

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. The solutions to the equation $x^2 - 8x + 32 = 0$ are

- (a) $3 \pm 3i$
- (b) $2 \pm 4i$
- (c) $1 \pm 2i$
- (d) $4 \pm 4i$

2. The domain of $f(x) = \frac{1}{\sqrt{-5x + 10}}$ is:

- (a) $x \neq 2$
- (b) $(2, \infty)$
- (c) $(-\infty, 2)$
- (d) $(0, \infty)$

3. List all of the asymptotes of the function $g(x) = \frac{2x^2 - x}{x^2 - 9}$

- (a) Vertical: $x = 9$; Horizontal: $y = 2$
- (b) Vertical: none; Horizontal: $y = 0$
- (c) Vertical: $x = 3, x = -3$; Horizontal: $y = 2$
- (d) Vertical: $x = 3, x = -3$; Horizontal: none

4. Suppose $h = (f \circ g^{-1})(x)$ and $f(1) = 2, f(-3) = 5, g(-3) = 1, g(1) = 10$. Find $h(1)$.

- (a) -6
- (b) 2
- (c) 5
- (d) 10

5. Let $p(x) = x^3 + 2x^2 - 11x - 12$. Which of the following statements is not true?

- (a) $p(3) = 0$
- (b) $(x + 3)$ is a factor of $p(x)$
- (c) $(3, 0)$ is an x -intercept of the graph of $p(x)$
- (d) p is a polynomial function

6. Using properties of logarithms, which of the following is equivalent to

$$3 \log_5(x - 1) - \left[\frac{1}{2} \log_5(y) + \log_5(3z) \right]$$

- (a) $\log_5 \left(\frac{x - 1}{y^{\frac{1}{2}} z} \right)$
- (b) $\log_5 \left(\frac{(x - 1)^3}{3z\sqrt{y}} \right)$
- (c) $\log_5 \left(\frac{3z(x - 1)^3}{\sqrt{y}} \right)$
- (d) $\log_5 \left(\frac{3(x - 1)}{y^{\frac{1}{2}} z^3} \right)$

7. Find the solution set of the inequality $|2x - 5| + 2 < 7$

- (a) $(5, \infty)$
- (b) $(0, 5)$
- (c) $(-2, 5)$
- (d) No solution

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

- (a) $-3x + 2$
- (b) $3 - 2x - h$
- (c) $-2x + 3 + 3h$
- (d) 1

9. List the properties of the function $q(x) = 22 - e^{x+3}$

- (a) Domain: $(-\infty, \infty)$; Range: $(22, \infty)$ HA: $y = 22$
- (b) Domain: $(-3, \infty)$; Range: $(-\infty, \infty)$ VA: $x = -3$
- (c) Domain: $(-\infty, \infty)$; Range: $(-\infty, 22)$ HA: $y = 22$
- (d) Domain: $(-\infty, \infty)$; Range: $(-\infty, \infty)$ VA: $x = -3$

10. The solution to the following system of equations is? $\begin{cases} x + 2y = 7 \\ 3x - y = 1 \end{cases}$

- (a) $(\frac{7}{9}, \frac{28}{9})$
- (b) $(\frac{-1}{2}, 3)$
- (c) $(\frac{7}{2}, -1)$
- (d) $(\frac{9}{7}, \frac{20}{7})$

11. What is the slope of any line perpendicular to the line $2x - y = 8$?

- (a) 2
- (b) -2
- (c) $\frac{1}{2}$
- (d) $-\frac{1}{2}$

12. What is $8 + 6i$ multiplied by its conjugate equal to?

- (a) 100
- (b) $100 + 96i$
- (c) $36 + 96i$
- (d) 28

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. In a nuclear power plant leak, radioactive Iodine-131 is leaked into the air. It has a half life of only 8 days. (Leave answers in exact form.)

(a) Assume an exponential model and find the decay constant for the model.

- (b) If this element was released today, how long would it be until exactly 4% of the original amount leaked remained in the air?

14. Algebraically solve the following equations for x .

(a) $\log_2(x^2 - 6x) - 6 = -2$

(b) $e^{3x}e^5 = (e^x)^2$

(c) $3^x = 2^{x-1}$

15. Consider the function $f(x) = -\sqrt{x+3} - 2$

(a) Identify the parent function. Describe the transformations of f from its parent function.

(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 $p(x) = x^4 - 10x^3 - 9x^2 - 20x - 22$.

(a) List all possible rational zeros of $p(x)$.

(b) Algebraically find all zeros of p .

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

Bonus Answer any of the following questions.

1. (10 pts) What positive value of k would make the given lines parallel?

$$kx + 2y = 8, \text{ and } 18x + ky = 12$$

2. (10 pts) A ball is thrown upward so its height in feet at time t seconds is $h(t) = 96t - 16t^2$. **Algebraically** find the following: What time the ball reaches its maximum height. What is the maximum height attained by the ball? When does the ball hit the ground?