MATH 107 FINAL EXAMINATION

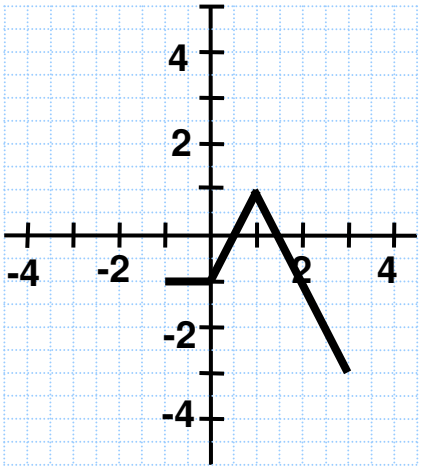
This is an open-book exam. You may refer to your text and other course materials as you work on the exam, and you may use a calculator. **You must complete the exam individually. Neither collaboration nor consultation with others is allowed.**

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 [1/2, 3/2]; Range [0, 1]
B. Domain [–1, 3]; Range [–3, 1]
C. Domain [–1, 1]; Range [–1, 1]
D. Domain [–3, 1]; Range [–1, 3]

2. Solve: $\sqrt{11+2x} = x-2$ 2. _____

A. 7
B. –13
C. –1, 7
D. No solution

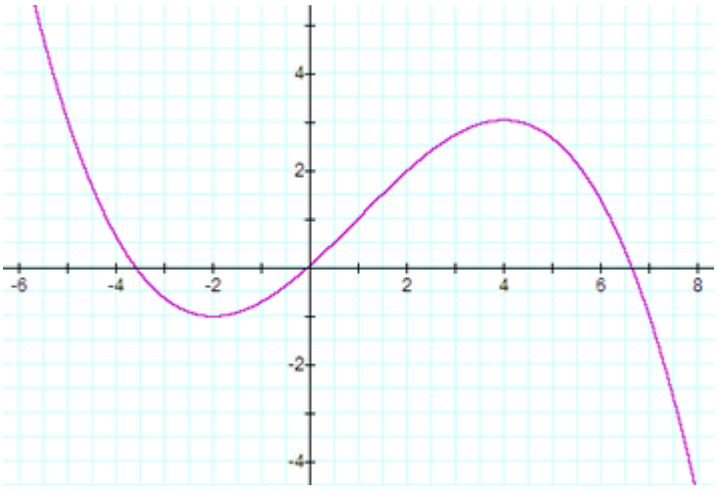
3. Determine the interval(s) on which the function is increasing. 3. _____

A. $(-\infty, -3.6)$ and $(0, 6.7)$

B. $(-\infty, -2)$ and $(4, \infty)$

C. $(0, 6.7)$

D. $(-2, 4)$



4. Determine whether the graph of $y = 9 + |x|$ is symmetric with respect to the origin, the *x*-axis, or the *y*-axis. 4. _____

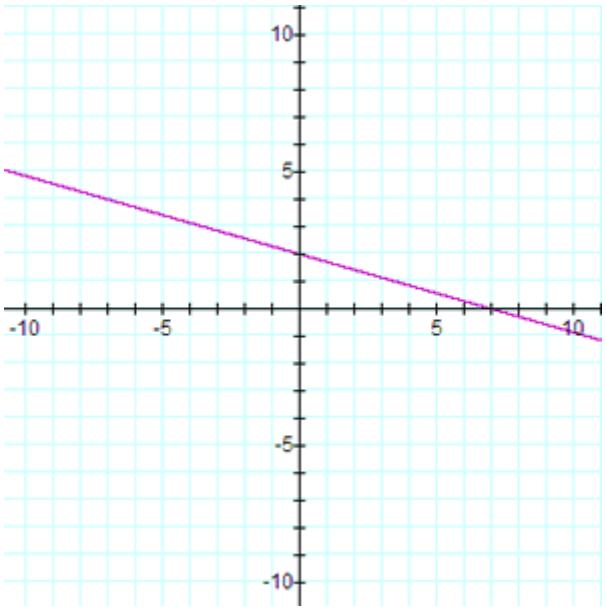
A. symmetric with respect to the *x*-axis only
B. symmetric with respect to the *y*-axis only
C. symmetric with respect to the origin only
D. not symmetric with respect to the *x*-axis, not symmetric with respect to the *y*-axis, and not symmetric with respect to the origin

5. Solve, and express the answer in interval notation: $|5 - 6x| \leq 13$. 5. _____

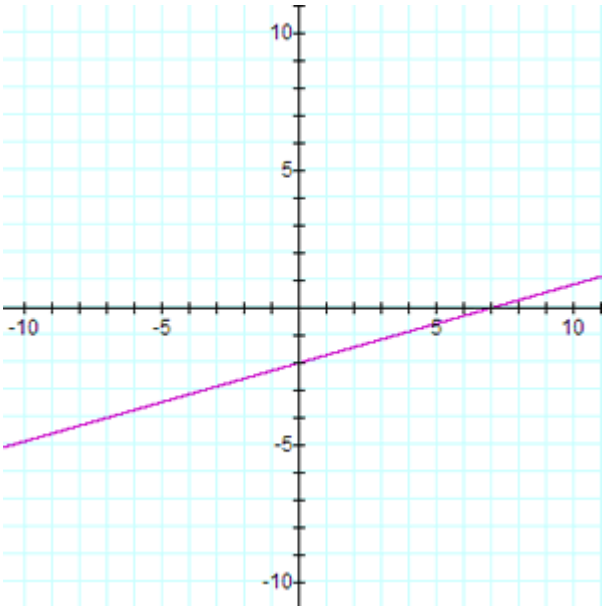
A. $[3, \infty)$
B. $(-\infty, -4/3] \cup [3, \infty)$
C. $(-\infty, -4/3]$
D. $[-4/3, 3]$

6. Which of the following represents the graph of $2x - 7y = 14$? 6. _____

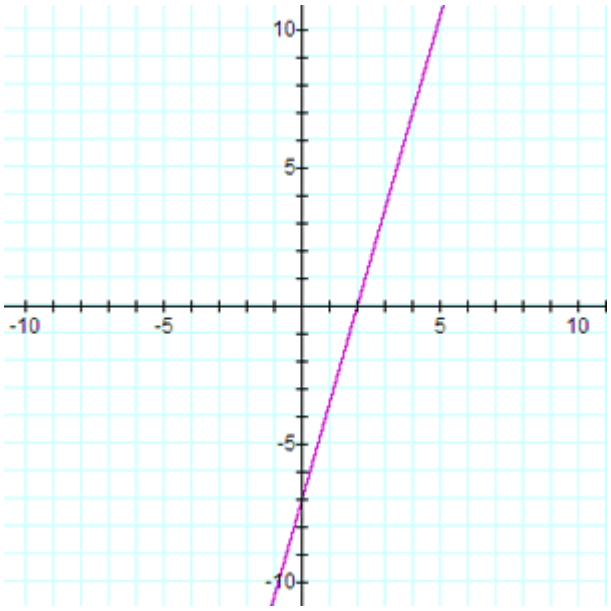
A.



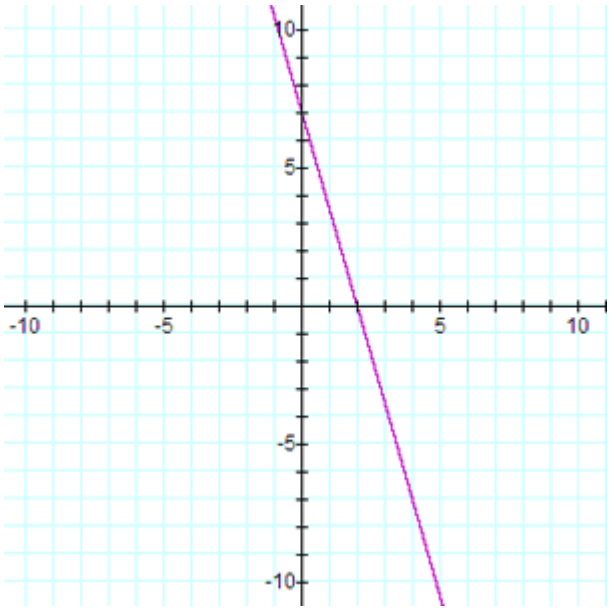
B.



C.



D.



7. Write a slope-intercept equation for a line parallel to the line $x - 4y = 6$ which passes through the point $(-8, 3)$. 7. _____

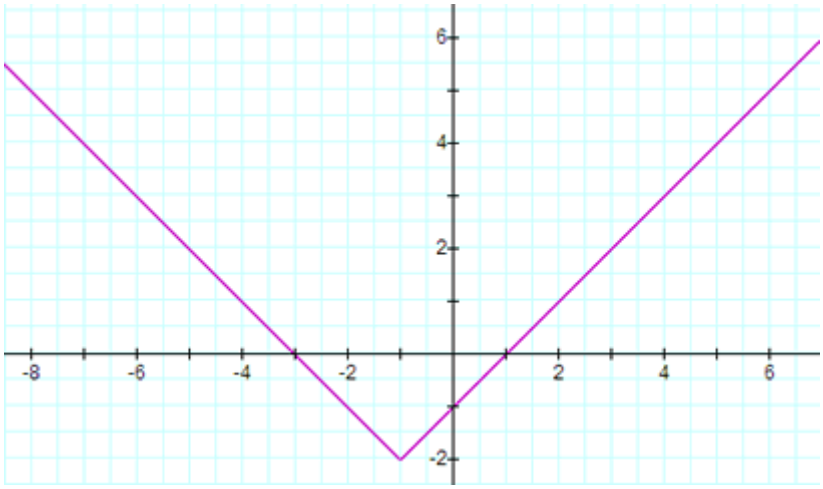
A. $y = -4x - 29$

B. $y = \frac{1}{4}x + 3$

C. $y = \frac{1}{4}x + 5$

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

8. Which of the following best describes the graph? 8. _____



A. It is a parabola.
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: $3 \log y + \log 1 - \log (x + 2)$ 9. _____

A. $\dfrac{\log(3y)}{\log(x+2)}$

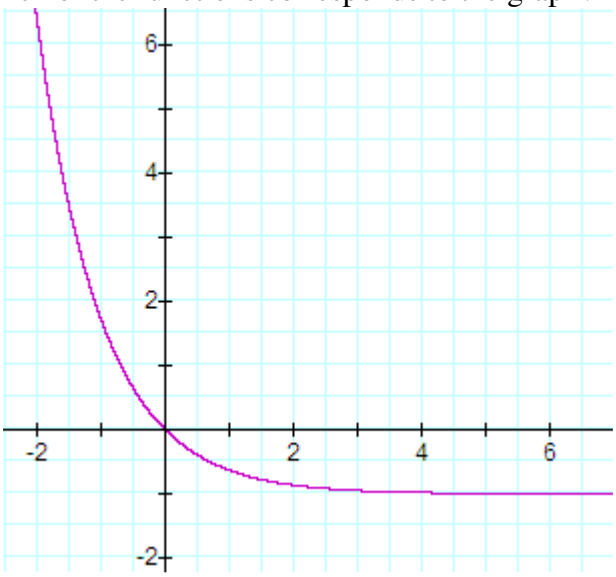
B. $\log(3y - x - 1)$

C. $\log\left(\dfrac{3y+1}{x+2}\right)$

D. $\log\left(\dfrac{y^3}{x+2}\right)$

10. _____

10. Which of the functions corresponds to the graph?



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

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

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

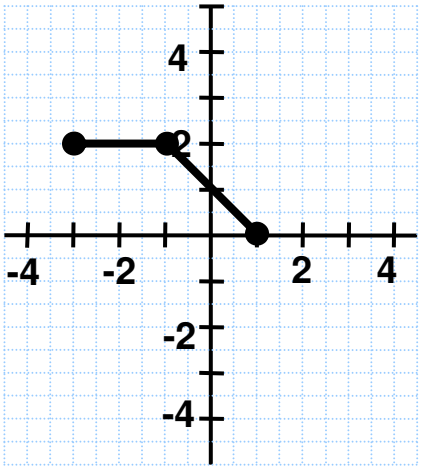
D. $f(x) = -e^{x}$

11. Suppose that a function f has no x-intercepts.
Which of the following statements MUST be true? 11. _____

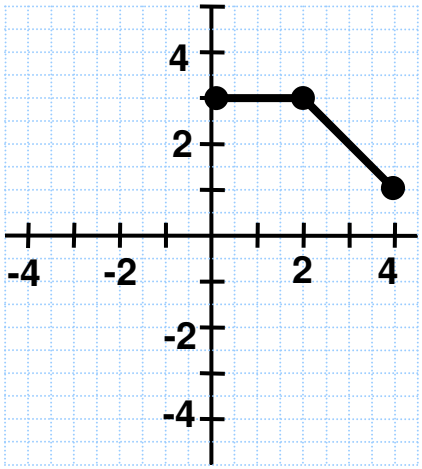
A. The equation $f(x) = 0$ has no real-number solution.
B. The graph of f is a horizontal line.
C. $f(x) > 0$ for all x in the domain of f.
D. f is an invertible function.

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

SHORT ANSWER:

13. Multiply and simplify: $(8 + 3i)(2 + 5i)$.
Write the answer in the form $a + bi$, where a and b are real numbers. Answer: _____

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14. Solve, and write the answer in interval notation: $\frac{x-1}{x+5} \geq 0$. Answer: _____

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15. A can of soda at 82° F. is placed in a refrigerator that maintains a constant temperature of 35° F. The temperature T of the soda t minutes after it is placed in the refrigerator is given by

$$T(t) = 35 + 47\, e^{-0.058\, t}$$

Find the temperature of the soda 10 minutes after it is placed in the refrigerator. (Round to the nearest tenth of a degree.)

Answer: _____

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16. Find the value of the logarithm: $\log_6\left(\frac{1}{36}\right)$. Answer: _____

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17. Solve: $5^{3x-2} = 25$. Answer: _____

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18. Suppose $4,700 is invested in an account at an annual interest rate of 3.8% compounded continuously. How long (to the nearest tenth of a year) will it take the investment to double in size? Answer: _____

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19. Let $f(x) = x^2 + 4x + 10$.

(a) Find the vertex. Answer: _____

(b) State the range of the function. Answer: _____

(c) On what interval is the function decreasing? Answer: _____

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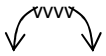
20. Consider the polynomial $P(x)$, shown in both standard form and factored form.

$$P(x) = -\frac{1}{8}x^4 + \frac{3}{4}x^3 - \frac{3}{8}x^2 - \frac{13}{4}x + 3 = -\frac{1}{8}(x+2)(x-1)(x-3)(x-4)$$

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

A.	B.	C.	D.
			

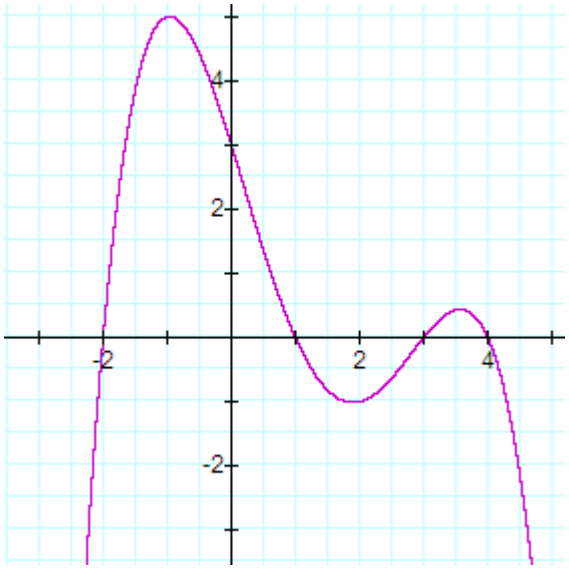
Answer: _____

(b) State the y-intercept. Answer: _____

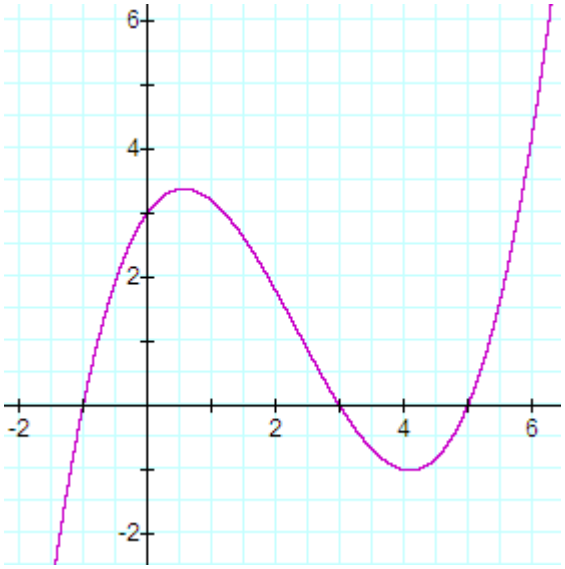
(c) State the zeros of the function. Answer: _____

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

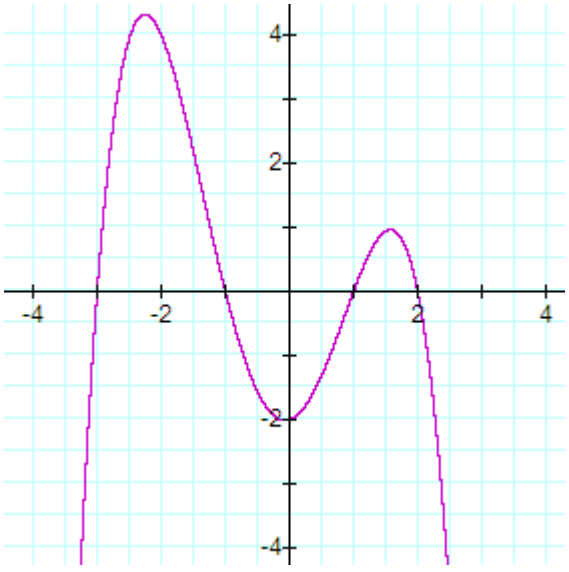
GRAPH A



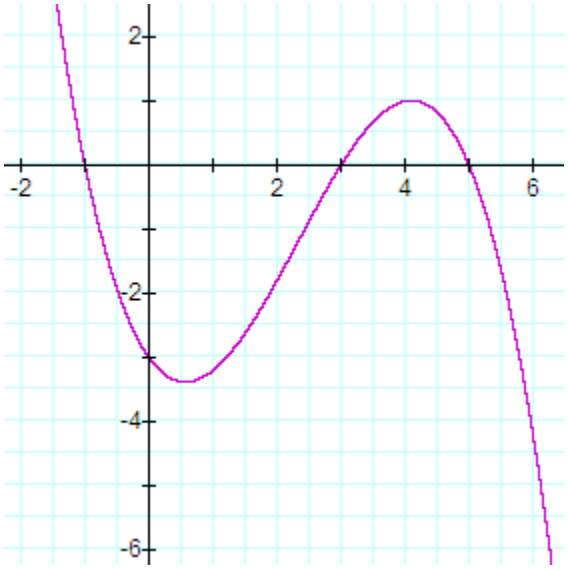
GRAPH B



GRAPH C



GRAPH D



21. Let $f(x)=\dfrac{3x-9}{x-2}$.

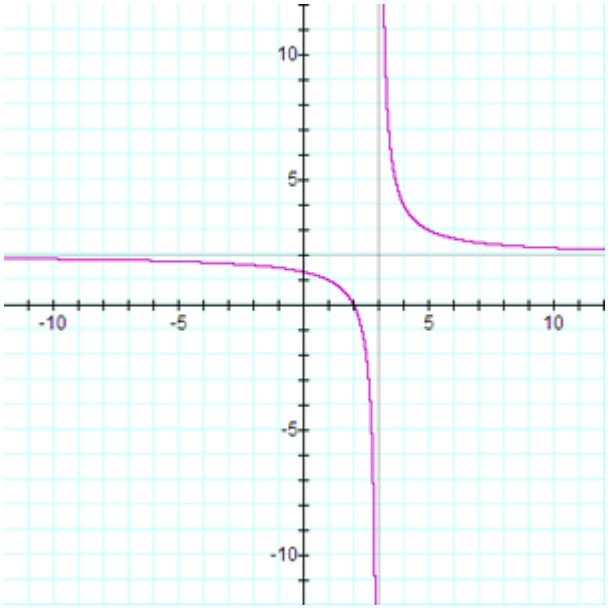
(a) State the domain. Answer: _____

(b) State the horizontal asymptote. Answer: _____

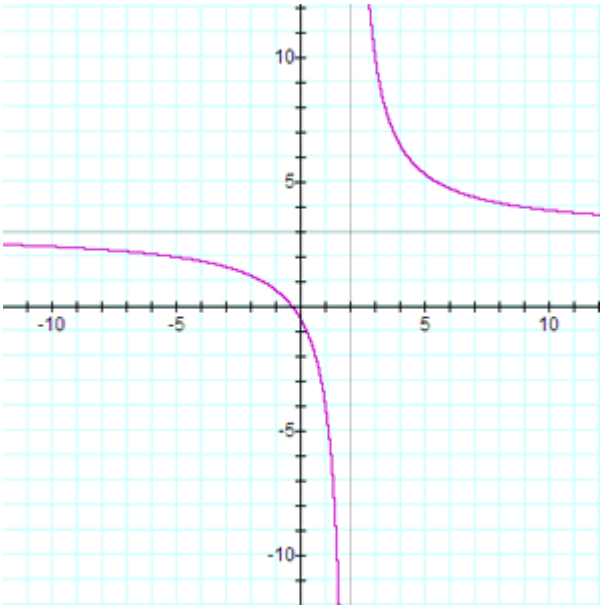
(c) State the vertical asymptote(s). Answer: _____

(d) Which of the following represents the graph of $f(x)=\dfrac{3x-9}{x-2}$? Answer: _____

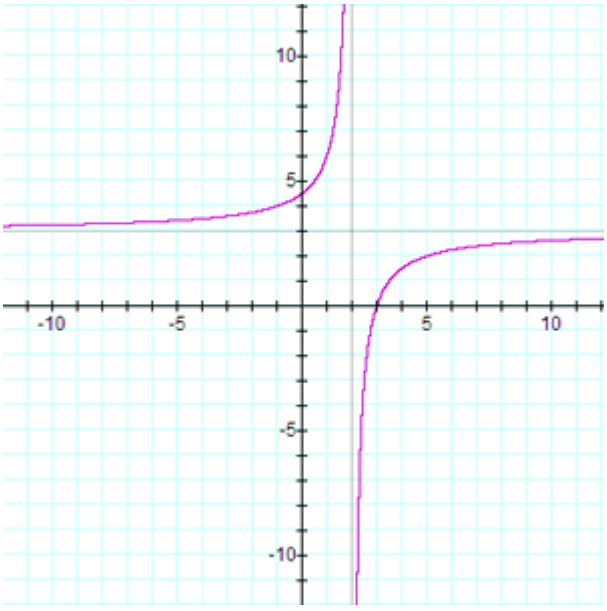
GRAPH A.



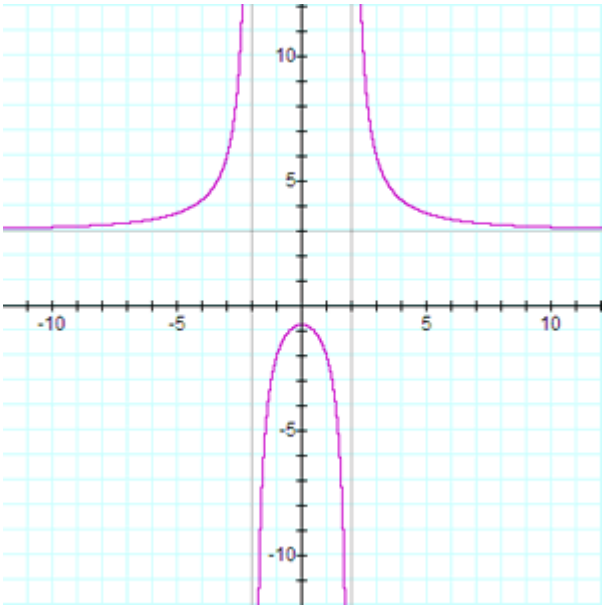
GRAPH B.



GRAPH C.



GRAPH D.



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

22. Let $f(x) = \sqrt{x+3}$ and $g(x) = x - 5$.

(a) Find $\left(\frac{f}{g}\right)(-2)$. **Show work.** **Do not multiply here. Evaluate the quotient function.**

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

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23. Points (2, 1) and (6, –5) are endpoints of a line segment.

(a) What is the length of the line segment? Give the exact answer, no decimals, simplified as much as possible. **Show work.**
(b) What is the midpoint *M* of the line segment?
(c) Given the point *M* you found in part (b), state the point symmetric to *M* about the *y*-axis.

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24. Find the equation for a line which passes through the points (5, 2) and (8, –7). Write the equation in slope-intercept form. **Show work.**

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25. A salesperson earns a base salary of $1,475 per month and a commission of 8.4% on the amount of sales. If the salesperson has a paycheck of $4,637.60 for one month, what was the amount of sales for the month? **Show work.**

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26. Let $f(x) = 5x^2 - 4$ and $g(x) = x - 2$. **Both parts of this problem are asking for composition or evaluation of functions, not multiplication.**

(a) Find the composite function $(f \circ g)(x)$ and simplify. **Show work.**
(b) Find $(f \circ g)(-2)$. **Show work.**

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27. Find the exact solutions and simplify as much as possible: $8x^2 = 6x + 1$. **Show work.**

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

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29. The Travel Time bus company has determined that when x tourists are given a particular bus tour, the profit P, in dollars, is given by

$$P(x) = -0.25\,x^2 + 28.50x - 310$$

(a) What is the company's profit if 28 tourists are given the tour?

(b) How many tourists should be given the tour in order to maximize the company's profit? **Show work.**

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30. Solve: $\frac{x+6}{x-1} = \frac{14}{x^2-1}$. **Show work.**
