Name_____
KUID_____
Instructor_____

Part 1: Multiple Choice (120 points). Show your work in the space provided. Circle the correct answer. Partial credit will be given only if work is shown. Each problem is worth 10 points.

1. Find the equation of a line through the point $(2, -3)$ which is perpendicular to the line $x - 4y = 8$.

   (a) $y = \frac{1}{4}x - \frac{7}{2}$

   (b) $y = -4x + 2$

   (c) $y = 4x - 11$

   (d) $y = -4x + 5$

2. Solve the inequality $-6 + 5x - x^2 \geq 0$.

   (a) $(2, 3)$

   (b) $[2, 3]$

   (c) $(-\infty, 2] \cup [3, \infty)$

   (d) $(-\infty, \infty)$

3. Evaluate the difference quotient $\dfrac{f(x+h) - f(x)}{h}$ for the function $f(x) = 3x^2 + x - 1$.

   (a) $3x + h + 1$

   (b) $3x + 3h + 1$

   (c) $6x + 3h + 1$

   (d) $6x + 1$

4. Use the properties of logarithms to write the expression $\frac{1}{3}\log_2(x) + 2\log_2(x+4)$ as a single logarithm.

   (a) $\log_2(\sqrt[3]{x} + (x+4)^2)$

   (b) $\log_2((x+4)^2\sqrt[3]{x})$

   (c) $\log_2\left(\dfrac{x^3}{(x+4)^2}\right)$

   (d) $\log_2(\frac{7}{3}x + 8)$

5. Write a quadratic function with vertex at $(-3, 1)$ passing through the point $(0, -2)$

   (a) $f(x) = x^2 + 6x + 10$

   (b) $f(x) = -\frac{1}{5}(x + 3)^2 + 1$

   (c) $f(x) = -x^2 - 6x - 10$

   (d) $f(x) = -\frac{1}{3}(x + 3)^2 + 1$

6. List the properties of the function $t(x) = 3 \cdot 2^{x-1} + 1$

   (a) Domain: $(-\infty, \infty)$; Range: $(1, \infty)$ HA: $y = 1$

   (b) Domain: $(1, \infty)$; Range: $(-\infty, \infty)$ VA: $x = 1$

   (c) Domain: $(-\infty, \infty)$; Range: $(-1, \infty)$ HA: $y = -1$

   (d) Domain: $(1, \infty)$; Range: $(-\infty, \infty)$ VA: $x = -1$

7. List the intervals where the function $q(x) = 5x - x^2$ is increasing and decreasing.

   (a) Increasing $(-\infty, 0)$; Decreasing $(0, \infty)$

   (b) Increasing $(\frac{5}{2}, \infty)$; Decreasing $(-\infty, \frac{5}{2})$

   (c) Increasing $(-\infty, \frac{5}{2})$; Decreasing $(\frac{5}{2}, \infty)$

   (d) Increasing $(-\infty, \frac{25}{4})$; Decreasing $(\frac{25}{4}, \infty)$

8. Which of the following is the factorization of the polynomial $2x^3 - 7x^2 - 10x + 24$?

   (a) $2(x - 6)(x - 4)(x - 2)$

   (b) $(2x - 3)(x - 4)(x + 2)$

   (c) $(2x + 3)(x - 4)(x - 1)$

   (d) $(2x - 3)(x + 3i)(x - 3i)$

9. Write the equation of the circle with endpoints of a diameter at the points $(1, 1)$ and $(-3, -5)$?

   (a) $(x+1)^2 + (y+2)^2 = 13$
   (b) $(x-1)^2 + (y-1)^2 = 9$
   (c) $(x+2)^2 + (y+1)^2 = 17$
   (d) $(x+1)^2 + (y-2)^2 = 5$

10. You ask your accountant to invest your savings of \$5000 into a couple of investment accounts. He finds two accounts for you, one paying 1.9% interest per year and the other paying 2.1% interest per year. After one year you've made \$100 in interest and you're curious how much money he put into each account. Which of the following systems of equations models this problem?

    (a) $\begin{cases} x + y = 100 \\ x + y = 5000 \end{cases}$
    (b) $\begin{cases} x + y = 5000 \\ 1.9x + 2.1y = 100 \end{cases}$
    (c) $\begin{cases} x + y = 100 \\ .019x + .021y = 5000 \end{cases}$
    (d) $\begin{cases} x + y = 5000 \\ .019x + .021y = 100 \end{cases}$

11. Given $f(x) = \dfrac{2}{3-x}$ and $g(x) = 3^x$, evaluate $(g \circ f)(2)$

    (a) $-\dfrac{1}{3}$ (b) 9 (c) $\dfrac{4}{3-3^x}$ (d) $2 \cdot 3^{\frac{2}{3-x}}$

12. What is the end behavior of the function $p(x) = (3-x)(2x+7)(x+5)^2$?

    (a) Rises left, rises right
    (b) Falls left, rises right
    (c) Falls left, falls right
    (d) Rises left, falls right

Part 2: Long answer (80 points). Show all your work. Each question will be graded based on the accuracy of work shown. Answers should be exact unless otherwise stated. Each problem is worth 20 points.

13. Answer the following questions about the rational function

$$g(x) = \frac{3x^2 - 12}{x^3 + x^2 - 6x}$$

(a) What is the domain of g?

(b) Identify any holes in the graph of g.

(c) Identify any x-intercepts of the graph of g.

(d) What are the vertical asymptotes of g?

(e) What is the horizontal or slant asymptote of g?

14. Solve the following equations for x.

(a) $3^{x+2} = 7^x$

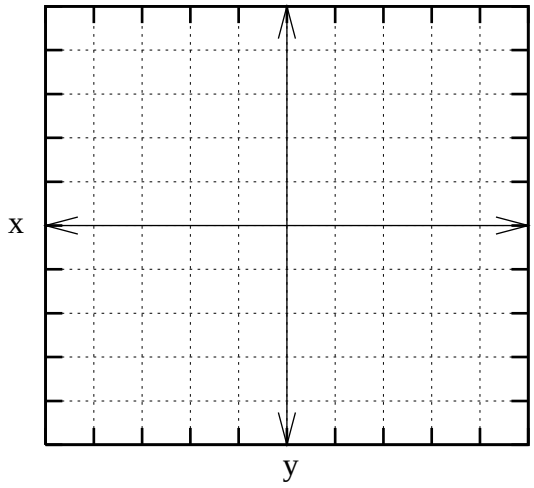
(b) $\log_5(x+1) - \log_5(2x) = 1$

(c) $e^{2x} - 3 \cdot e^x = 4$

15. Consider the function $f(x) = 2\sqrt{-x} + 1$

(a) Describe the transformations of f from its parent function $\sqrt{x}$.

(b) Sketch a graph of f, labeling at least 3 points.



(c) Find $f^{-1}(x)$ algebraically.

(d) What are the domain and range of f^{-1}?

16. Consider the polynomial $p(x) = x^4 - 6x^3 + 14x^2 - 16x + 8$.

    (a) Algebraically find all zeros of p.

    (b) Use the zeros to write p as a product of linear factors.

Bonus The temperature of a pizza (in Fahrenheit) t minutes after being taken out of the oven is given by the function

$$T(t) = 68 + 300e^{-.055t}$$

Answer the following questions.

(a) (5 pts) What is the temperature of the pizza when it is taken out of the oven?

(b) (10 pts) You would like to wait to eat the pizza until it has cooled to 200^o. Find (algebraically) how long this will take.

(c) (5 pts) Find the horizontal asymptote of the function and explain what it means in the context of the problem.