

Name: _____

Math 1015: Exam 2

1. State the following definitions:

a) Functions $f(x)$ and $g(x)$ are inverse functions of each other

b) Descartes' Rule of Signs for polynomials

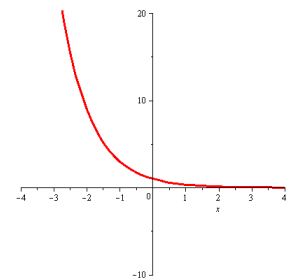
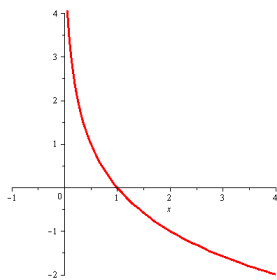
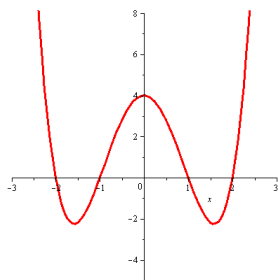
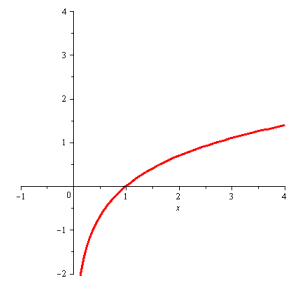
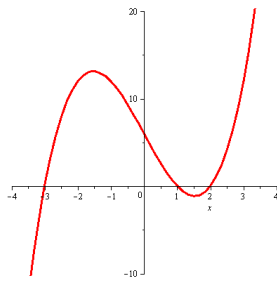
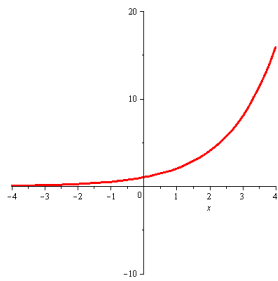
c) Complete the following *Rules of Logarithms*:

$$\log_a(A \cdot B) = \underline{\hspace{2cm}}$$

$$\log_a(A/B) = \underline{\hspace{2cm}}$$

$$\log_a(A^p) = \underline{\hspace{2cm}}$$

2. Match the following graphs to the functions listed below:



$$f(x) = x^3 - 7x + 6$$

$$g(x) = 2^x$$

$$h(x) = e^{-x}$$

$$p(x) = \ln(x)$$

$$q(x) = \log_{\frac{1}{2}}(x)$$

$$r(x) = (x^2 - 1)(x^2 - 4)$$

3. Consider the polynomial $p(x) = 3x^3 + 2x^2 - 7x + 2$

a. How many local extrema (max or min) does the polynomial have at most

b. How many positive roots can the polynomial have?

c. How many negative roots can the polynomial have?

d. List all possible rational roots of the polynomial.

4. Consider the polynomial $p(x) = x^3 + 2x^2 - 11x - 12$

a) Is the polynomial divisible without remainder by $(x - 2)$?

b) Is the polynomial divisible without remainder by $(x + 1)$?

5. Find *all* zeros of $p(x) = x^3 - 7x + 6$

6. Consider $r(x) = \frac{x^2 - 5x + 6}{2x^2 - 8x + 8}$

a) What is the domain of the function

b) What are the vertical asymptotes of the function, if any?

c) What are the horizontal asymptotes the function, if any?

7. Perform the following operations with logarithms (no calculator)

a) **Evaluate:** $\log_2(100) - 2\log_2(5)$

b) **Combine:** $\ln(x) - 2\ln(x^2 + x) + \ln(x + 1)$

c) **Expand:** $\log\left(\frac{x^3\sqrt{x-1}}{(x+1)(2x-1)^2}\right)$

d) **Convert to \log_4 :** $\log_8(16)$

8. Solve the following equations for x :

a) $3^{x-1} = 20$

b) $3\log_2(x + 4) = 9$

c) $\log_3(x - 1) + \log_3(x - 3) = 2$

d) $x^2e^x - e^x = 0$

9. The number of bacteria in a dish after t hours is given by $P(t) = 25 \cdot 2^{0.1t}$.

a) How many bacteria were initially present?

b) How many bacteria are present after 10 hours?

c) How long does it take for the number of bacteria to double?

10. **Extra Credit:** Graph the rational function $r(x) = \frac{2x+4}{x^2-3x-4}$. Make sure to label any asymptotes and intercepts.