

Instructions:

- Show ALL work to receive full credit. Answers with insufficient supporting work will receive little or no credit.
- Please CIRCLE your answers
- If you find the solution to a problem using a graph from your calculator (*where allowed*), you need to sketch that graph and label all relevant information.
- The exam consists of 16 problems starting on page 2 and ending on page 10. Make sure your exam is not missing any pages before you start.

Some Formulas that may be Useful:

$A = P\left(1 + \frac{r}{n}\right)^{nt}$ $\quad A = Pe^{rt}$ $\quad A = P(a)^t$ $\quad A = P(1 + r)^t$

$M = Log\left(\frac{I}{S}\right)$ $\quad T(t) = T_s + De^{-kt}$ $\quad m(t) = m_0 2^{\left(-\frac{t}{h}\right)}$

Problem	1	2	3	4	5	6	7	8	9
Max. Points	12	10	10	16	10	10	10	14	22
Student Score									
Problem	10	11	12	13	14	15	16		Total
Max.Points	12	12	12	12	12	14	12		200
Student Score									

1. Solve the following inequality. *Give your answers in interval notation.*

   $\frac{3x}{x-5} \leq x$ (12 points)

2. Divide the following polynomials and label the quotient and remainder. (Synthetic division will not work) (10 points)

   $$\frac{4x^3-3x^2+x-7}{x^2-5}$$

3. Consider the quadratic function $f(x) = 3x^2 - 18x + 21$. Complete the square to express the function in standard form. (10 points)

4. Find the inverse functions of the following two functions:

   a. Given $f(x) = \sqrt[3]{5x-2}$. Find the inverse function, $f^{-1}(x)$ (8 points)

   b. Given $g(x) = \frac{7x+1}{3-5x}$. Find the inverse function, $g^{-1}(x)$ (8 points)

5. A certain car gets approximately 26 miles/gallon on the highway and 19 miles/gallon in the city. Suppose you drove a total of 349.5 miles on a full tank (16 gallons). Let x = # of gallons used while driving on highway and y = # of gallons used for city driving. Set up and solve the system of equations. Show the algebra needed for full credit. (10 points)

   Gallons used on Highway = _____ Gallons used in City = ___________

   Miles driven on Highway = _______ Miles driven in City = ____________

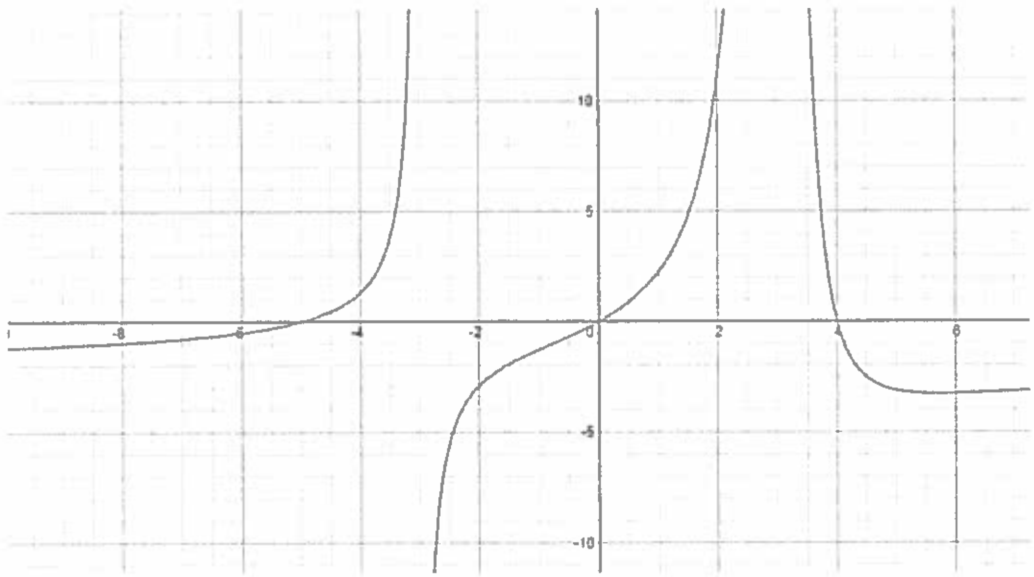
6. Given the function $f(x) = 3x - \sqrt{x}$ find the average rate of change of $f(x)$ from $x = 8$ to $x = 13$. Show the ratio and round the final answer to two decimal places. (10 points)

7. Given the function $f(x) = \frac{5}{x}$, find the average rate of change from $x = a$ to $x = a + h$.
   Simplify as much as possible and show your work. (10 points)

8. Suppose a certain company determines that if it sets the price of an item at 'p' dollars, then it can sell a quantity given by $q = 400 - 8p$ of the item.
   a. Based on this find a function for the revenue from sales of this item in terms of p. (8 points)

   b. Find the price 'p' that will maximize the revenue for the company.
      Draw a rough sketch of the graph of revenue with respect to price. (6 points)

9. Consider the rational function shown in the graph.



a. Find the x-intercept(s), if any (6 points)

b. Find the **equations** of any vertical asymptotes (4 points)

c. Find the **equation** of the horizontal asymptote (you can assume it has one) (4 points)

d. Write a rational function for the graph: (8 points)

$r(x) =$

10. Solve the following system of three equations in three variables. Show your work. (12 points)

$$\begin{aligned} x + 2y - z &= 11 \\ 3x - y + 2z &= 8 \\ 3x \qquad + 3z &= 15 \end{aligned}$$

11. Suppose \$3000 is deposited into an account that offers 6% annual interest compounded quarterly. How long until the account is worth \$10,000. Round your answer to the nearest tenth of a year. (12 points)

12. Assuming x is in the domain, expand the expression below as much as possible. (12 points)

$$\log\left(\frac{(x-5)\sqrt{x+2}}{(x-4)(x+3)^2}\right)$$

13. The population of a certain town is currently 27,000 people and is doubling every 4 years. When will the population reach 90,000 people? *Round your answer to the nearest tenth of a year.* (12 points)

14. Algebraically solve for x. Show all work. (12 points)

$$\log_2(x-3)+\log_2(x-1)=3$$

15. Suppose one City with a population of 20,000 has an annual growth rate of 9%, while another city has a population of 55,000 and an annual growth rate of only 6%. Solve the following equation to determine when they will have the same population.

$$20000(1.09)^x = 55000(1.06)^x$$ (14 points)

Your final answer must involve logarithms. *Decimal approximations will receive at most 8 points no matter how much work is shown.*

16. The Richter scale is $M = \log\frac{I}{S}$ where M is the magnitude of the earthquake, I is the intensity of the earthquake at the epicenter, and S is the intensity of the "standard" earthquake.

a. Change the equation $M = \log\frac{I}{S}$ from logarithmic form to exponential form and then solve for "I". (6 points)

b. A recent earthquake in Alaska had a magnitude of 7.1 on the Richter scale. At the OSU-Michigan football game a few weeks ago, the OSU seismologists measured the vibrations of the stadium after the winning play at a magnitude of 5.79. How many times more intense was the Alaska earthquake than the Ohio 'earthquake'? (In other words, what is the ratio of their intensities?)
(6 points)