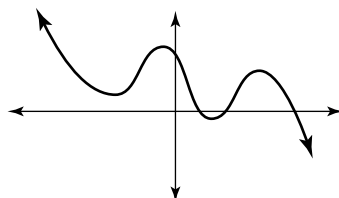


Math 111 Final Exam

1. (4pts each) True or False.

- (a) The domain of the function g with rule $g(x) = \sqrt{4x - 4}$ is $[0, \infty)$.
- (b) The lines $3y + 6 = 9x$ and $3y = -x$ are perpendicular.
- (c) The point $(-1, 6)$ is on the graph of the function f where $f(x) = 7x^4 + 2x + 1$.
- (d) There is no real number x such that $|5x^2 + 12x - \sqrt{x}| = -5$.
- (e) If $f(x) = -(g(x) + 4)$, then the graph of f is obtained from the graph of g by first shifting up 4 units and then reflecting about the x -axis.
- (f) If $x^2 - 25$ is a factor of a polynomial $f(x)$, then $x + 5$ and $x - 5$ are also factors of $f(x)$.
- (g) The following could be the graph of a polynomial function of degree 3.



2. (4pts each) Fill in the blank.

- (a) If $f(x) = 6 \ln(x - 2)$ then $f(3) =$ _____
- (b) Suppose g is an even function and $(3, -2)$ is on the graph of g . Then $g(-3) =$ _____
- (c) If $f(x) = \log(x)$ and $g(x) = \sqrt{4 - x}$ then the domain of f/g is _____
- (d) If f is a polynomial function and $f(-4) = 0$, then we know _____ is a factor of $f(x)$.

3. (10pts) Suppose f is a linear function whose graph contains the points $(0, -3)$ and $(3, 7)$. Find $f(x)$.

4. (10pts) Solve for x

$$x^2 - 16 = 3x(x - 4)$$

5. (10pts) Find the center and radius of the circle

$$x^2 - 10y = 3 - y^2$$

6. (10pts) Recall that the difference quotient for a function f is given by

$$\frac{f(x+h) - f(x)}{h}$$

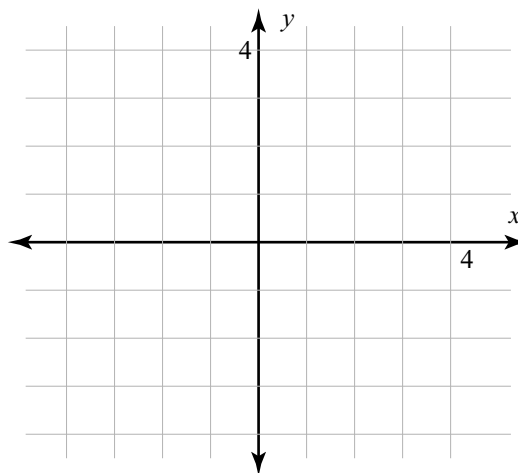
Compute and simplify the difference quotient for f where

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

7. Suppose f is the function with rule

$$f(x) = \begin{cases} 1 & \text{if } -4 < x \leq -2 \\ x^2 - 1 & \text{if } -2 < x \leq 1 \\ \ln(x) & \text{if } x > 1. \end{cases}$$

8. (10pts) Sketch the graph of f



9. (6pts) Give the domain and range of f in interval notation.

10. (10pts) Suppose you invest \$15 at 11% annual interest compounded continuously. How long will it take for you to have \$45 ?

[You do not need to simplify your answer, but be sure to include units.]

11. (10pts) Use the Round Trip Theorem to show that the functions g and f are inverses where

$$g(x) = \frac{1}{x-2} \quad \text{and} \quad f(x) = \frac{1}{x} + 2$$

12. (10pts) Suppose f is the one to one function with rule

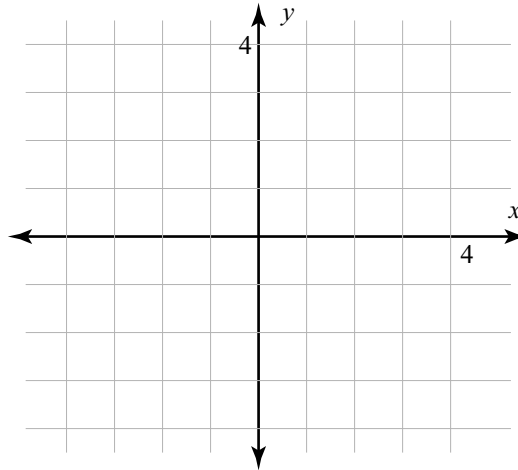
$$f(x) = 13 \cdot 2^{x+3}$$

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

14. (10pts) Suppose f is rational function whose graph has

- vertical asymptote $x = 2$,
- a hole at $(0, 1)$,
- horizontal asymptote $y = 0$,
- no x -intercepts.

Sketch a possible graph of f (there are many correct graphs).



15. (10pts) Let $g(x) = \frac{x^2+|x|}{x}$. Is g even, odd, or neither?

[You must correctly justify your answer to receive full credit.]

16. (10pts) Find all the real roots of $f(x) = x^4 + 3x^3 - 18x^2 - 40x$ given that $f(-5) = 0$.

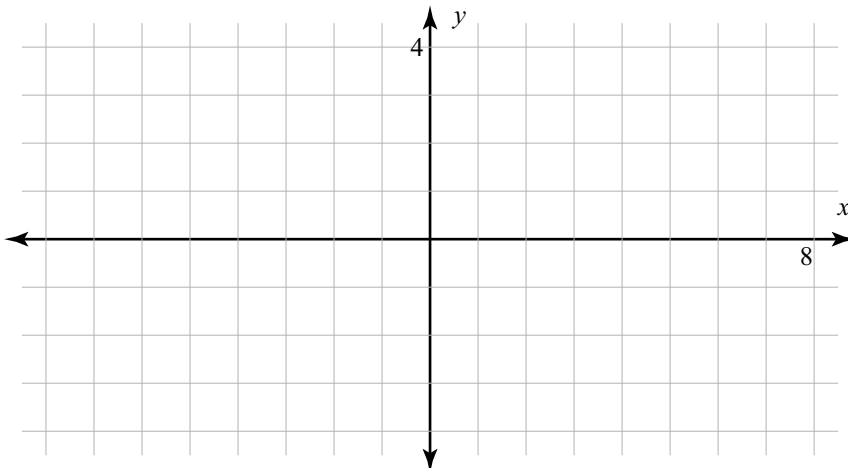
17. (10pts) Solve the following inequality and leave your answer in interval notation.

$$|2x + 7| \geq 5$$

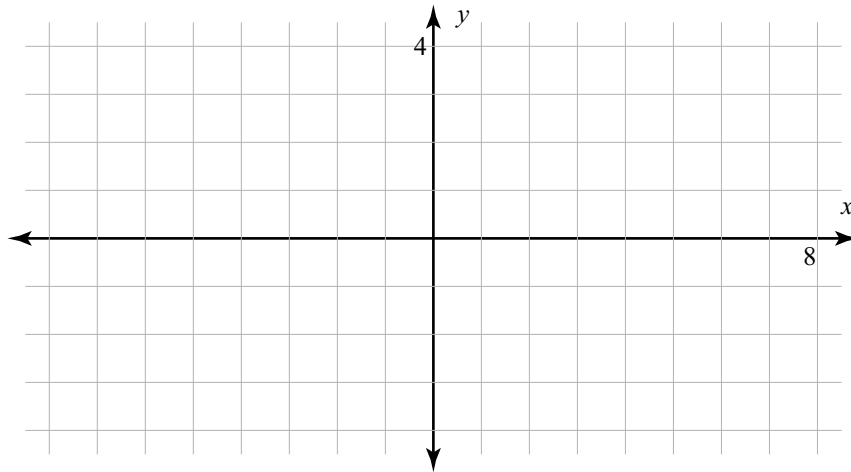
18. (10pts) Solve for x

$$\log(x - 2) = \log(1 - x) + \log(3)$$

19. (10pts) Sketch a graph of the function with rule $f(x) = -3|x - 5| + 3$.



20. (10pts) Sketch the graph of an odd function containing the points $(-5, -4)$, $(-1, 0)$, and $(3, -1)$.



21. (10pts) Let $f(x) = \ln(x)$, $g(x) = x^3$, $h(x) = x + 1$. Suppose

$$k(x) = (\ln(x + 1))^3$$

Write k as a composition of f, g , and h .

Bonus (10pts) Let $f(x) = x(x - 1)^4$. Either find the rule of $f^{-1}(x)$ or show that f does not have an inverse.