

Name: \_\_\_\_\_

**Instructions:** Answer the questions in the spaces provided. If you need more space, use the bottom of the last page. Partial credit will be awarded. Scientific calculators are allowed, but graphing calculators, smartphones and computers are not allowed. This exam is closed book and closed notes.

1. [10 points] Solve the following equation by factoring.

$$3x^2 + 15x - 42 = 0$$

2. [10 points] Solve the following quadratic equation by “completing the square.”

$$x^2 + 8x - 14 = 0$$

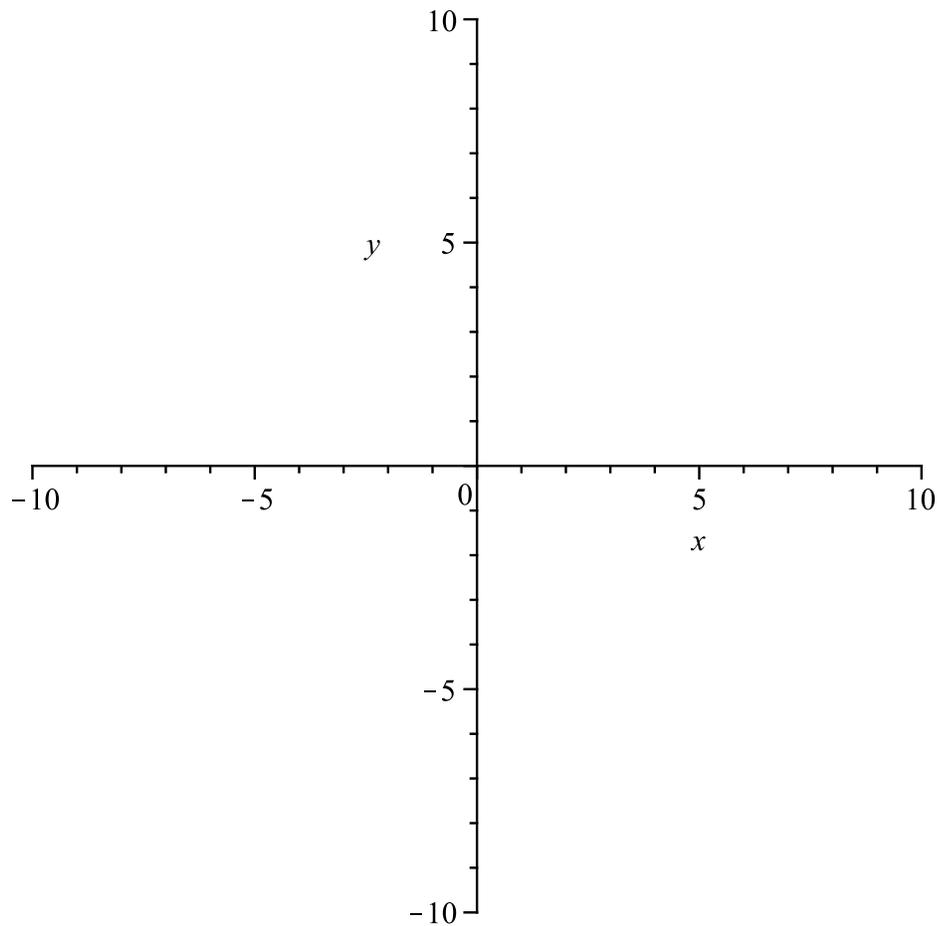
3. Determine the domains of the following functions:

(a) [5 points]  $f(x) = \sqrt{x - 2}$

(b) [5 points]  $g(x) = \frac{\log(x + 7)}{x - 2}$

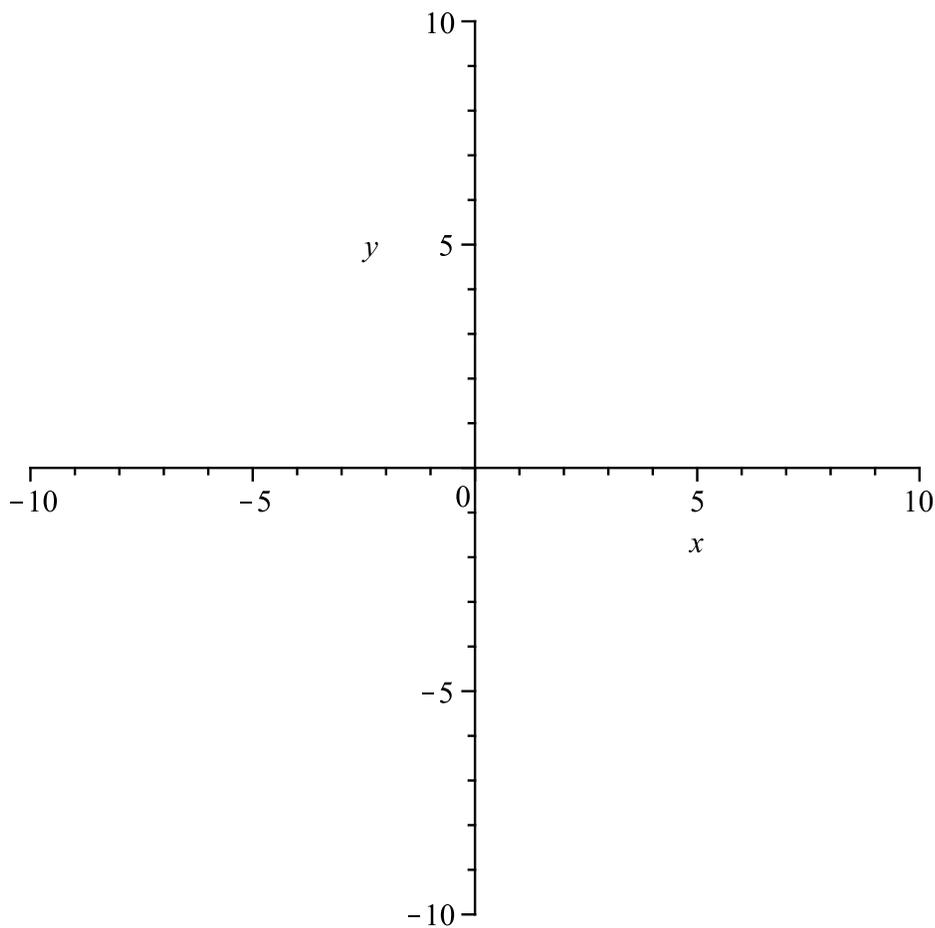
4. [10 points] Graph the following rational function. Be sure to clearly mark asymptotes, the  $y$ -intercept and the  $x$ -intercepts.

$$f(x) = \frac{2(x - 3)(x + 3)}{(x - 4)(x + 1)}$$



5. [10 points] Graph the following function. Hint: You may want to decompose the function into the form  $(v \circ b \circ h)(x)$  where  $b(x) = x^2$ , is the base function, and  $v(x)$  and  $h(x)$  are linear transformations. Be sure to indicate the coordinates of the vertex.

$$f(x) = -(x - 3)^2 + 1$$



6. [10 points] Find the inverse function,  $f^{-1}(x)$  of the function  $f(x) = 2x^3 - 5$ .

7. [10 points] Find all solutions to the following logarithmic equation.

$$\log_3(x + 4) - \log_3(x + 1) = \log_3(x)$$

8. Rewrite the following exponential equation as a logarithmic equation and rewrite the logarithmic equation as an exponential equation.

(a) [5 points]  $3^4 = 81$

(b) [5 points]  $\log_5(125) = 3$

9. Suppose a population of bacteria are modeled by the following exponential function:

$$P(t) = 1000e^{0.576t}$$

where time  $t$ , is measured in hours.

(a) [5 points] How many bacteria are originally present, when  $t = 0$ ?

(b) [5 points] How many hours (to the nearest hour) will it take until the bacteria population reaches 1,000,000?

10. True or False.

- (a) [2 points] The graph of a rational function never intersects a vertical asymptote.  
A. True    B. False
- (b) [2 points] The graph of a rational function never intersects a horizontal asymptote.  
A. True    B. False
- (c) [2 points] If  $(f \circ g)(x) = x = (g \circ f)(x)$  for all  $x$ , then  $g$  is the inverse of  $f$ , that is  $g = f^{-1}$ .  
A. True    B. False
- (d) [2 points] A function  $f$  is one-to-one if  $f(x) = f(y) \Rightarrow x = y$ .  
A. True    B. False
- (e) [2 points] If a function has an inverse, then its graph and the graph of its inverse are symmetric with respect to the line  $y = x$ .  
A. True    B. False

11. [5 points (bonus)] What is the theme of the course?

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Question	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
11	0	
Total:	100	