

# Math 113 Sample Exam Number 2, Spring 2010

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April 7, 2010

## Contents

<b>1</b>	<b>Polynomials</b>	<b>1</b>
<b>2</b>	<b>Rational Functions</b>	<b>1</b>
2.1	Polynomial Divisions . . . . .	1
2.2	Graphing Rational Functions . . . . .	1
<b>3</b>	<b>Logarithms and Exponentials</b>	<b>2</b>
3.1	Evaluation of Logarithms and Exponentials . . . . .	2
3.2	Inverse Functions . . . . .	3
3.3	More Equations to Solve . . . . .	3
<b>4</b>	<b>Applications of Logarithms and Exponential Functions</b>	<b>3</b>

## 1 Polynomials

Know what the graph of a polynomial can look like based on the degree of the polynomial.

## 2 Rational Functions

### 2.1 Polynomial Divisions

Perform the following Polynomial division

$$\frac{x^4 + 3x^2 + x - 5}{x^2 + 2x - 1}.$$

### 2.2 Graphing Rational Functions

For the following rational functions

$$f(x) = \frac{2x}{x^2 - x - 2}, \quad g(x) = \frac{3x}{x + 2}$$

$$h(x) = \frac{x^2 + 1}{x^3 - x}, \quad k(x) = \frac{x^2 + 5}{x + 1}$$
$$m(x) = \frac{x}{x^2 + 1}$$

1. Find the domain.
2. Find any  $x$  or  $y$  intercepts.
3. Find any vertical or horizontal asymptotes.
4. Sketch the graphs, and if possible, determine the range explicitly.

### 3 Logarithms and Exponentials

#### 3.1 Evaluation of Logarithms and Exponentials

Evaluate the following.

1.  $\log \sqrt{100000}$
2.  $\log_2 \sqrt[3]{64}$
3.  $\ln \frac{1}{e^{\frac{1}{3}}}$
4.  $\log_2 16^\pi$
5.  $\log_8 128$

Solve for the unknown quantity  $b$  or  $x$ .

1.  $\log_2 x = 16$
2.  $\log_2 x = -9$
3.  $\log_b 64 = 2$
4.  $\log_b 64 = \frac{6}{5}$
5.  $\log_4(3x + 1) = -2$
6.  $13 = 10^{2x}$

## 3.2 Inverse Functions

Find the inverse functions of the following.

1.  $f(x) = \pi^x$
2.  $f(x) = 9^{3x+2}$
3.  $f(x) = 5^x + 2$
4.  $f(x) = 3 \cdot e^x$
5.  $\log_{\pi^2} x$
6.  $\log_4(2x - 9)$
7.  $f(x) = 8 + 9 \log_2(4x - 7)$ .
8.  $f(x) = \log_{3x} 7$

## 3.3 More Equations to Solve

Find all solutions to:

1.  $\log_5(x + 4) + \log_5(x + 2) = 2$
2.  $\frac{\log_9(13x)}{\log_9(4x)} = 2$

## 4 Applications of Logarithms and Exponential Functions

1. At the current rate of growth, the earth's population of people doubles every 69 years. If this growth rate continues, when will the earth's population become  $\frac{1}{2}$  larger than the current population?
2. Suppose that 50 dollars is invested in a bank account whose interest rate is 1.2 % per year, compounded monthly. Find the time  $t$  (in years) when there is 75 dollars in the account.
3. Suppose that 50 dollars is invested in a bank account whose interest rate is 1.2 % per year, compounded continuously. Find the time  $t$  (in years) when there is 75 dollars in the account.
4. Suppose that 50 dollars is invested in a bank account whose interest rate is 1.2 % per year, compounded semiannually. Find the amount in the account in 50 years.
5. Plutonium-239 has a half-life of 24,110 years. How many years will it take for a sample of this substance to have 5 % of its original amount?