MATH 107 FINAL EXAMINATION

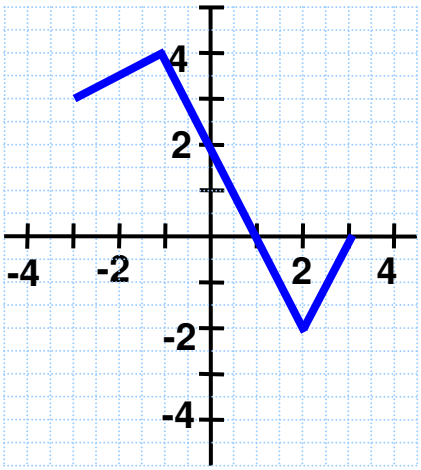
This is an open-book exam. You may refer to your text and other course materials as you work on the exam, and you may use a calculator. **You must complete the exam individually. Neither collaboration nor consultation with others is allowed.**

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 [–3, 3]; Range [0, 3]
C. Domain [–2, 4]; Range [–3, 3]
D. Domain [–1, 4]; Range [–2, 2]

2. Solve: $\sqrt{2x+20} = x+6$ 2. _____

A. –8, –2
B. –2
C. –14
D. No solution

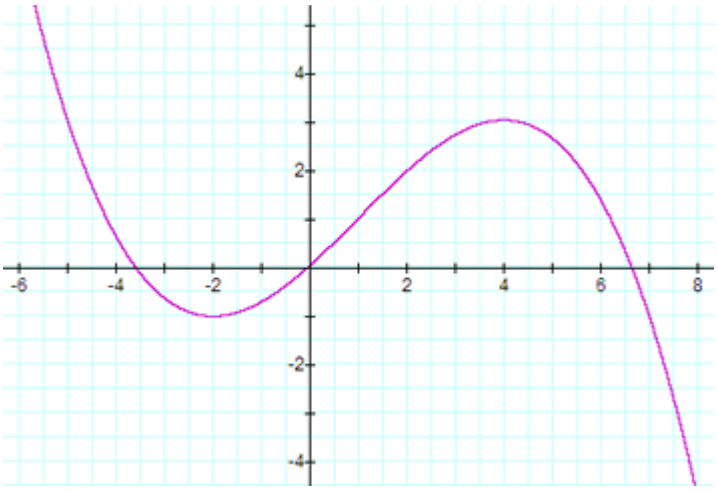
3. Determine the interval(s) on which the function is decreasing. 3. _____

A. (–3.6, 0) and (6.7, ∞)

B. (–2, 4)

C. (–∞, –2) and (4, ∞)

D. (–1, 3)



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

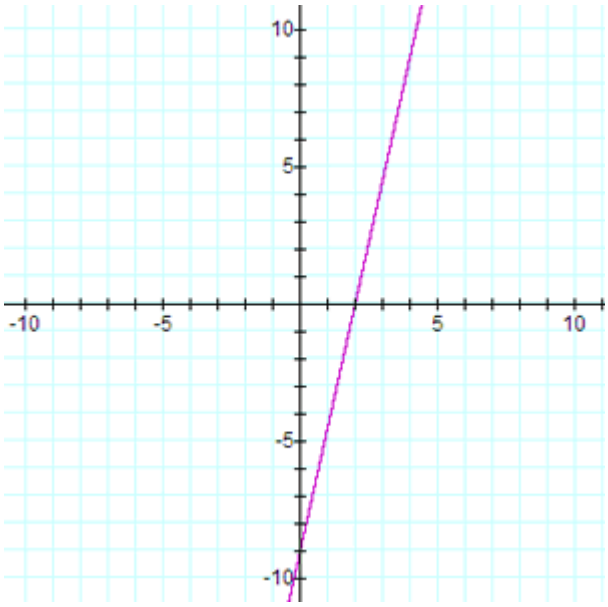
A. symmetric with respect to the *x*-axis only
B. symmetric with respect to the *y*-axis only
C. symmetric with respect to the origin only
D. not symmetric with respect to the *x*-axis, not symmetric with respect to the *y*-axis, and not symmetric with respect to the origin

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

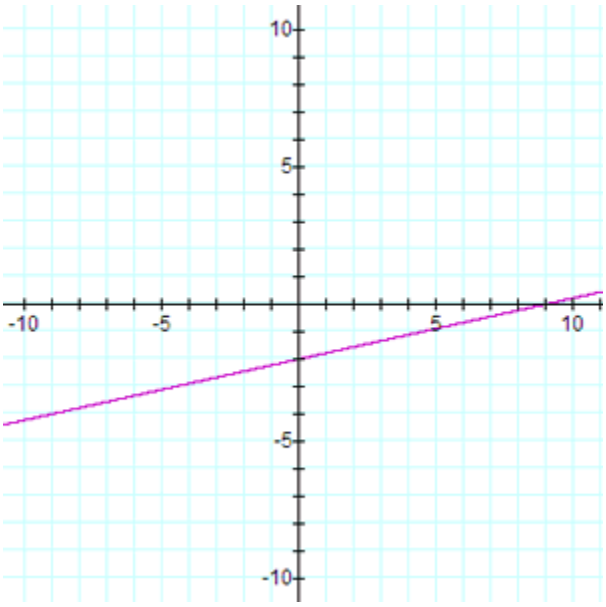
A. [4/3, ∞)
B. (–∞, –4/3] ∪ [3, ∞)
C. (–∞, 3] ∪ [–4/3, ∞)
D. [–4/3, 3]

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

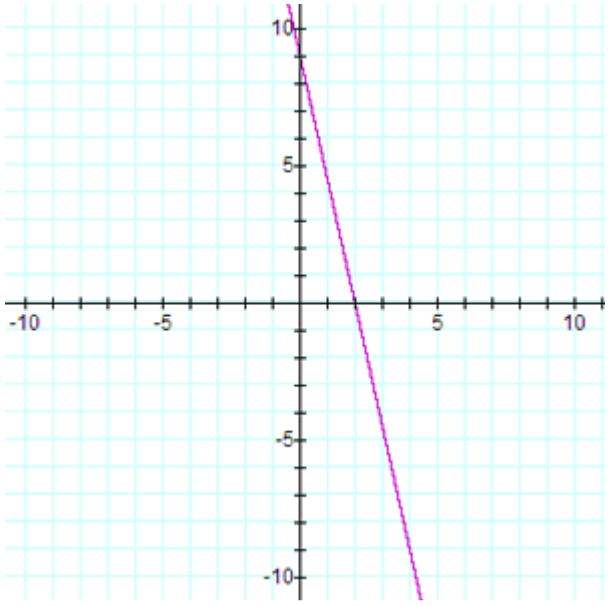
A.



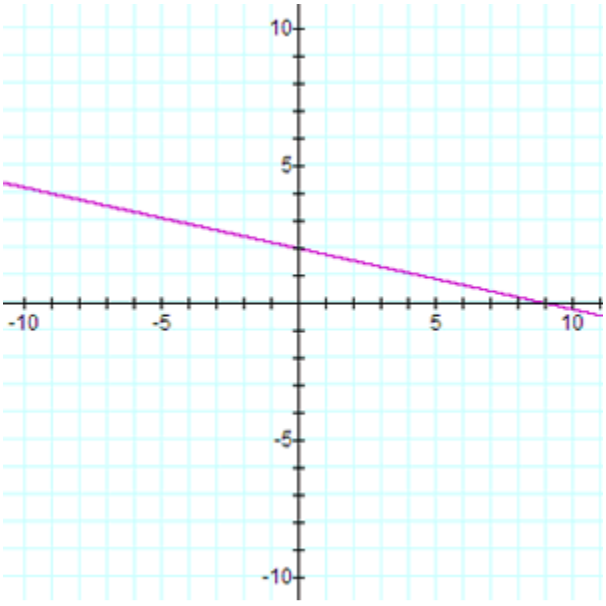
B.



C.



D.



7. Write a slope-intercept equation for a line parallel to the line $x + 3y = 8$ which passes through the point $(-4, 5)$. 7. _____

A. $y = -\frac{1}{3}x + \frac{11}{3}$

B. $y = -\frac{1}{3}x + 5$

C. $y = \frac{1}{3}x + 5$

D. $y = -3x - 7$

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

A. It is the graph of an absolute value relation.
B. It is the graph of a function but not one-to-one
C. It is the graph of a function and it is one-to-one.
D. It is not the graph of a function.

9. Express as a single logarithm: $3 \log (x + 2) + \log 1 - \log y$ 9. _____

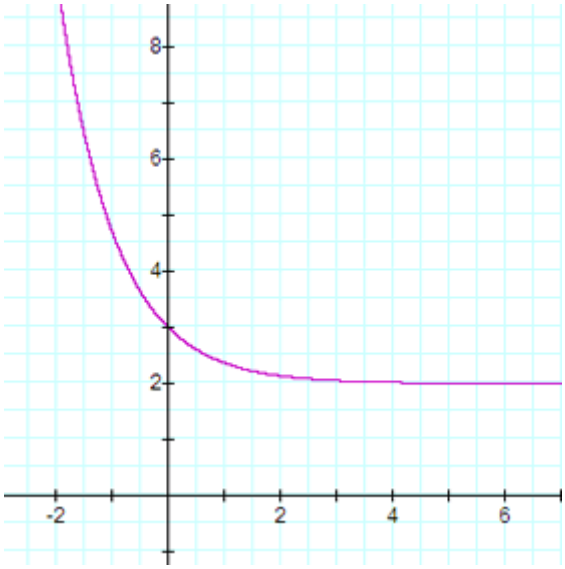
A. $\dfrac{6\log(x)+1}{\log y}$

B. $\log\left(\dfrac{x^3+8}{y}\right)$

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

D. $\log(3x+7-y)$

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



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

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

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

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

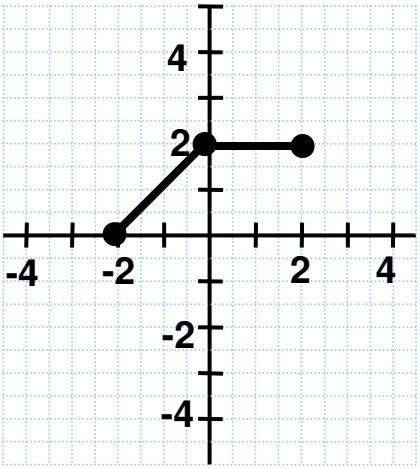
11. Suppose that a function f has no x-intercepts.

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

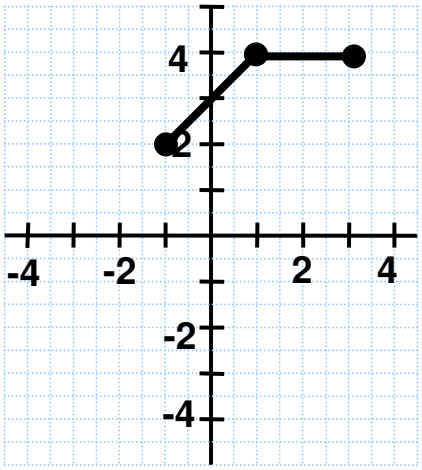
A. The graph of f has no points whose x-coordinate is 0.
B. The equation $f(x) = 0$ has no real-number solution.
C. f is an invertible function.
D. The graph of f is a horizontal line.

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

SHORT ANSWER:

13. Multiply and simplify: $(3 - 5i)(4 + 7i)$.
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: $\frac{x-5}{x-8} \geq 0$. Answer: _____

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15. A can of soda at 83° 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

$$T(t) = 35 + 48\, e^{-0.058\, t}$$

Find the temperature of the soda 15 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: $\log_4\left(\frac{1}{16}\right)$. Answer: _____

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17. Solve: $8^{2x-7} = 64$. Answer: _____

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18. Suppose $1,200 is invested in an account at an annual interest rate of 7.6% 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 $f(x) = x^2 - 10x + 45$.

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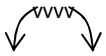
20. Consider the polynomial $P(x)$, shown in both standard form and factored form.

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

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

A.	B.	C.	D.
			

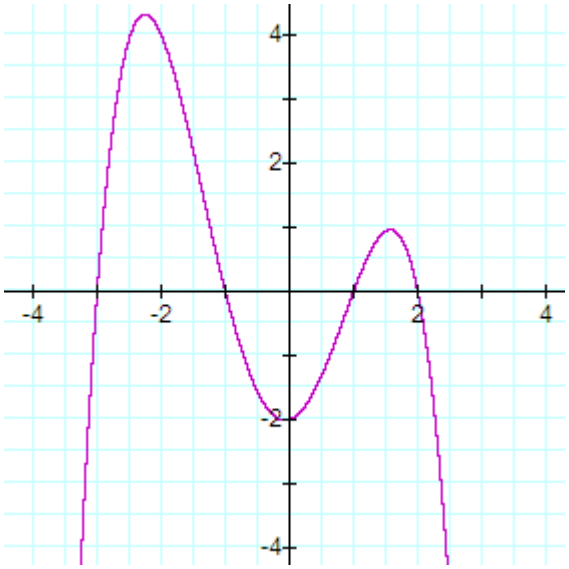
Answer: _____

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

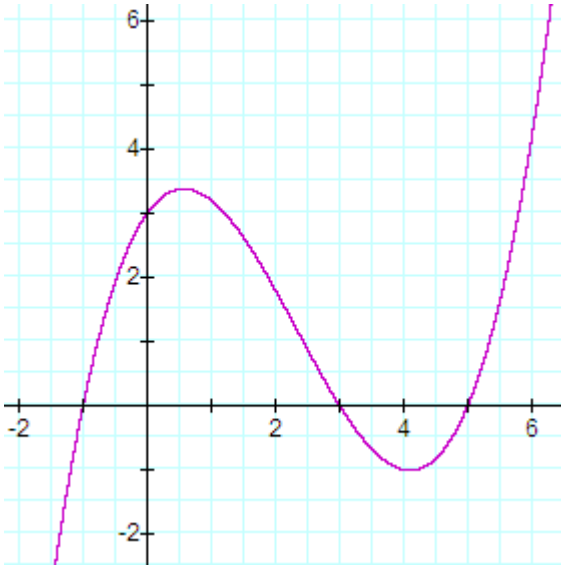
(c) State the zeros of the function. Answer: _____

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

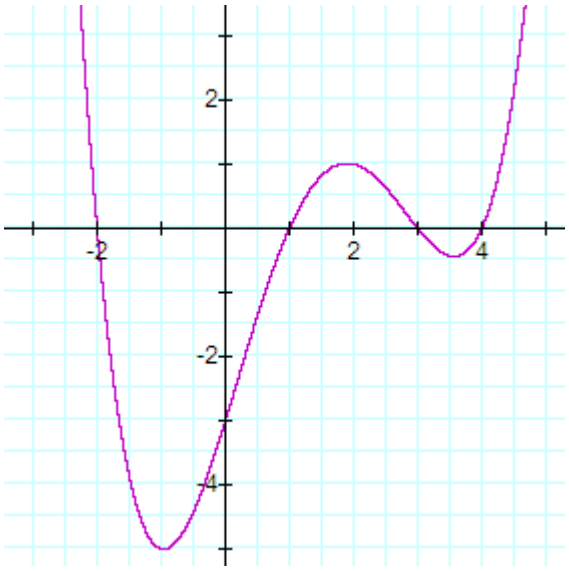
GRAPH A



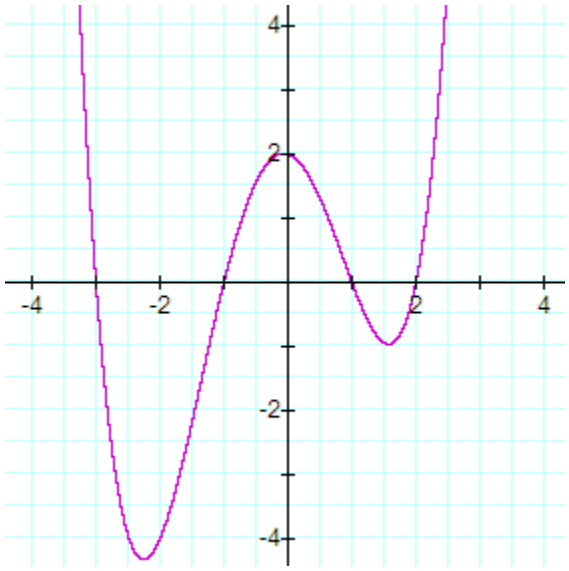
GRAPH B



GRAPH C



GRAPH D



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

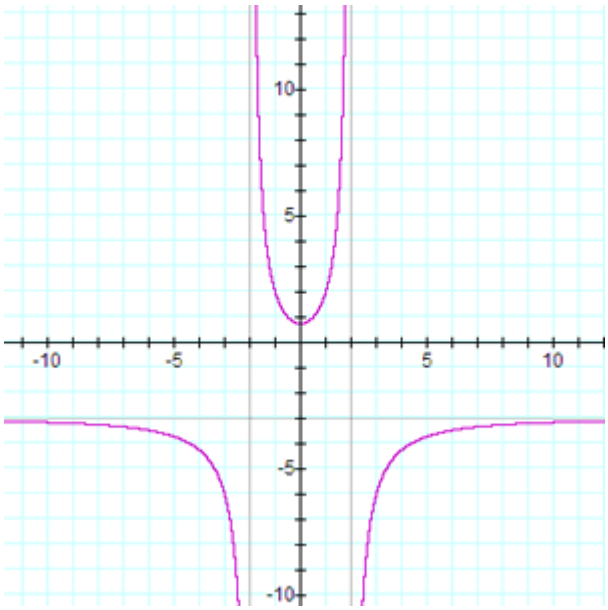
(a) State the domain. Answer: _____

(b) State the horizontal asymptote. Answer: _____

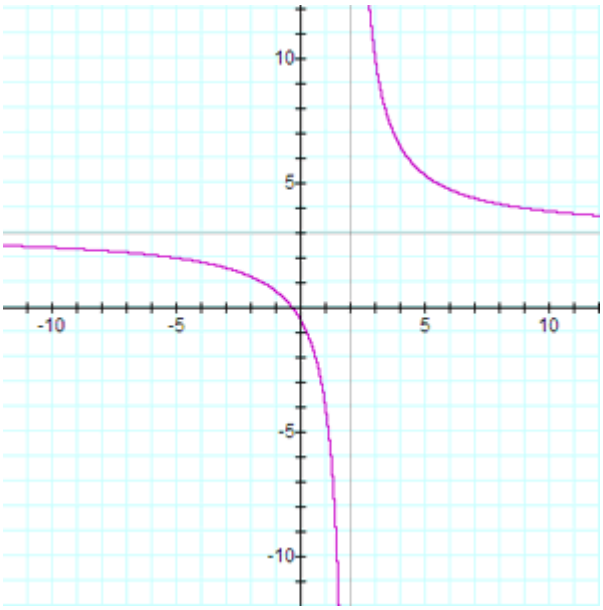
(c) State the vertical asymptote(s). Answer: _____

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

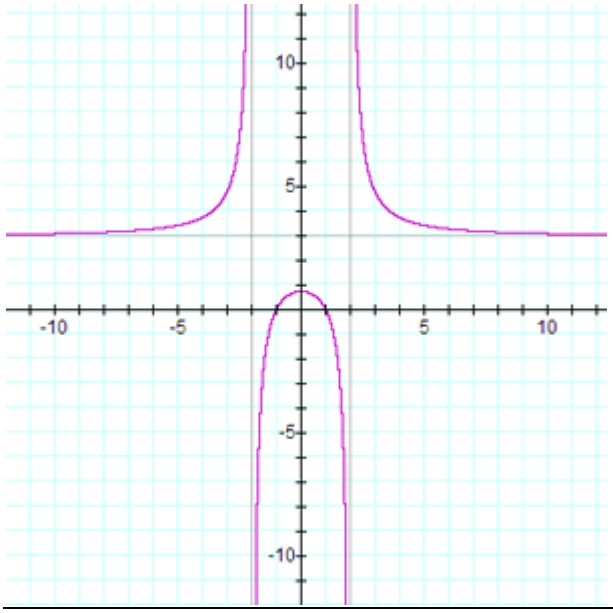
GRAPH A.



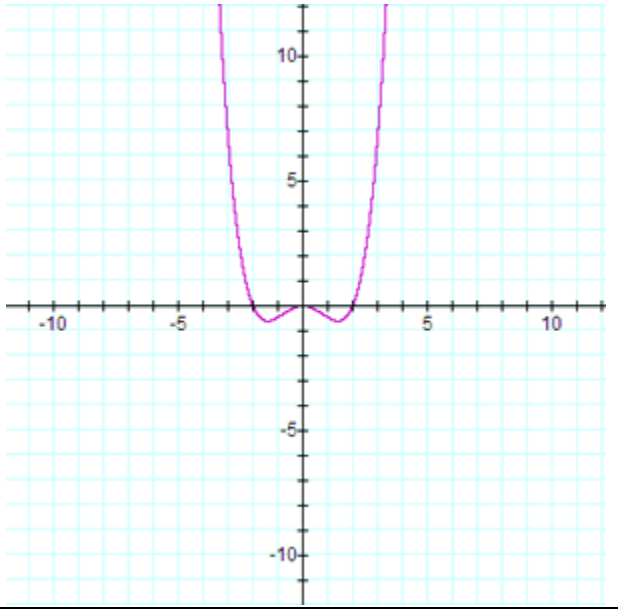
GRAPH B.



GRAPH C.



GRAPH D.



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

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

(a) Find $\left(\frac{f}{g}\right)(11)$. **Show work.**

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

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23. Points (–3, 3) and (1, 9) 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 (–5, 6) and (–7, 8). Write the equation in slope-intercept form. **Show work.**

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25. Elise, a resident of Metropolis, pays Metropolis an annual tax of $50 plus 1.6% of her annual income. If Elise paid $1,202 in tax, what was Elise's income? **Show work.**

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26. Let $f(x) = 2x^2 - 9$ and $g(x) = x - 6$.

(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: $5x^2 + 1 = 8x$. **Show work.**

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28. Given the function $f(x) = \frac{5}{8} - \frac{1}{8}x$, 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

$$P(x) = -0.002\,x^2 + 4.6x - 1600$$

(a) What is the company's profit if 700 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: $\dfrac{x+9}{x+7} + \dfrac{28}{x^2-49} = 0$. **Show work.**
