

MATH 107 FINAL EXAMINATION

This is an open-book exam. You may refer to your text and other course materials as you work on the exam, and you may use a calculator. **You must complete the exam individually. Neither collaboration nor consultation with others is allowed.**

Record your answers and work on the separate answer sheet provided.

There are 30 problems.

Problems #1–12 are Multiple Choice.

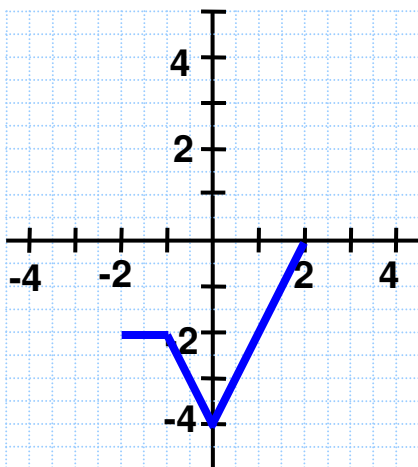
Problems #13–21 are Short Answer. (Work not required to be shown)

Problems #22–30 are Short Answer with work required to be shown.

MULTIPLE CHOICE

1. Determine the domain and range of the piecewise function.

1. _____



- A. Domain $[-4, 0]$; Range $[-2, 2]$
- B. Domain $[-4, 0]$; Range $[0, 2]$
- C. Domain $[-2, 2]$; Range $[-4, 0]$
- D. Domain $[0, 2]$; Range $[-4, 0]$

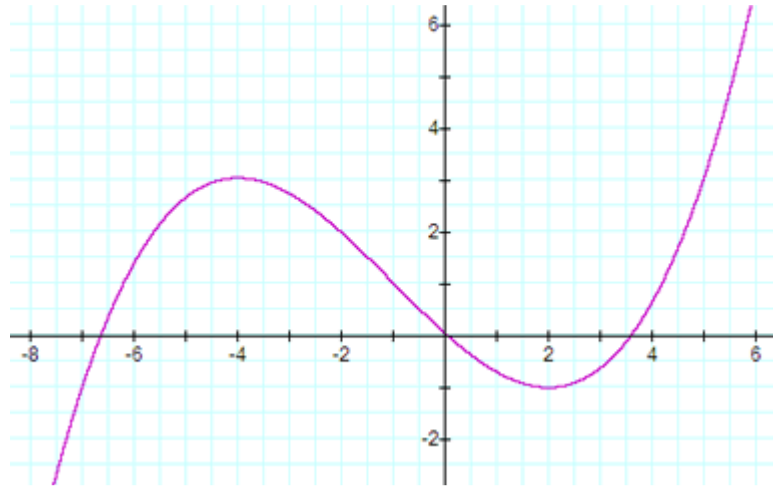
2. Solve: $\sqrt{10-3x} = -x$

2. _____

- A. $-5, 2$
- B. -5
- C. $5/2$
- D. No solution

3. Determine the interval(s) on which the function is increasing. 3. _____

- A. $(-\infty, -4)$ and $(2, \infty)$
- B. $(-6.7, 0)$ and $(3.6, \infty)$
- C. $(-4, 2)$
- D. $(-1, 3)$



4. Determine whether the graph of $y = 3|x| - 1$ is symmetric with respect to the origin, the x -axis, or the y -axis. 4. _____

- A. not symmetric with respect to the y -axis, not symmetric with respect to the x -axis, and not symmetric with respect to the origin
- B. symmetric with respect to the origin only
- C. symmetric with respect to the x -axis only
- D. symmetric with respect to the y -axis only

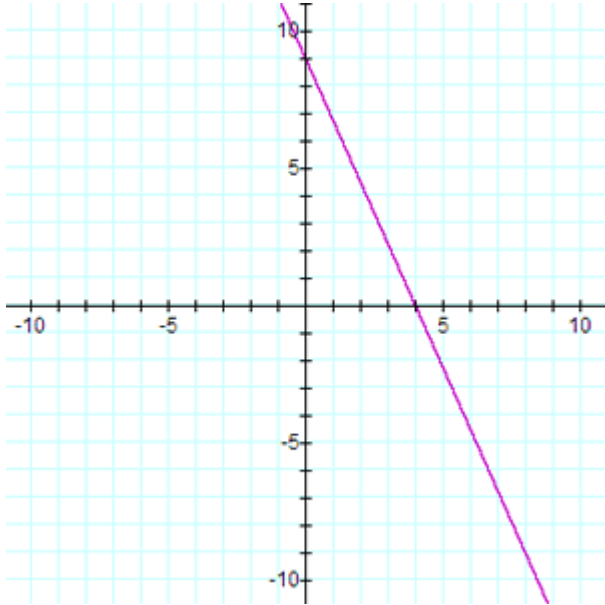
5. Solve, and express the answer in interval notation: $|7 - 3x| \leq 11$. 5. _____

- A. $(-\infty, -4/3]$
- B. $[-4/3, 6]$
- C. $(-\infty, -4/3] \cup [6, \infty)$
- D. $(-\infty, 6] \cup [-4/3, \infty)$

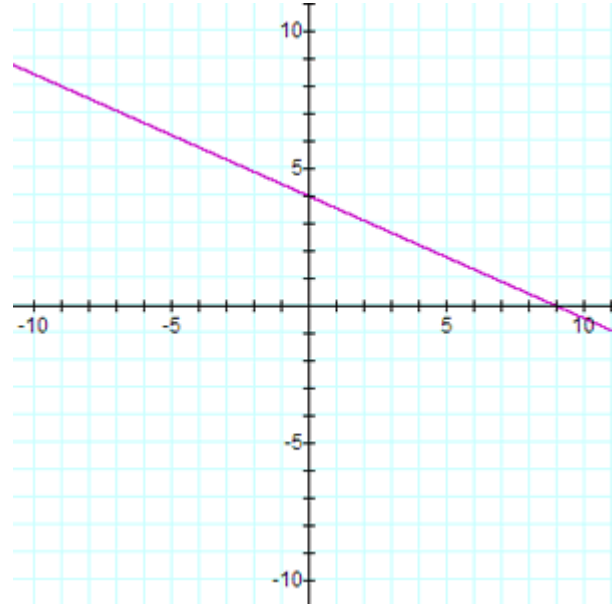
6. Which of the following represents the graph of $9x - 4y = 36$?

6. _____

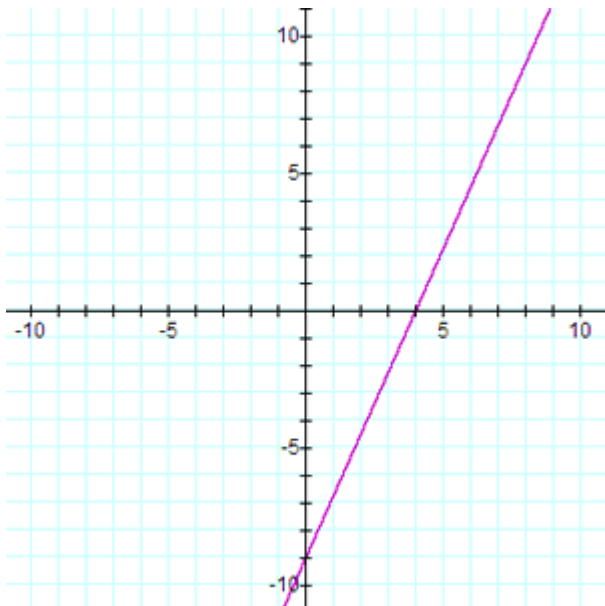
A.



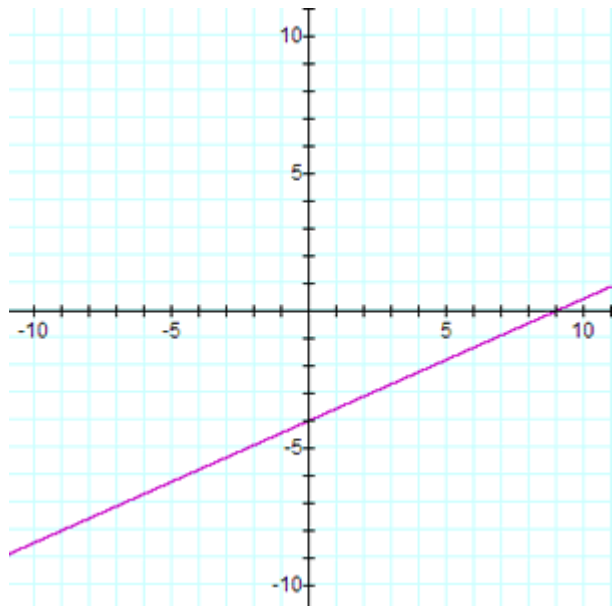
B.



C.



D.



7. Write a slope-intercept equation for a line parallel to the line $x - 6y = 12$ which passes through the point $(-18, 7)$. 7. _____

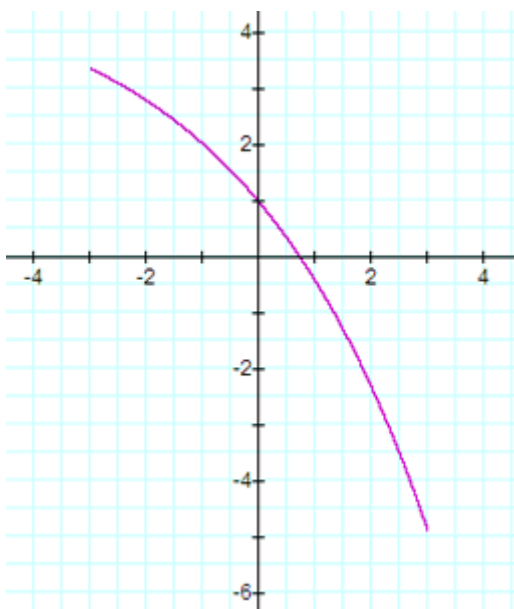
A. $y = \frac{1}{6}x + 10$

B. $y = \frac{1}{6}x + 7$

C. $y = -6x - 101$

D. $y = -\frac{1}{6}x + 4$

8. Does the graph below represent a function and is it one-to-one? 8. _____



- A. It is not a function but it is one-to-one.
B. It is a function and it is one-to-one.
C. It is a function but not one-to-one.
D. It is not a function and it is not one-to-one.

9. Express as an equivalent expression: $\log x + \log 1 - 8 \log (y + 2)$

9. _____

A. $\log \left[\frac{x}{(y+2)^8} \right]$

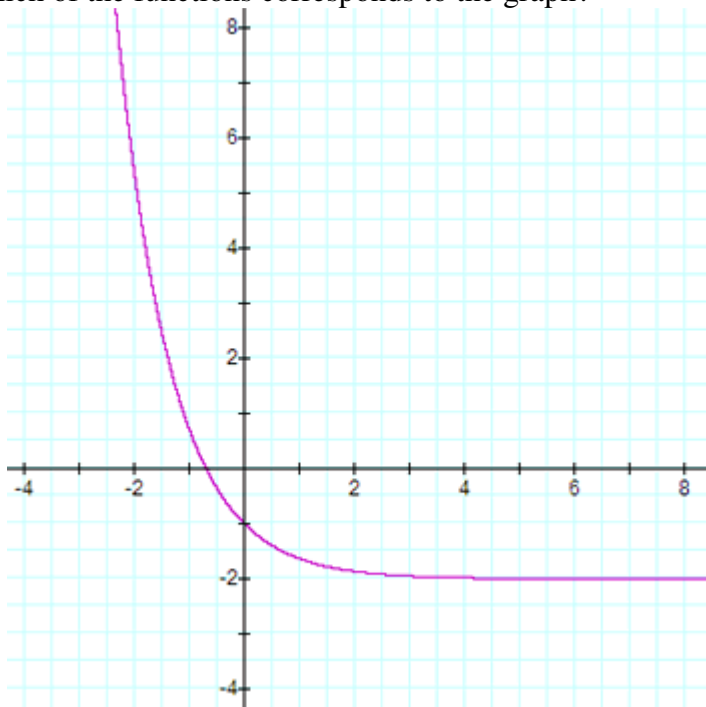
B. $\frac{\log x}{\log (y+2)^8}$

C. $\log \left[\frac{x+1}{8(y+2)} \right]$

D. $\log (x-8y-15)$

10. Which of the functions corresponds to the graph?

10. _____



A. $f(x) = -e^x - 1$

B. $f(x) = e^{-x} - 1$

C. $f(x) = e^x - 1$

D. $f(x) = e^{-x} - 2$

11. Suppose that for a function f , the equation $f(x) = 0$ has exactly three real-number solutions.

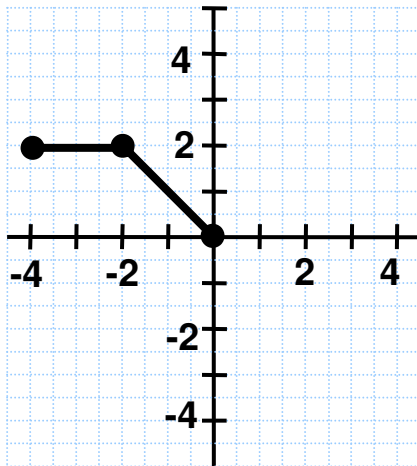
Which of the following statements MUST be true?

11. _____

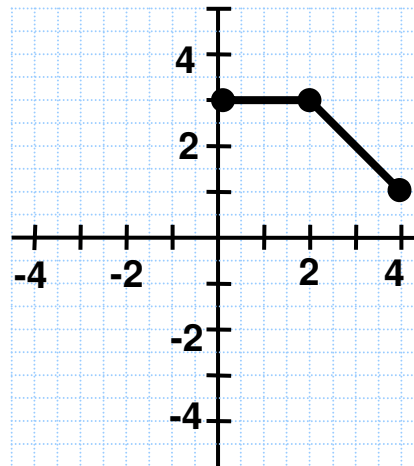
- A. f has exactly three x -intercepts.
- B. f has exactly three y -intercepts.
- C. f is a polynomial of degree 3.
- D. f is an invertible function.

12. The graph of $y = f(x)$ is shown at the left and the graph of $y = g(x)$ is shown at the right. (No formulas are given.) What is the relationship between $g(x)$ and $f(x)$?

12. _____



$y = f(x)$



$y = g(x)$

- A. $g(x) = f(x + 1) + 4$
- B. $g(x) = f(x + 4) + 3$
- C. $g(x) = f(x - 4) + 1$
- D. $g(x) = f(x + 1) + 2$

SHORT ANSWER:

13. Multiply and simplify: $(3 + 4i)(6 - 7i)$.

Write the answer in the form $a + bi$, where a and b are real numbers.

Answer: _____

14. Solve, and write the answer in interval notation: $\frac{x+9}{x-4} \leq 0$.

Answer: _____

15. Water initially at 190° F. is left in a room of temperature 60° F to cool.

After t minutes, the temperature T of the water is given by $T(t) = 60 + 130e^{-0.096t}$

Find the temperature of the water 30 minutes after it is left to cool. (Round to the nearest degree.)

Answer: _____

16. Find the value of the logarithm: $\log_3\left(\frac{1}{9}\right)$.

Answer: _____

17. Solve: $5^{3x-8} = 25$.

Answer: _____

18. Suppose \$7,200 is invested in an account at an annual interest rate of 4.5% compounded continuously. How long (to the nearest tenth of a year) will it take the investment to double in size?

Answer: _____

19. Let $f(x) = x^2 + 10x + 32$.

(a) Find the vertex.

Answer: _____

(b) State the range of the function.

Answer: _____

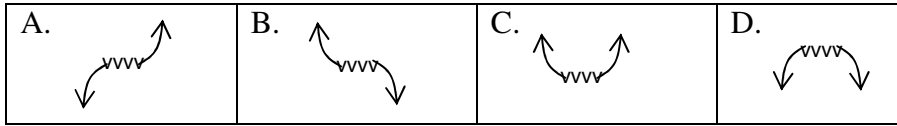
(c) On what interval is the function decreasing?

Answer: _____

20. Consider the polynomial $P(x)$, shown in both standard form and factored form.

$$P(x) = -\frac{1}{5}x^3 - \frac{3}{5}x^2 + \frac{13}{5}x + 3 = -\frac{1}{5}(x-3)(x+1)(x+5)$$

(a) Which sketch illustrates the end behavior of the polynomial function?



Answer: _____

(b) State the y-intercept.

Answer: _____

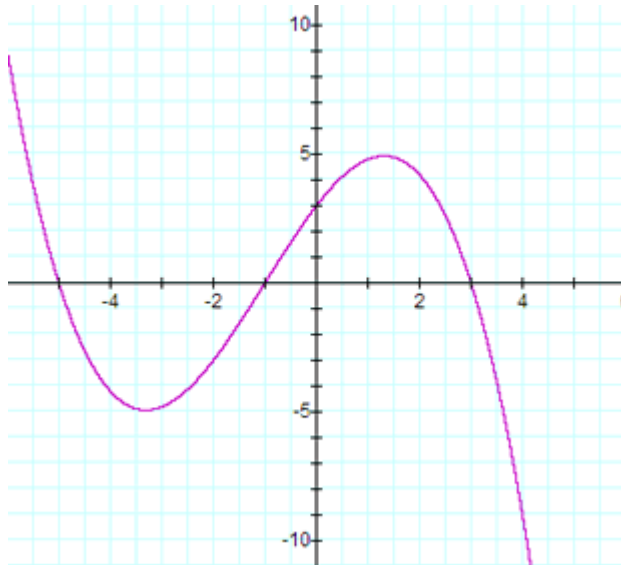
(c) State the zeros of the function.

Answer: _____

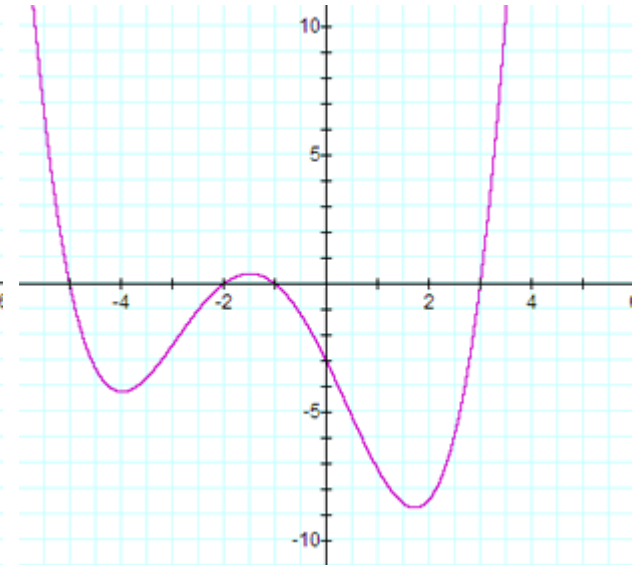
(d) State which graph below is the graph of $P(x)$.

Answer: _____

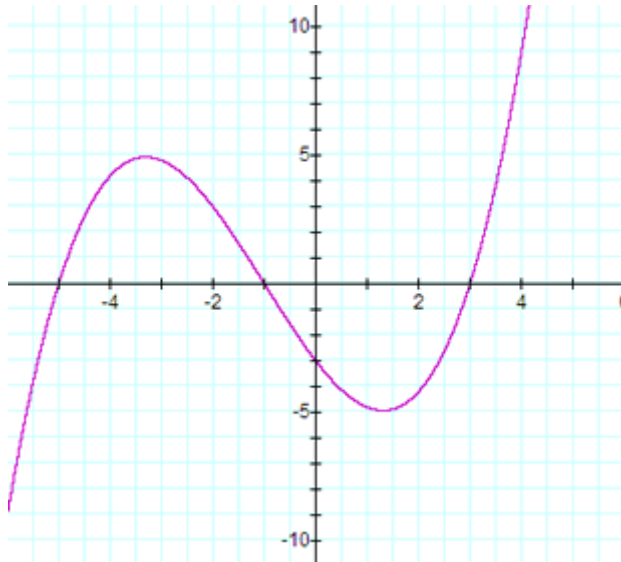
GRAPH A



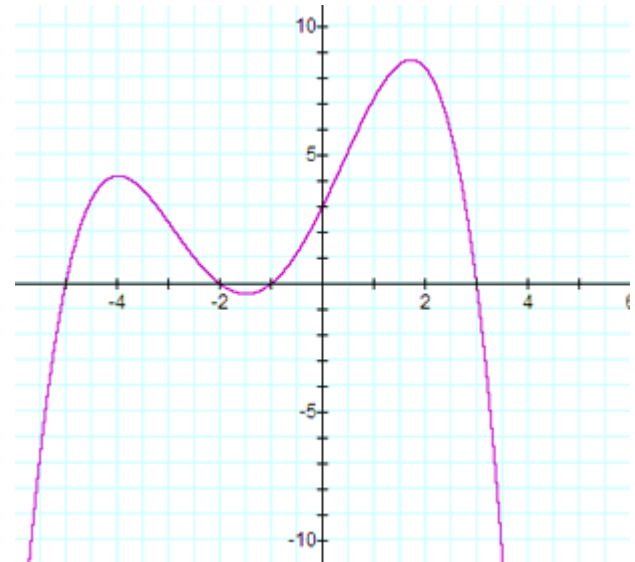
GRAPH B



GRAPH C



GRAPH D



21. Let $f(x) = \frac{3x^2 + 3}{x^2 - 4}$.

(a) State the domain.

Answer: _____

(b) State the horizontal asymptote.

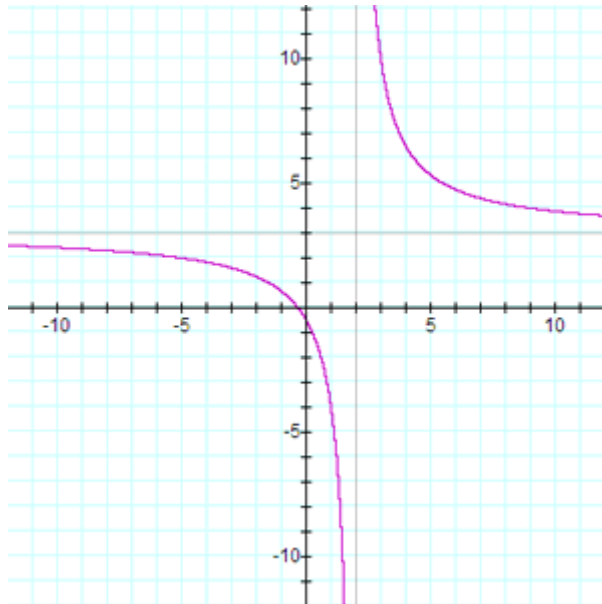
Answer: _____

(c) State the vertical asymptote(s).

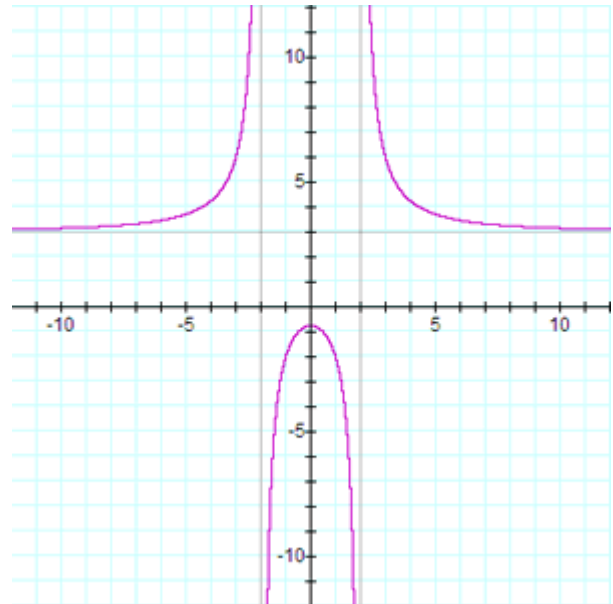
Answer: _____

(d) Which of the following represents the graph of $f(x) = \frac{3x^2 + 3}{x^2 - 4}$? Answer: _____

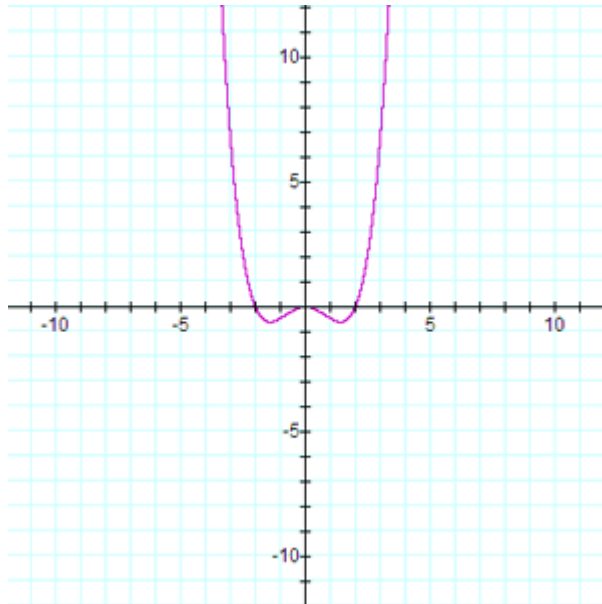
GRAPH A.



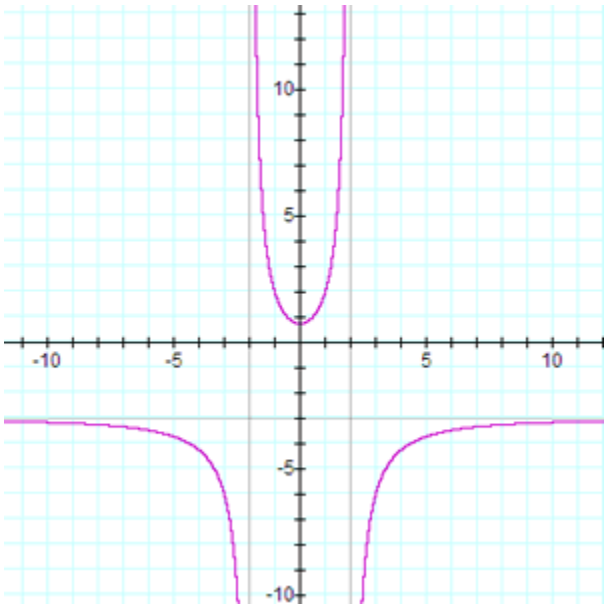
GRAPH B.



GRAPH C.



GRAPH D.



SHORT ANSWER, with work required to be shown, as indicated.

22. Let $f(x) = x + 2$ and $g(x) = \sqrt{5 - x}$.

(a) Find $\left(\frac{f}{g}\right)(-4)$. **Show work.**

(b) Find the domain of the quotient function $\frac{f}{g}$. **Explain.**

23. Points $(2, 1)$ and $(6, -3)$ are endpoints of the diameter of a circle.

(a) What is the length of the diameter? Give the exact answer, simplified as much as possible.

Show work.

(b) What is the center point C of the circle?

(c) Given the point C you found in part (b), state the point symmetric to C about the x -axis.

24. Find the equation for a line which passes through the points $(3, -5)$ and $(-1, 1)$. Write the equation in slope-intercept form. **Show work.**

25. A salesperson earns a base salary of \$2,100 per month and a commission of 6.5% on the amount of sales made. If the salesperson has a paycheck of \$3,699 for one month, what was the amount of sales for the month? **Show work.**

26. Let $f(x) = 3x^2 + 7$ and $g(x) = x - 3$.

(a) Find the composite function $(f \circ g)(x)$ and simplify. **Show work.**

(b) Find $(f \circ g)(-2)$. **Show work.**

27. Find the exact solutions and simplify as much as possible: $7x^2 + 2 = 8x$. **Show work.**

28. Given the function $f(x) = 4 - \frac{1}{7}x$, find a formula for the inverse function. **Show work.**

29. Dream Donuts, Inc. has determined that when x donuts are made daily, the profit P (in dollars) is given by

$$P(x) = -0.002x^2 + 4.1x - 1200$$

(a) What is the company's profit if 600 donuts are made daily?

(b) How many donuts should be made daily in order to maximize the company's profit? **Show work.**

30. Solve: $\frac{x+9}{x+4} + \frac{40}{x^2-16} = 0$. **Show work.**
