MATH 107 FINAL EXAMINATION

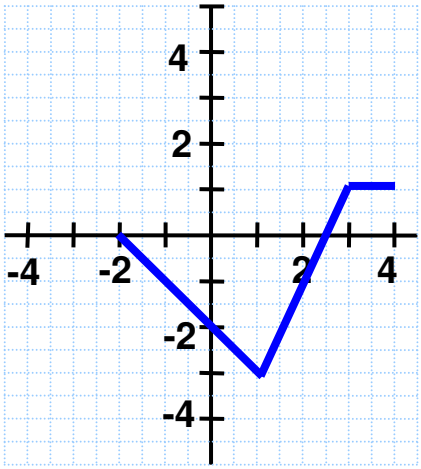
This is an open-book exam. You may refer to your text and other course materials as you work on the exam, and you may use a calculator. **You must complete the exam individually. Neither collaboration nor consultation with others is allowed.**

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 [– 2, 2.5]; Range [–3, 0]
B. Domain [–2, ∞); Range [–3,∞)
C. Domain [– 2, 4]; Range [– 3, 1]
D. Domain [– 3, 1]; Range [– 2, 4]

2. Solve: $\sqrt{19-3x} = x-3$ 2. _____

A. No solution
B. 5
C. –2, 5
D. 11/2

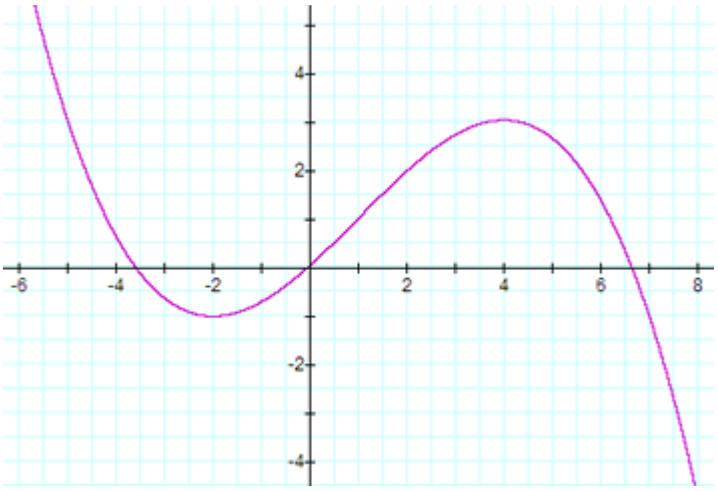
3. Determine the interval(s) on which the function is increasing. 3. _____

A. (–2, 4)

B. (–1, 3)

C. (–∞, –3.6) and (0, 6.7)

D. (–∞, –2) and (4, ∞)



4. Determine whether the graph of $y = |8 - x|$ is symmetric with respect to the origin, the *x*-axis, or the *y*-axis. 4. _____

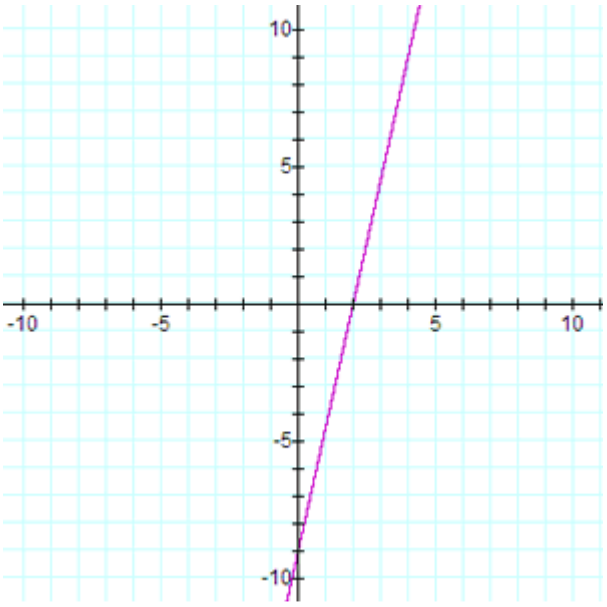
A. symmetric with respect to the *x*-axis only
B. symmetric with respect to the *y*-axis only
C. symmetric with respect to the origin only
D. not symmetric with respect to the *x*-axis, not symmetric with respect to the *y*-axis, and not symmetric with respect to the origin

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

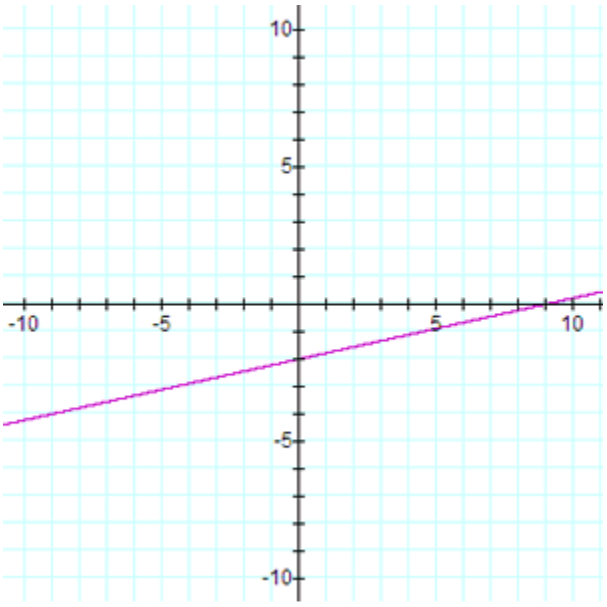
A. [–4/3, 3]
B. (–∞, –4/3] ∪ [3, ∞)
C. (–∞, –4/3]
D. [3, ∞)

6. Which of the following represents the graph of $2x + 9y = 18$? 6. _____

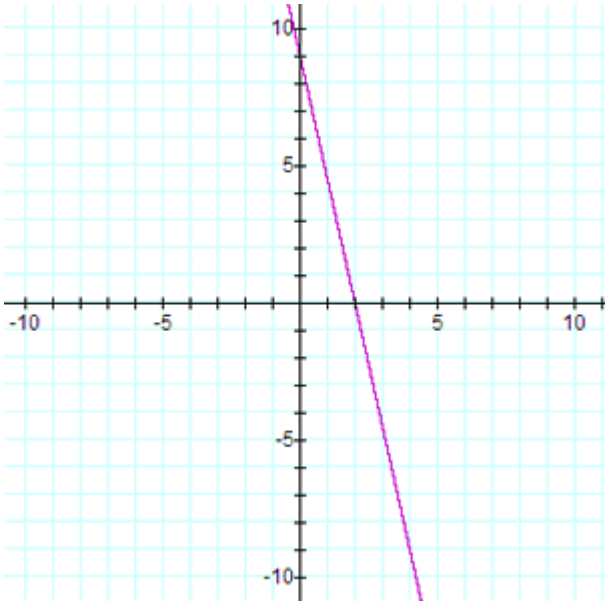
A.



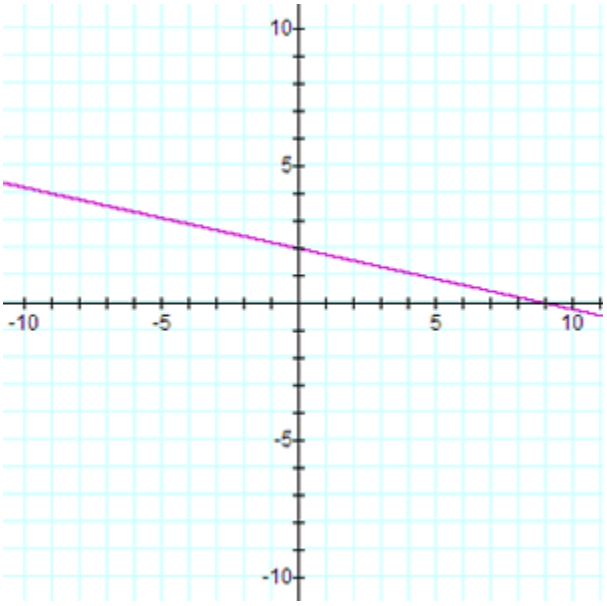
B.



C.



D.



7. Write a slope-intercept equation for a line parallel to the line $x - 4y = 6$ which passes through the point $(12, -3)$. 7. _____

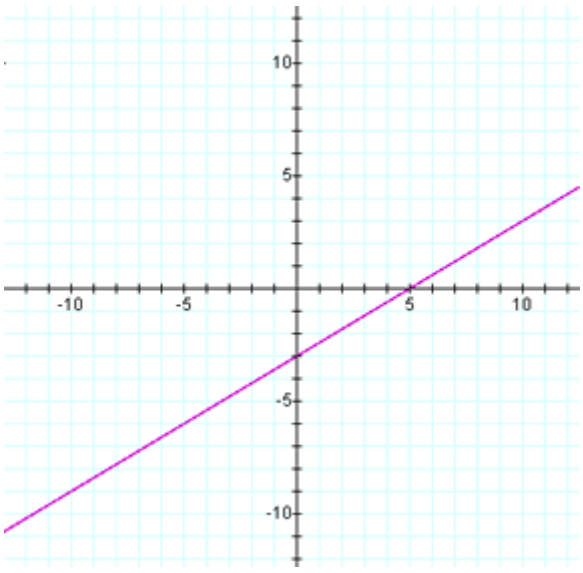
A. $y = -4x + 45$

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

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

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

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



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

9. Express as an equivalent expression: $9 \log x - \log (y + 3) + \log 1$ 9. _____

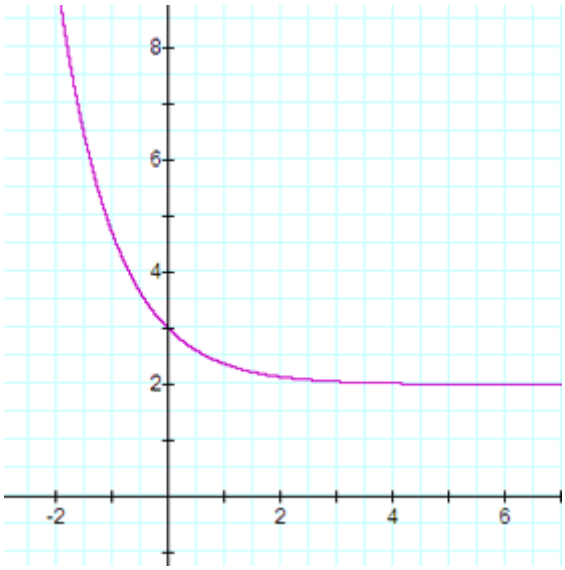
A. $\log(9x - y - 2)$

B. $\dfrac{\log x^9}{\log (y+3)}$

C. $\log\left(\dfrac{9x+1}{y+3}\right)$

D. $\log\left(\dfrac{x^9}{y+3}\right)$

10. Which of the functions corresponds to the graph? 10. _____



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

B. $f(x) = e^{-x} + 3$

C. $f(x) = -e^{x} + 3$

D. $f(x) = e^{x} + 3$

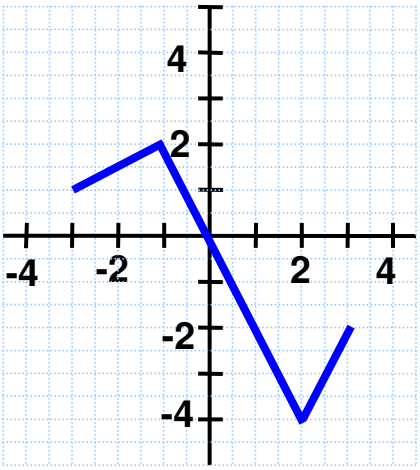
11. Suppose that for a function f, the equation $f(x) = 0$ has no real-number solutions.

Which of the following statements MUST be true? 11. _____

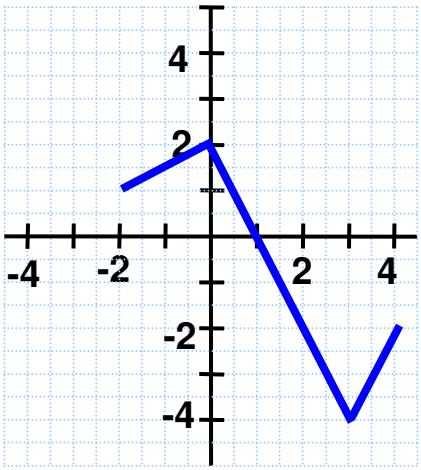
A. f is an invertible function.
B. f has no x-intercepts.
C. f has no y-intercepts.
D. $f(x) > 0$ for all x in the domain of f.

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

SHORT ANSWER:

13. Multiply and simplify: $(5 - 9i)(3 + i)$.
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: $\frac{x+1}{x-6} \geq 0$. Answer: _____

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15. A bowl of soup at 195° F. is placed in a room of constant temperature of 65° F. The temperature T of the soup t minutes after it is placed in the room is given by

$$T(t) = 65 + 130\, e^{-0.075\, t}$$

Find the temperature of the soup 26 minutes after it is placed in the room. (Round to the nearest tenth of a degree.)

Answer: _____

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

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17. Solve: $3^{7x-1} = 9$. Answer: _____

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18. Suppose $7,500 is invested in an account at an annual interest rate of 2.3% 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 $f(x) = x^2 - 8x + 10$.

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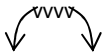
20. Consider the polynomial $P(x)$, shown in both standard form and factored form.

$$P(x)=\frac{1}{2}x^4+\frac{1}{2}x^3-\frac{7}{2}x^2-\frac{1}{2}x+3=\frac{1}{2}(x+3)(x+1)(x-1)(x-2)$$

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

A.	B.	C.	D.
			

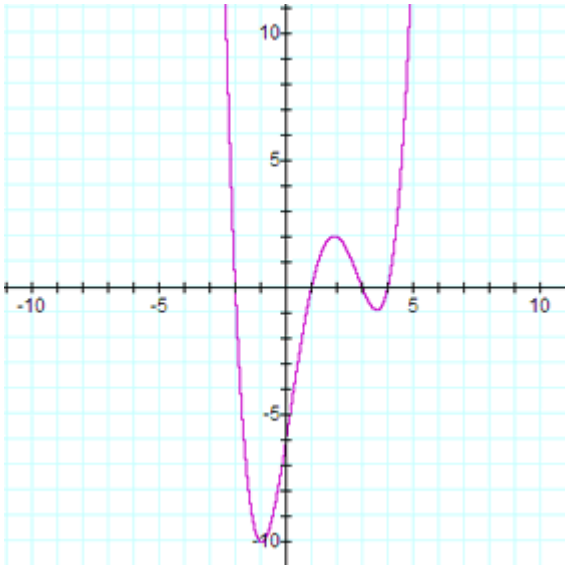
Answer: _____

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

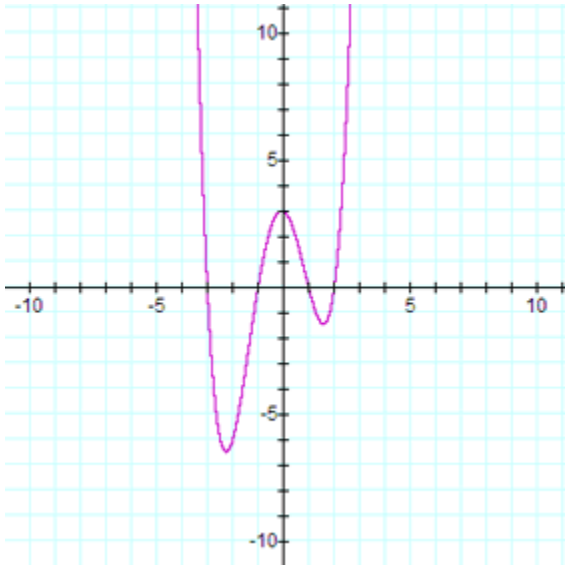
(c) State the zeros of the function. Answer: _____

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

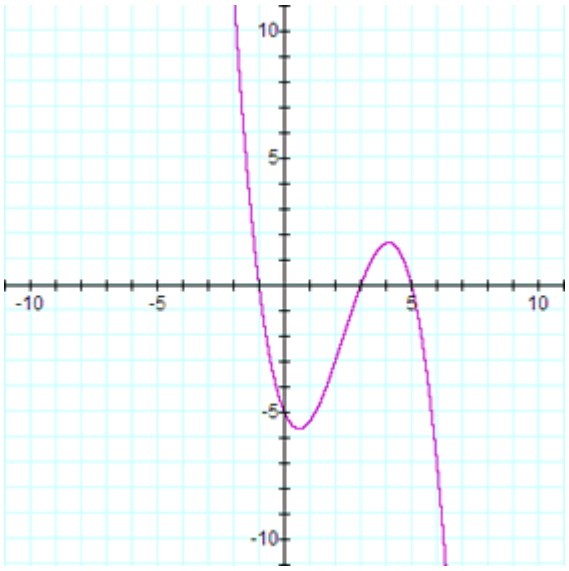
GRAPH A



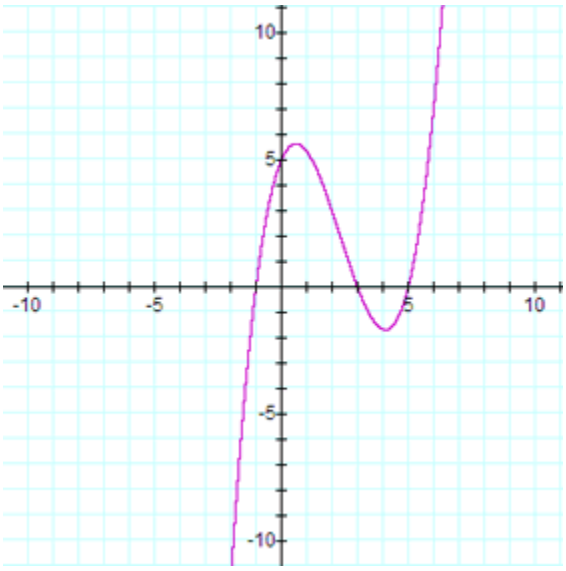
GRAPH B



GRAPH C



GRAPH D



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

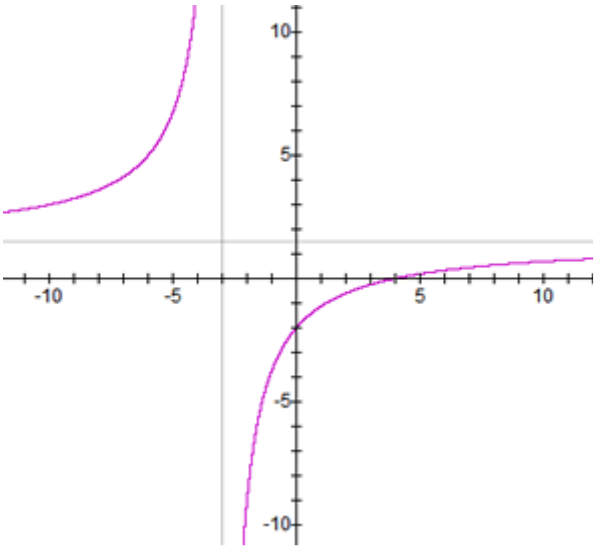
(a) State the domain. Answer: _____

(b) State the horizontal asymptote. Answer: _____

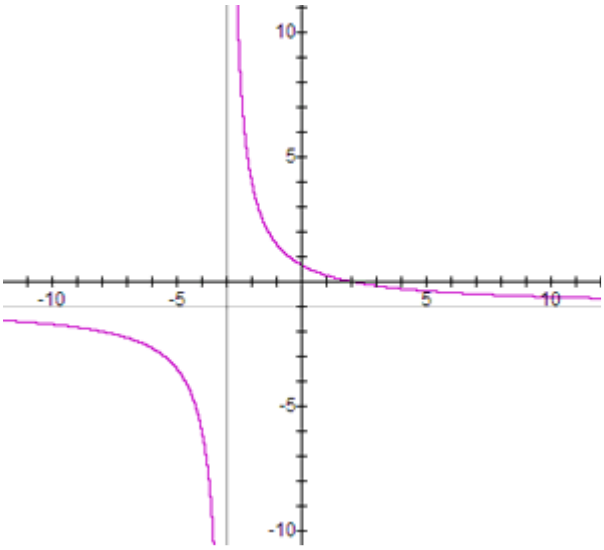
(c) State the vertical asymptote(s). Answer: _____

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

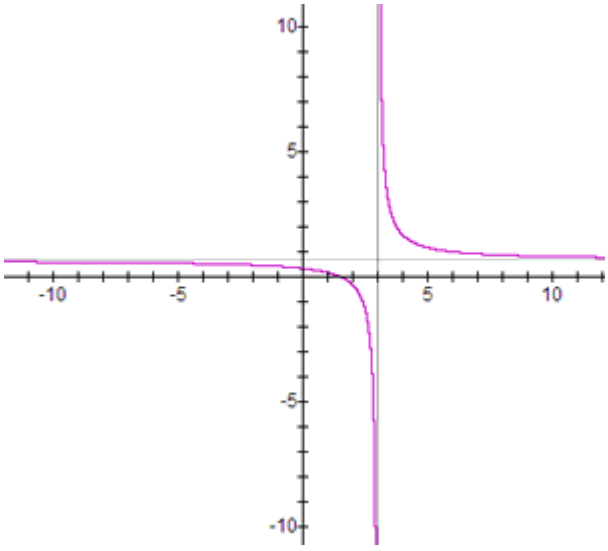
GRAPH A.



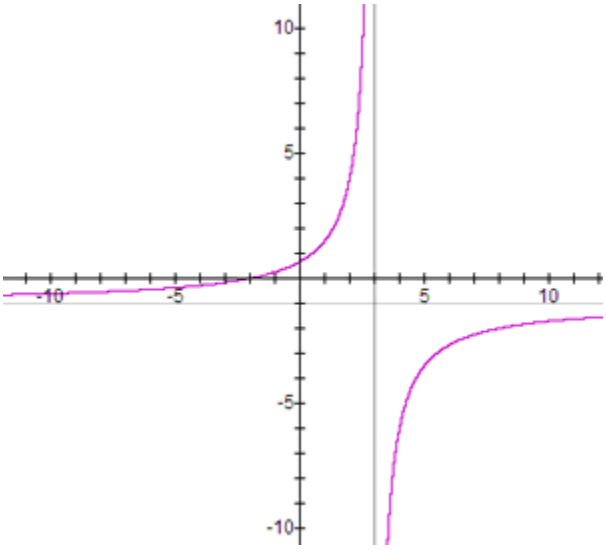
GRAPH B.



GRAPH C.



GRAPH D.



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

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

(a) Find $\left(\frac{f}{g}\right)(-1)$. **Show work.**

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

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23. Points (6, 3) and (–2, 7) 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.

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24. Find the equation for a line which passes through the points (–1, 8) and (1, 4) . Write the equation in slope-intercept form. **Show work.**

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25. A salesperson earns a base salary of $1,960 per month and a commission of 6.8% on the amount of sales. If the salesperson has a paycheck of $4,380.80 for one month, what was the amount of sales for the month? **Show work.**

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26. Let $f(x) = 4x^2 + 9$ and $g(x) = x - 5$.

(a) Find the composite function $(f \circ g)(x)$ and simplify. **Show work.**
(b) Find $(f \circ g)(3)$. **Show work.**

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27. Find the exact solutions and simplify as much as possible: $2x^2 + 11 = 10x$. **Show work.**

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28. Given the function $f(x) = \frac{1}{6}x - 7$, 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

$$P(x) = -0.25\,x^2 + 25.50x - 160$$

(a) What is the company's profit if 40 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: $\frac{x+13}{x+6} + \frac{84}{x^2-36} = 0$. **Show work.**
