MATH 107 FINAL EXAMINATION

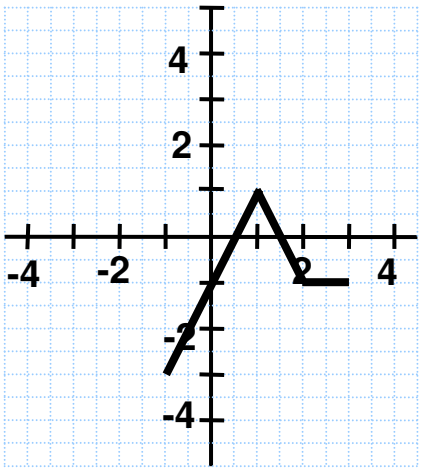
This is an open-book exam. You may refer to your text and other course materials as you work on the exam, and you may use a calculator. **You must complete the exam individually. Neither collaboration nor consultation with others is allowed.**

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. _____

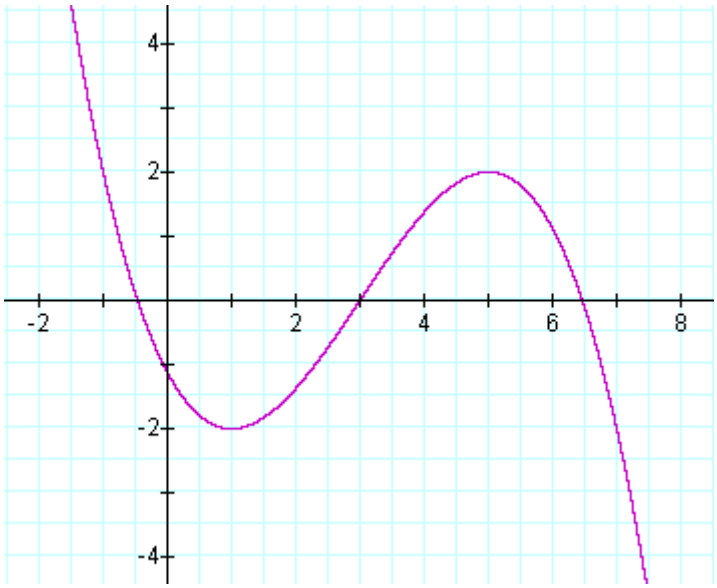


A. Domain [–1, 1]; Range [0, 1]
B. Domain [–1, 3]; Range [–3, 1]
C. Domain [–3, 1]; Range [–1, 3]
D. Domain [1/2, 3/2]; Range [0, 1]

2. Solve: $\sqrt{24-5x} = -x$ 2. _____

A. –8
B. –8, 3
C. 1/6
D. No solution

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



A. $(-\infty, -0.5)$ and (5, 6.5)

B. (– 0.5, 3)

C. (–2, 2)

D. (1, 5)

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

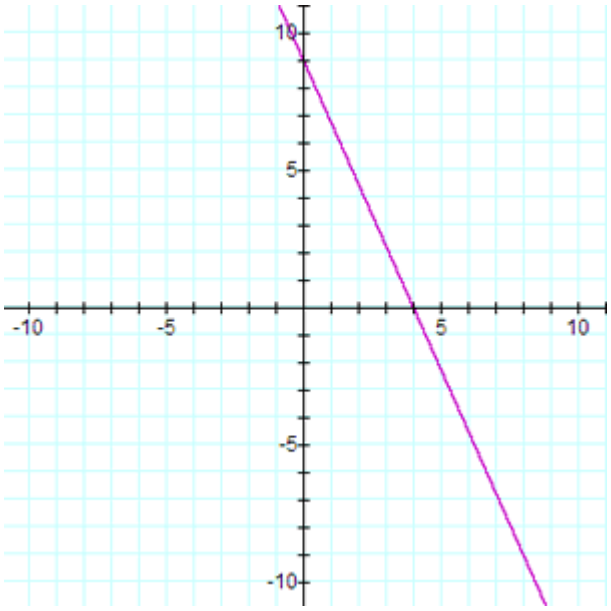
A. symmetric with respect to the origin only
B. symmetric with respect to the *x*-axis only
C. symmetric with respect to the *y*-axis only
D. not symmetric with respect to the *x*-axis, not symmetric with respect to the *y*-axis, and not symmetric with respect to the origin

5. Solve, and express the answer in interval notation: $|7 - 3x| \le 17$. 5. _____

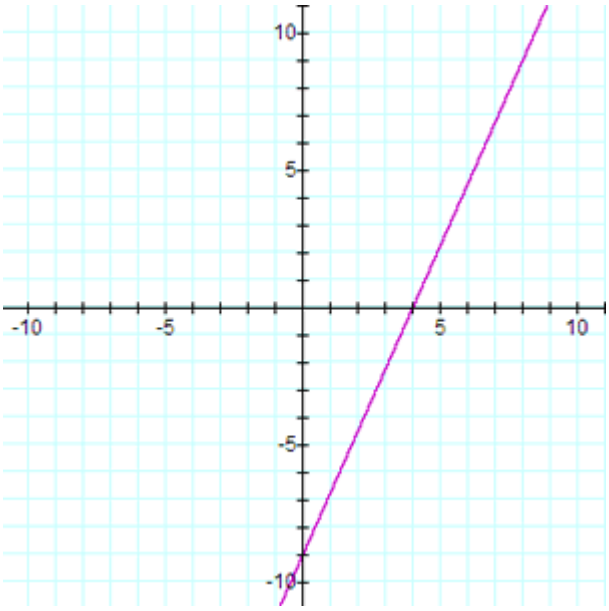
A. (–∞, –10/3]
B. [–8, 10/3]
C. [–10/3, 8]
D. (–∞, –10/3] ∪ [8, ∞)

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

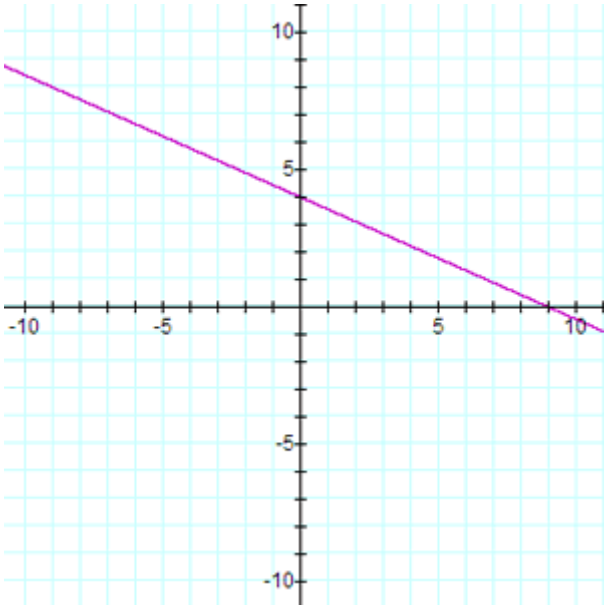
A.



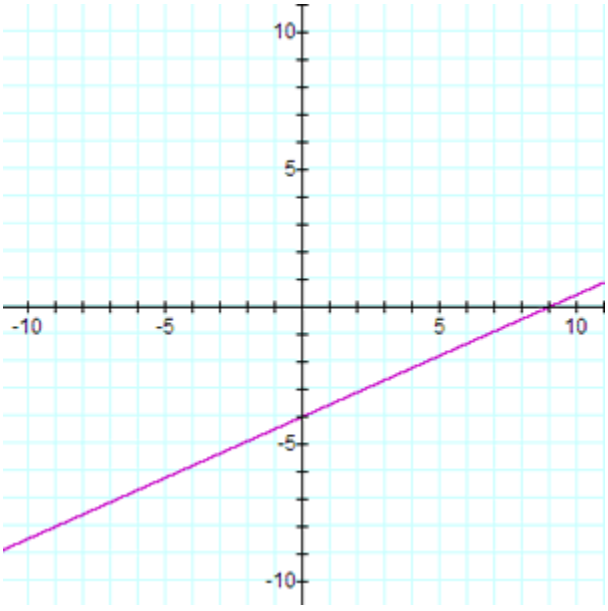
B.



C.



D.



7. Write a slope-intercept equation for a line parallel to the line $x - 8y = 16$ which passes through the point $(24, -1)$. 7. _____

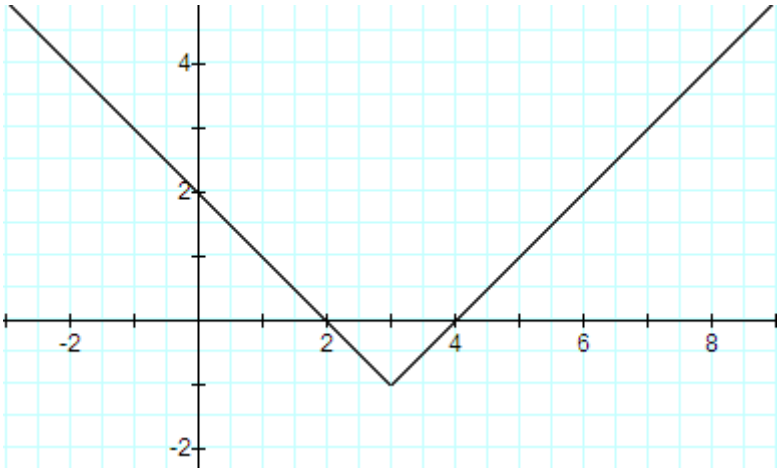
A. $y = -2x + 47$

B. $y = -\frac{1}{8}x - 2$

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

D. $y = \frac{1}{8}x - 4$

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: $6 \log x - \log y + \log 1$ 9. _____

A. $\log\left(\frac{x^6}{y}\right)$

B. $\log\left(\frac{x+1}{y}\right)^6$

C. $\log(6x - y + 1)$

D. $\log(6x - y)$

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

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

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

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

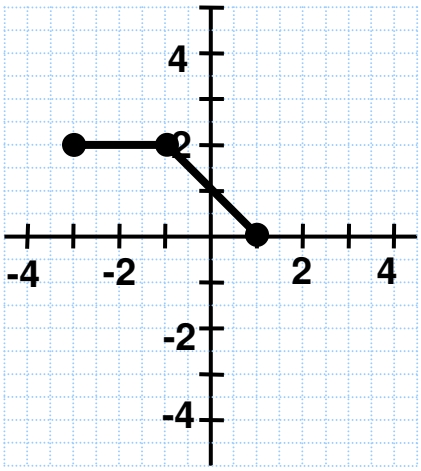
D. $f(x) = -e^{x} + 3$

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

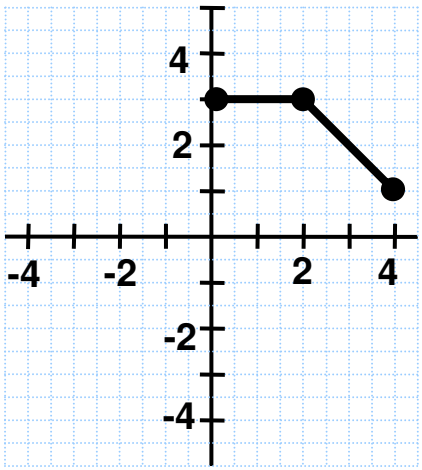
A. f is a linear function.
B. f is an invertible function.
C. $f(x) \geq 0$ for all x in the domain of f.
D. The equation $f(x) = 0$ has exactly one real-number solution.

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

SHORT ANSWER:

13. Multiply and simplify: $(4 + 7i)^2$.
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: $\frac{x+5}{x+1} \geq 0$. Answer: _____

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15. A can of soda at 81° F. is placed in a refrigerator that maintains a constant temperature of 38° F. The temperature T of the soda t minutes after it is placed in the refrigerator is given by

$$T(t) = 38 + 43e^{-0.058t}$$

Find the temperature of the soda 20 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: $\log_8\left(\frac{1}{64}\right)$. Answer: _____

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17. Solve: $7^{6x+1} = 49$. Answer: _____

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18. Suppose $9,400 is invested in an account at an annual interest rate of 3.5% 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 $f(x) = x^2 + 8x + 9$.

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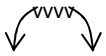
20. Consider the polynomial $P(x)$, shown in both standard form and factored form.

$$P(x) = -\frac{1}{3}x^3 + \frac{7}{3}x^2 - \frac{7}{3}x - 5 = -\frac{1}{3}(x+1)(x-3)(x-5)$$

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

A.	B.	C.	D.
			

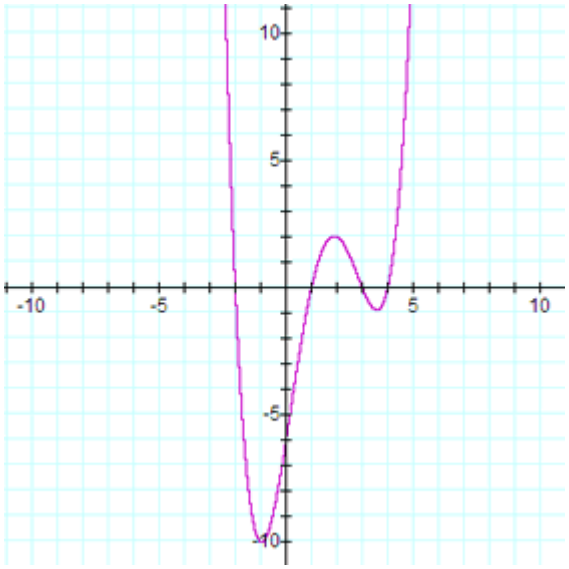
Answer: _____

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

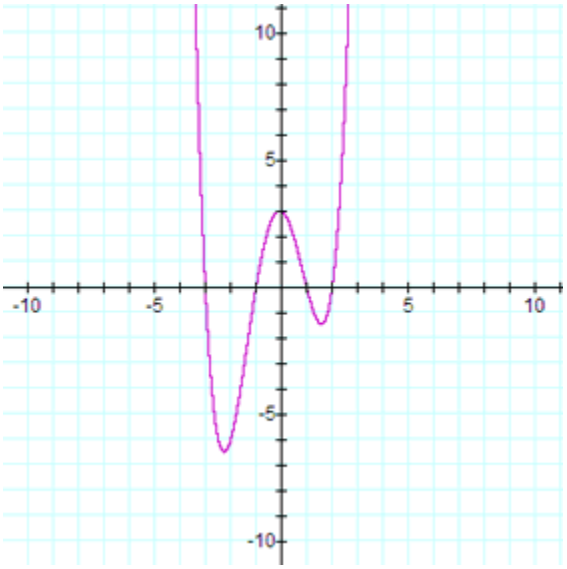
(c) State the y-intercept. Answer: _____

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

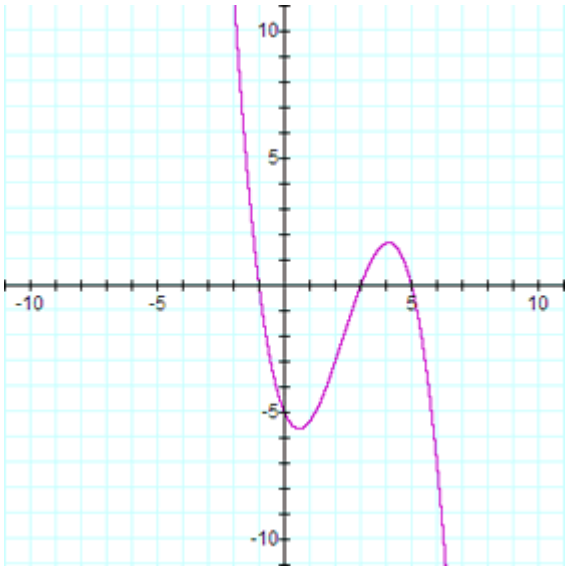
GRAPH A



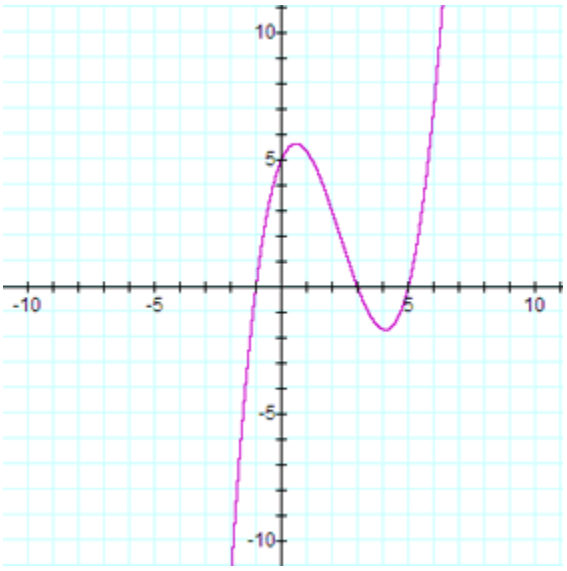
GRAPH B



GRAPH C



GRAPH D



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

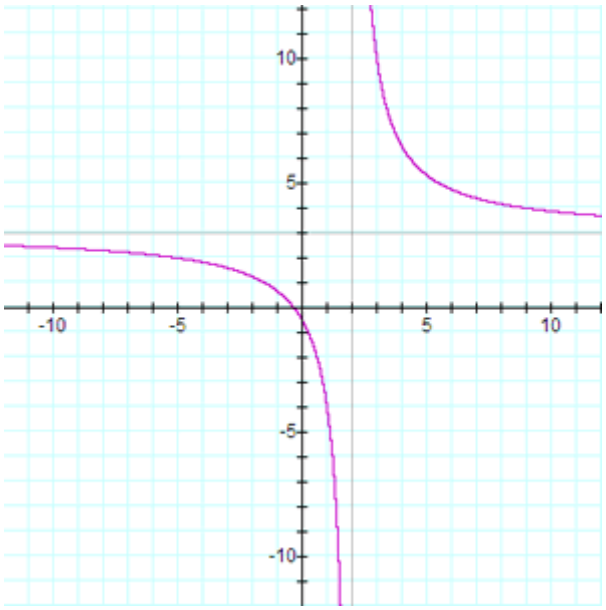
(a) State the domain. Answer: _____

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

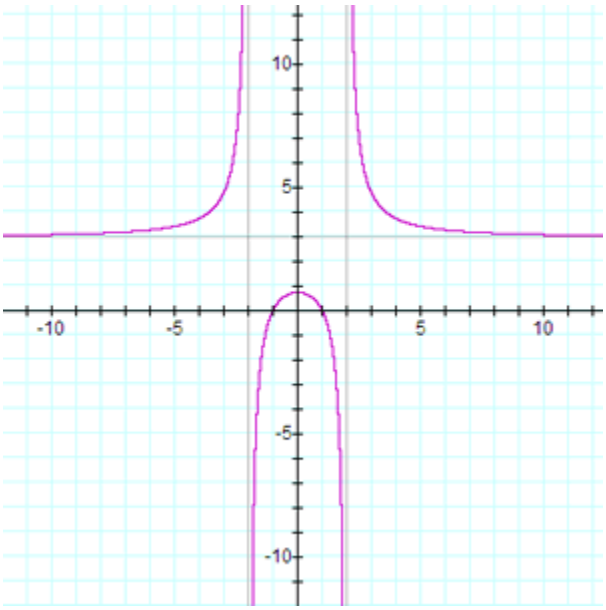
(c) State the horizontal asymptote. Answer: _____

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

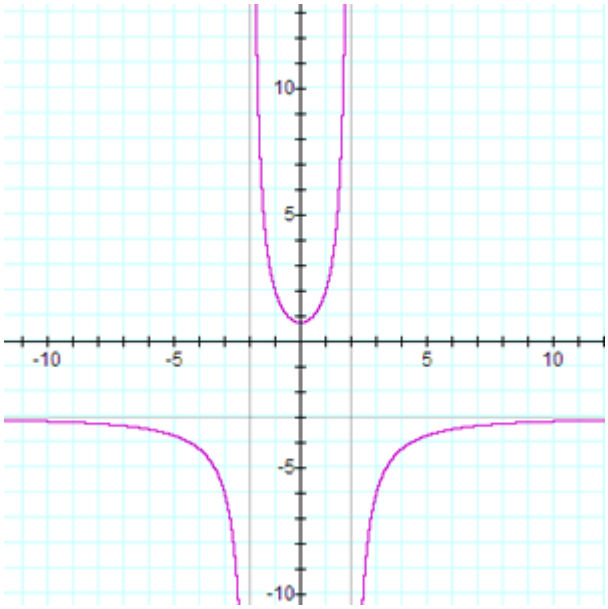
GRAPH A.



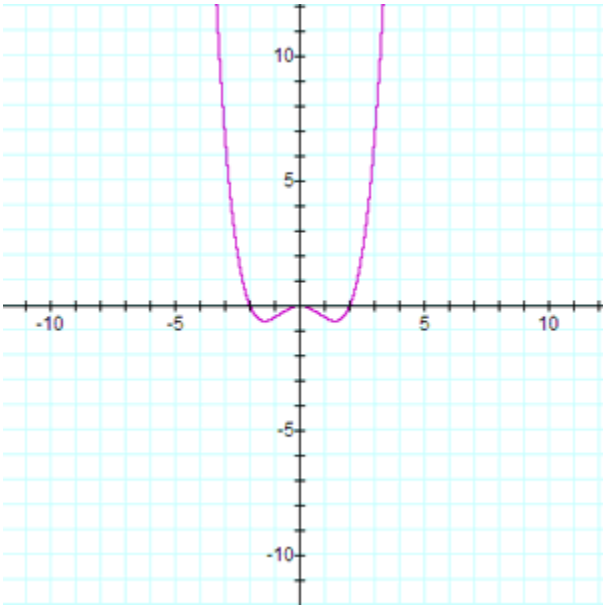
GRAPH B.



GRAPH C.



GRAPH D.



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

22. Let $f(x) = \sqrt{x-4}$ and $g(x) = x - 8$.

(a) Find $\left(\frac{f}{g}\right)(13)$. **Show work.**

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

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23. Points (–5, 2) and (1, 8) 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 *y*-axis.

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24. Find the equation for a line which passes through the points (– 6, 3) and (– 4, –9). Write the equation in slope-intercept form. **Show work.**

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25. Pete, a resident of Metropolis, pays Metropolis an annual tax of $70 plus 1.8% of his annual income. If Pete paid $1,186 in tax, what was Pete's income? **Show work.**

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26. Let $f(x) = 2x^2 - 7$ and $g(x) = x - 6$.

(a) Find the composite function $(f \circ g)(x)$ and simplify. **Show work.**
(b) Find $(f \circ g)(5)$. **Show work.**

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27. Find the exact solutions and simplify as much as possible: $2x^2 = 8x + 3$. **Show work.**

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

$$P(x) = -0.25\,x^2 + 24.50x - 160$$

(a) What is the company's profit if 32 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: $\frac{x+11}{x+3} + \frac{48}{x^2-9} = 0$. **Show work.**
