## MATH 107 FINAL EXAMINATION

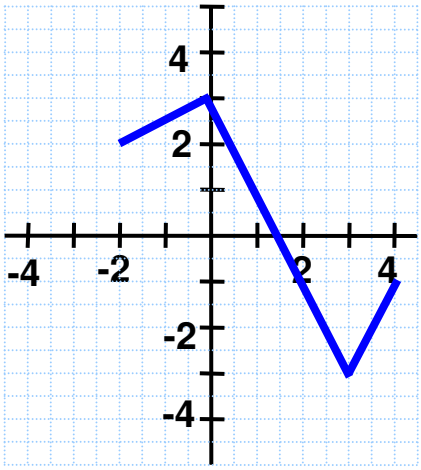
This is an open-book exam. You may refer to your text and other course materials as you work on the exam, and you may use a calculator. **You must complete the exam individually. Neither collaboration nor consultation with others is allowed.**

**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 [–3, 3]; Range [–2, 4]
B. Domain [–2, 4]; Range [–3, 3]
C. Domain [–2, 2]; Range [–1, 4]
D. Domain [–2, 3/2]; Range [3/2, 4]

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

A. –6, –2
B. –2
C. 0
D. No solution

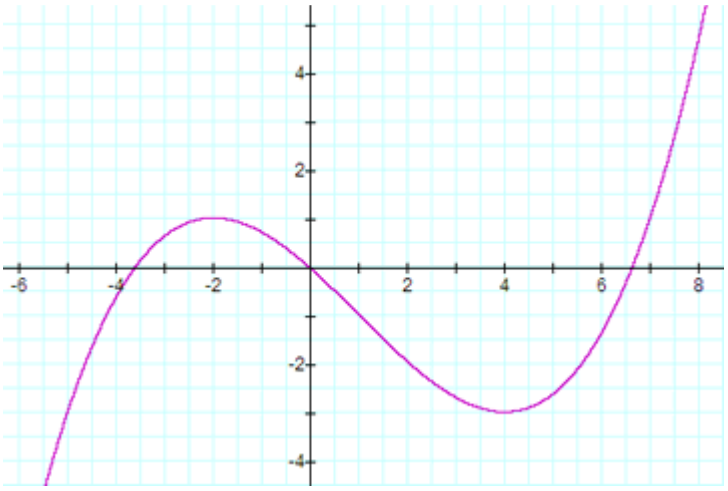
3. Determine the interval(s) on which the function is decreasing. 3. _____

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

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

C. $(-2, 4)$

D. $(-3, 1)$




4. Determine whether the graph of $7 + |x|$ is symmetric with respect to the origin, the *x*-axis, or the *y*-axis. 4. _____

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

B. symmetric with respect to the *x*-axis only

C. symmetric with respect to the *y*-axis only

D. symmetric with respect to the origin only

5. Solve, and express the answer in interval notation: $|6 - 5x| \geq 14$. 5. _____

A. $[-8/5, \infty)$

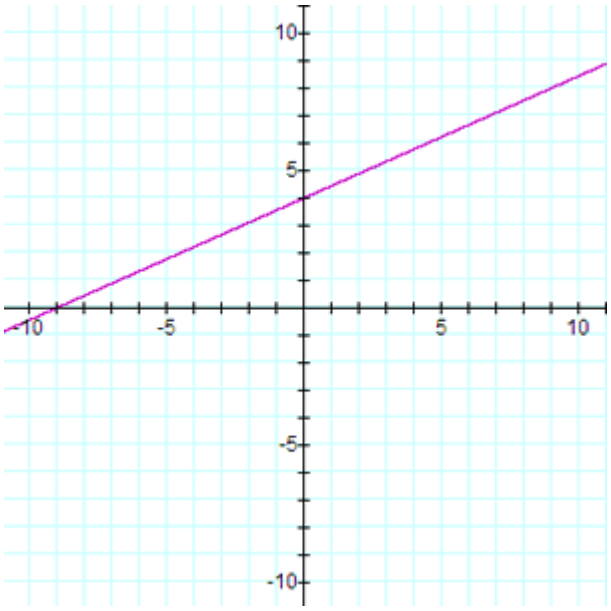
B. $[-8/5, 4]$

C. $(-\infty, -8/5] \cup [4, \infty)$

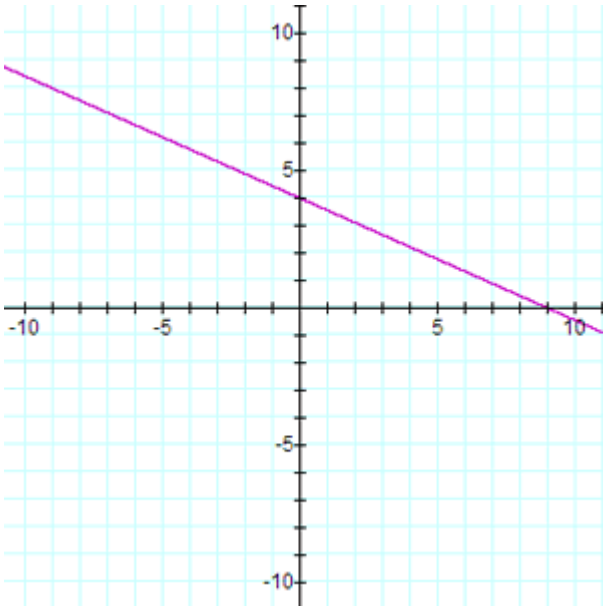
D. $(-\infty, 4] \cup [-8/5, \infty)$

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

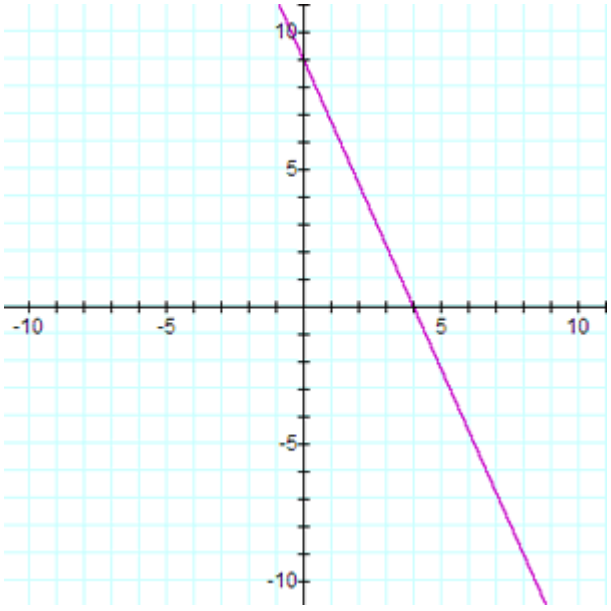
A.



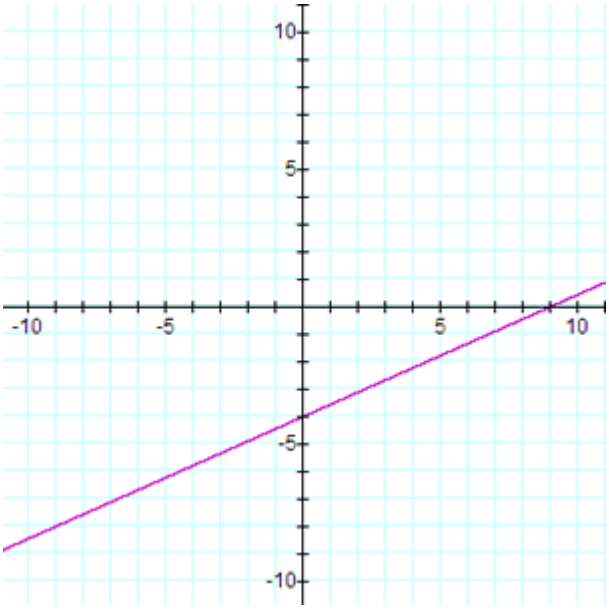

B.




C.




D.



7. Write a slope-intercept equation for a line parallel to the line $x - 8y = 3$ which passes through the point $(16, -5)$. 7. _____

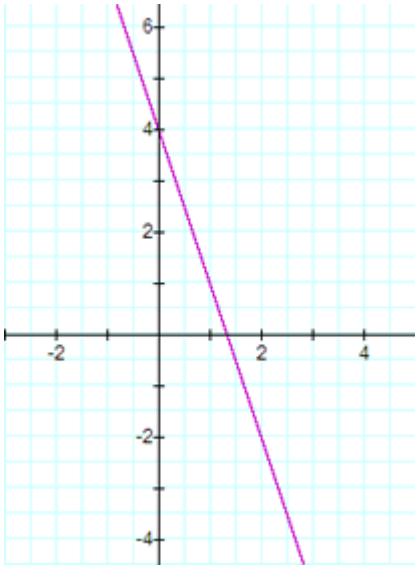
A. $y = -8x + 123$

B. $y = \frac{1}{8}x - 5$

C. $y = -\frac{1}{8}x - 3$

D. $y = \frac{1}{8}x - 7$

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 a single logarithm: $\log x - 8 \log y + \log 1$ 9. _____

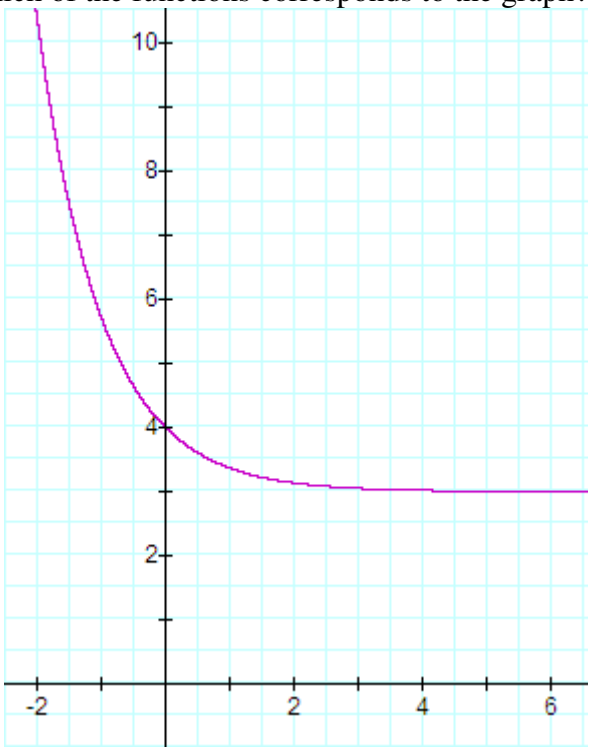
A. $\log\left(\frac{x+1}{y}\right)^8$

B. $\log\left(\frac{x}{8y+1}\right)$

C. $\log\left(\frac{x}{y^8}\right)$

D. $\log(x-8y+1)$

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




A. $f(x) = -e^x + 3$

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

C. $f(x) = e^x + 4$

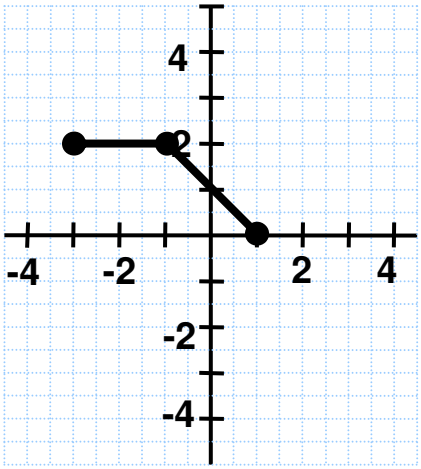
D. $f(x) = e^{-x} + 4$

11. Suppose that a function $f$ has exactly three $x$-intercepts.
Which of the following statements MUST be true? 11. _____

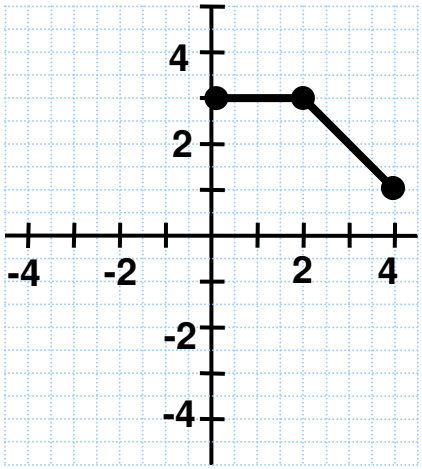
A. There are three points on the graph of $f$ which have $x$-coordinates of 0.
B. The equation $f(x) = 0$ has exactly three real-number solutions.
C. $f$ is a cubic polynomial function.
D. $f$ is an invertible function.

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

**SHORT ANSWER**:

13. Multiply and simplify: $(8 + i)(5 - 2i)$.
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: $\frac{x+4}{x-2} \geq 0$. Answer: _____

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15. A bowl of soup at 165° F. is placed in a room of constant temperature of 75° F. The temperature $T$ of the soup $t$ minutes after it is placed in the room is given by

$$T(t) = 75 + 90\, e^{-0.075\, t}$$

Find the temperature of the soup 20 minutes after it is placed in the room. (Round to the nearest 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: $7^{5x+8} = 49$. Answer: _____

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18. Suppose $3,800 is invested in an account at an annual interest rate of 7.9% 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 $f(x) = x^2 - 4x - 1$.

(a) Find the vertex. Answer: _____

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

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

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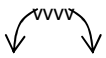
20. Consider the polynomial $P(x)$, shown in both standard form and factored form.

$$P(x)=\frac{1}{10}x^4+\frac{9}{10}x^3+\frac{19}{10}x^2-\frac{9}{10}x-2=\frac{1}{10}(x+5)(x+4)(x+1)(x-1)$$

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

| A. | B. | C. | D. |
|---|---|---|---|
|  |  |  |  |

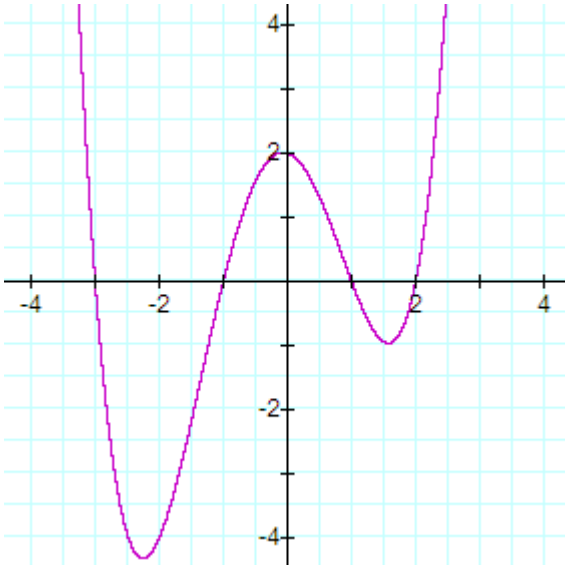
Answer: _____

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

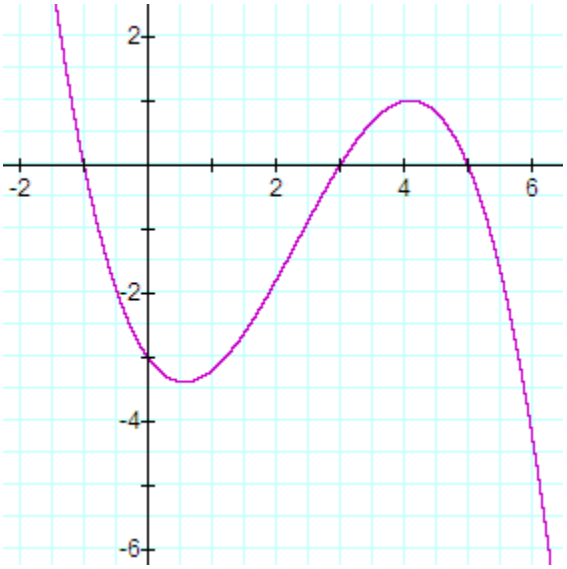
(c) State the zeros of the function. Answer: _____

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

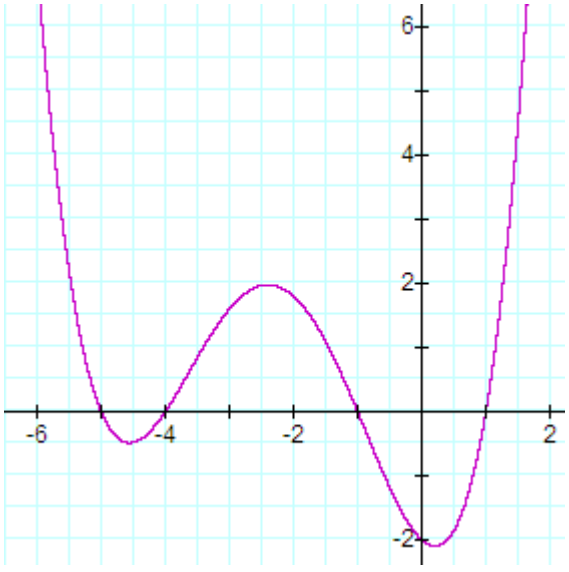
GRAPH A



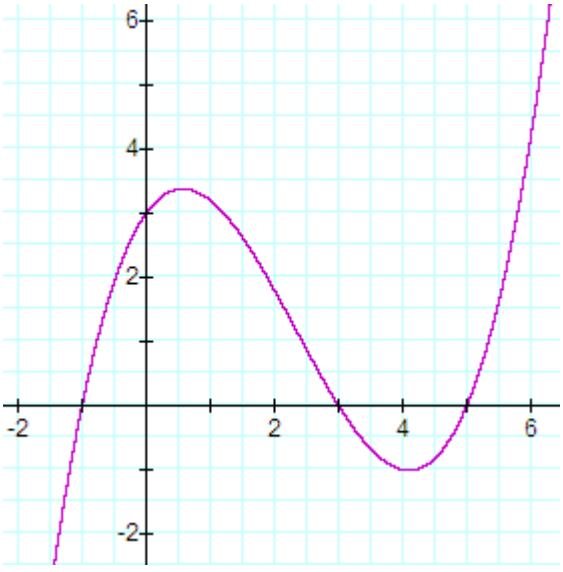

GRAPH B




GRAPH C




GRAPH D



21. Let $f(x)=\dfrac{2x-18}{x-5}$ .

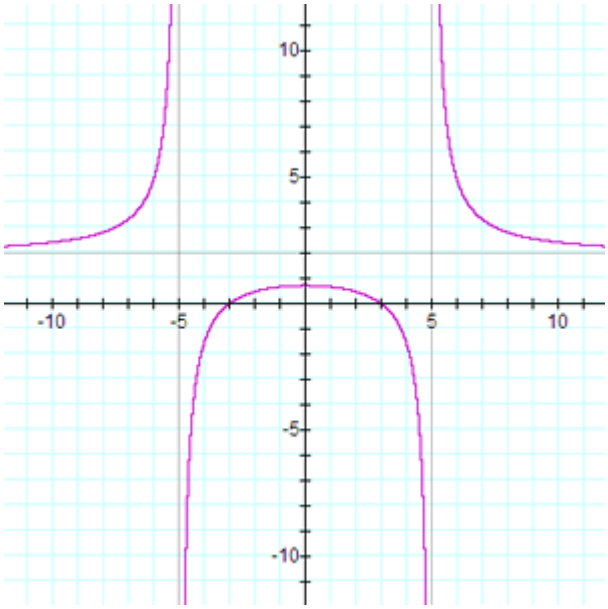
(a) State the domain. Answer: _____

(b) State the horizontal asymptote. Answer: _____

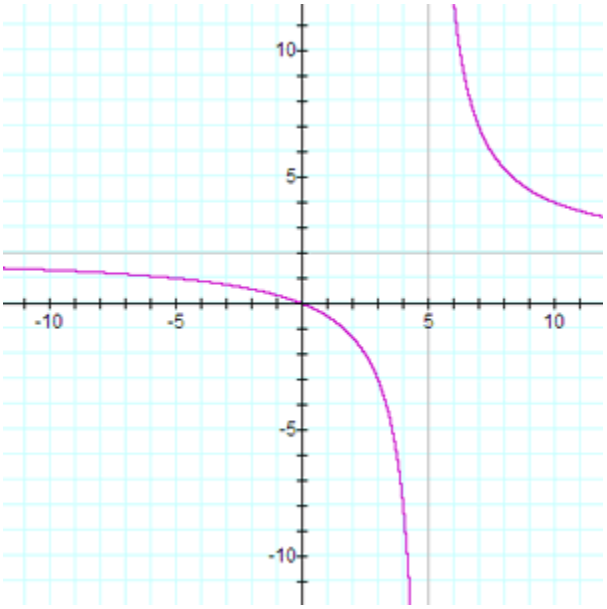
(c) State the vertical asymptote(s). Answer: _____

(d) Which of the following represents the graph of $f(x)=\dfrac{2x-18}{x-5}$ ? Answer: _____

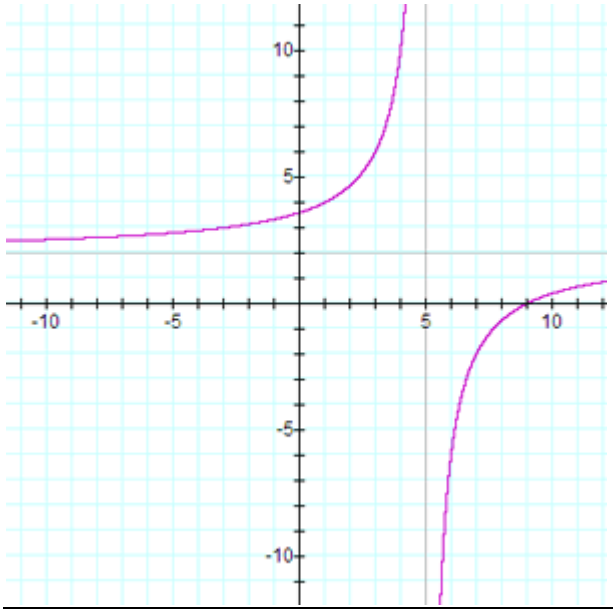
GRAPH A.



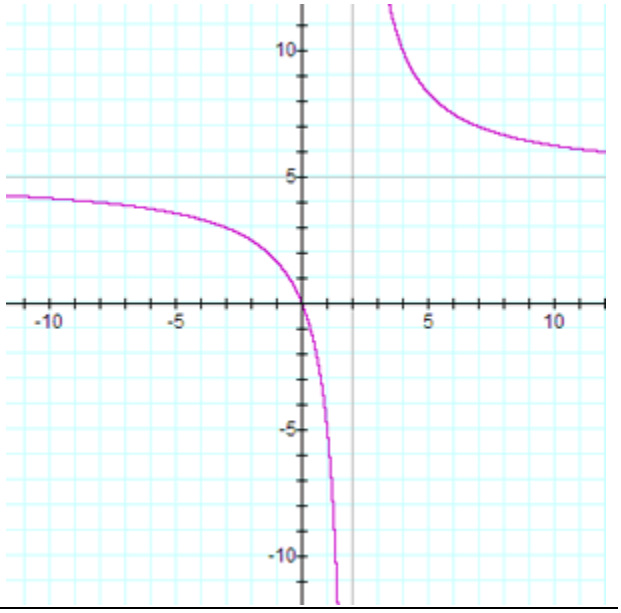

GRAPH B.




GRAPH C.




GRAPH D.



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

22. Let $f(x) = x - 3$ and $g(x) = \sqrt{x-1}$.

(a) Find $\left(\frac{f}{g}\right)(10)$. **Show work.**

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

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23. Points (3, 4) and (–5, 6) 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 (3, –6). Write the equation in slope-intercept form. **Show work.**

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25. Ron, a resident of Metropolis, pays Metropolis an annual tax of $65 plus 1.4% of his annual income. If Ron paid $1,087 in tax, what was Ron's income? **Show work.**

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26. Let $f(x) = 3x^2 + 4$ and $g(x) = x - 5$.

(a) Find the composite function $(f \circ g)(x)$ and simplify. **Show work.**
(b) Find $(f \circ g)(-1)$. **Show work.**

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27. Find the exact solutions and simplify as much as possible: $12x^2 - 1 = 2x$. **Show work.**

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28. Given the function $f(x) = \frac{7}{3} - \frac{1}{6}x$, find a formula for the inverse function. **Show work.**

29. Donut Delights, Inc. has determined that when $x$ donuts are made daily, the profit $P$, in dollars, is given by

$$P(x) = -0.002\,x^2 + 4.7x - 2100$$

(a) What is the company's profit if 800 donuts are made daily?

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

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30. Solve: $\frac{x-10}{x-7} + \frac{42}{x^2-49} = 0$. **Show work.**

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