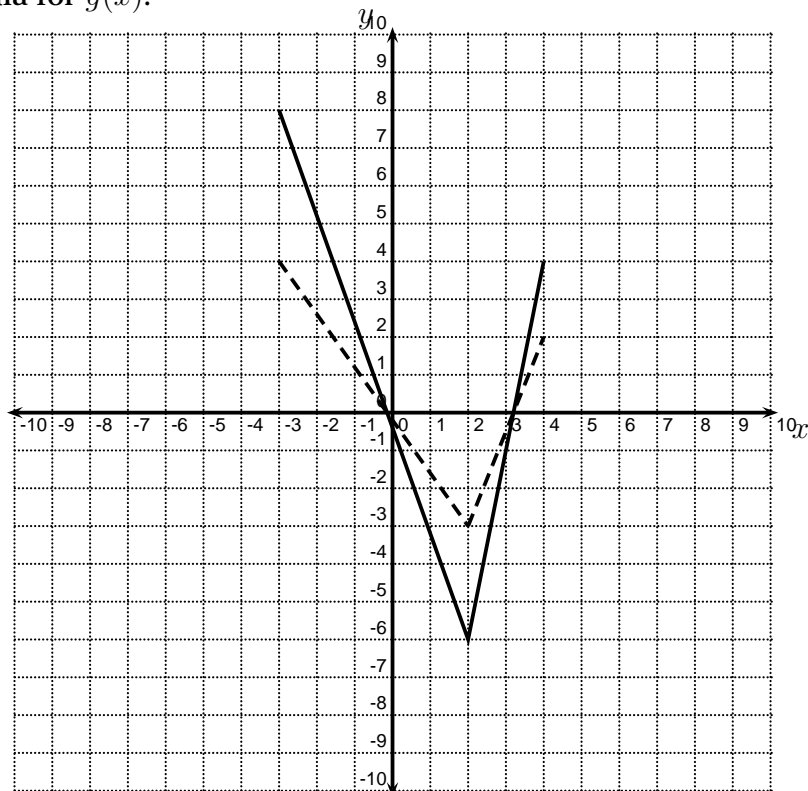1. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Find a formula for $g(x)$.

Possibilities:

(a) $g(x) = f(2x)$

(b) $g(x) = 2f(x)$

(c) $g(x) = f\left(\frac{1}{2}x\right)$

(d) $g(x) = -2f(x)$

(e) $g(x) = \frac{1}{2}f(x)$

2. Suppose that the graph of $y = f(x)$ contains the point (5,3). Find a point on the graph of $y = 2f(x) - 4$.

3. Let $f(x) = |x + 4| - 4$. Find the average rate of change of $f(x)$ between $x = -8$ and $x = 9$.

   Possibilities:

   (a) $-9/17$

   (b) 9

   (c) $17/9$

   (d) $9/17$

   (e) -9

4. Suppose that the graph of $y = f(x)$ contains the point (10,-20). Find a point on the graph of $y = f(5x) + 7$.

5. Let $f(x) = x^2 + 6x$. Find the average rate of change of $f(x)$ from $x = a$ to $x = a + h$. Assume $h \neq 0$.

   Possibilities:

   (a) $-2a - h - 6$

   (b) $\dfrac{2ah + h^2 + 12a + 6h}{h}$

   (c) 1

   (d) $2a + h + 6$

   (e) $\dfrac{h^2 + 6h}{h}$

6. The mass $m(t)$ remaining after t years from a 80-gram sample of a radioactive elmement is given by $m(t) = 80e^{-0.2t}$. When will the mass remaining equal 8 grams? Round your answer to the nearest hundredth of a year.

   Possibilities:

   (a) About 0.18 years

   (b) About 11.51 years

   (c) About 2.30 years

   (d) About 0.12 years

   (e) About 5.00 years

7. Solve.
$$\log_8(x - 5) + \log_8(x + 2) = 1$$
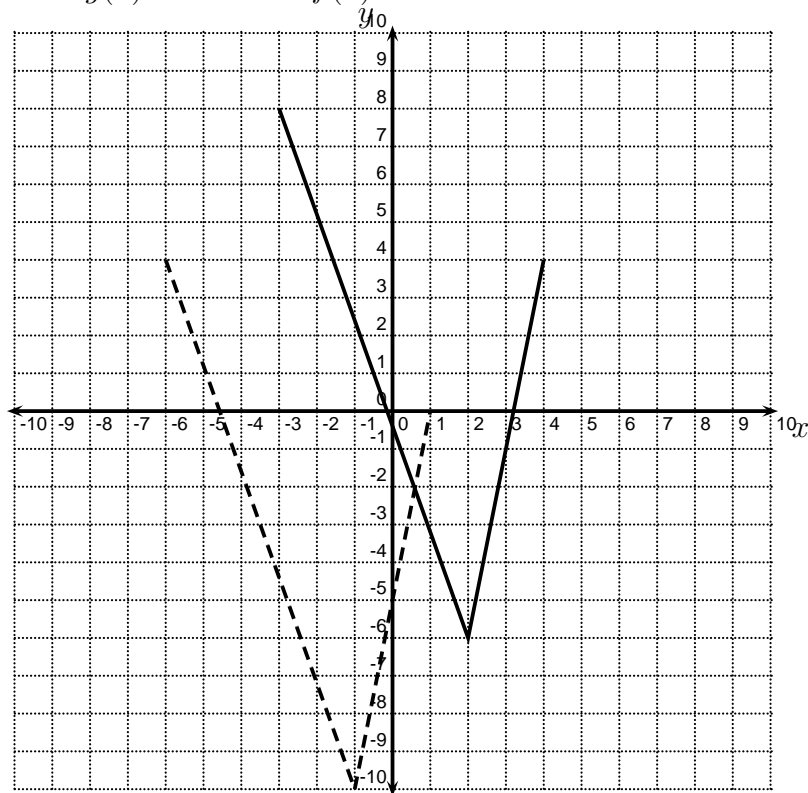
   Possibilities:

   (a) $x_1 = 6$ and $x_2 = 3$

   (b) $x_1 = 5$ and $x_2 = -2$

   (c) $x_1 = 6$

   (d) $x_1 = 5$

   (e) $x_1 = 6$ and $x_2 = -3$

8. Find all real solutions or state that there are NONE.
$$8e^{x-6} = 2.$$

9. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Find a formula for $g(x)$ in terms of $f(x)$.

10. Suppose that the graph of $y = f(x)$ contains the point (-2,7). Find a point on the graph of $y = 5f(x+3)$.

11. Let $f(x) = 6x + 4$. Find the average rate of change of $f(x)$ from $x = -5$ to $x = 9$.

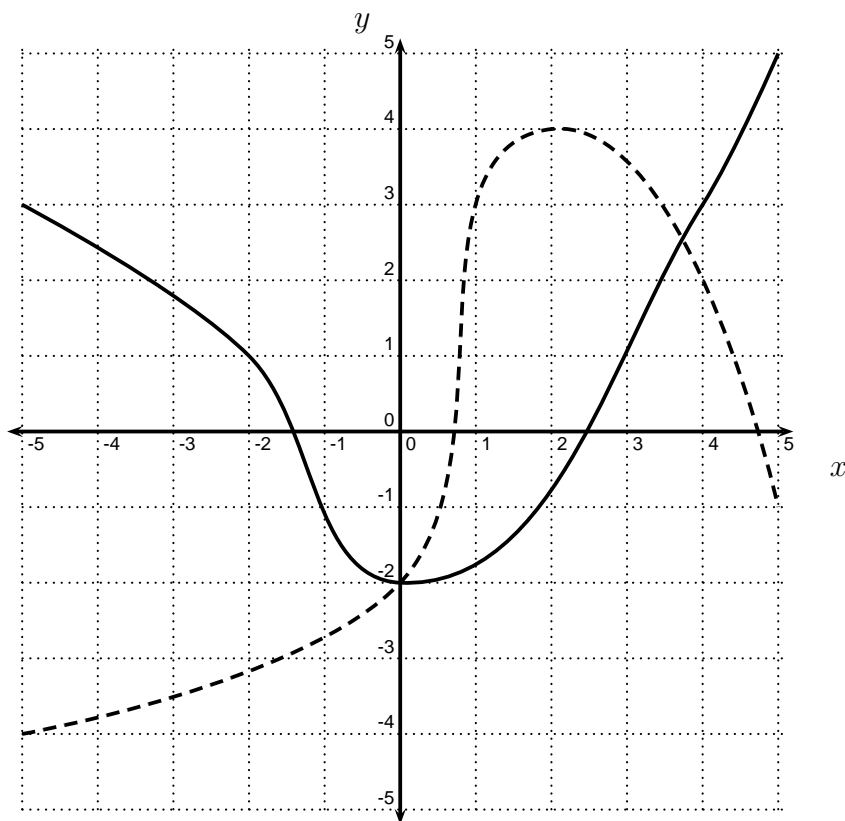**Possibilities:**

(a) 3

(b) 6

(c) 5

(d) 2

(e) 4

12. Let $f(x) = \ln(3x + 7)$. Find $f^{-1}(x)$.

13. Let $f(x) = 2e^{5x+3}$. Find $f^{-1}(x)$.

3

14. The number of bacteria in a culture is modeled by the function $n(t) = 80e^{.45t}$ where t is measured in hours. After how many hours will the number of bacteria reach 7000?

Possibilities:

  (a) About 9.94 hours

  (b) About 4.47 hours

  (c) About 71.53 hours

  (d) About 4.32 hours

  (e) About 11.51 hours

15. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Use the graphs to evaluate $f(g(2))$.

16. Let $f(x) = \sqrt{x-3}$ and $g(x) = \sqrt{4-x}$. Find the domain of $(f + g)(x)$.

17. Let $f(x) = 3x - 7$. Find $f(f(x))$

18. If \$5000 is invested at an interest rate of 8% per year compounded quarterly, find the amount of the investment at the end of 18 years.

   Possibilities:

   (a) \$6802.44

   (b) \$5412.16

   (c) \$20805.70

   (d) \$7141.23

   (e) \$1274912.56

19. You wish to purchase a new cell phone. You have a coupon for \$10 and the store is running a special which allows you to deduct 15% from the price. If the original price of the cell phone is 175 dollars, what is the final price if you apply the coupon and then apply the 15% discount.

20. Let $h(x) = (2x + 1)^5$. Find functions $f(x)$ and $g(x)$ such that $h(x) = f(g(x))$.

   Possibilities:

   (a) $f(x) = (2x + 1)^3$ and $g(x) = (2x + 1)^2$

   (b) $f(x) = x^5$ and $g(x) = 2x + 1$

   (c) $f(x) = x^5 + 1$ and $g(x) = 2x$

   (d) $f(x) = 2x$ and $g(x) = x^5 + 1$

   (e) $f(x) = 2x + 1$ and $g(x) = x^5$

21. Which of the following functions are one-to-one?

   (a). $a(x) = |x|$

   (b). $b(x) = x^3$

   (c). $c(x) = x^3 + 1$

   (d). $d(x) = 5$

   (e). $e(x) = x^4$

   (f). $f(x) = x^4 + 1$

   (g). $g(x) = (x + 1)^3$

   (h). $h(x) = |x + 1|$

   (i). $i(x) = 2x + 3$

   (j). $j(x) = \sqrt{x}$

   (k). $k(x) = \sqrt[3]{x}$

   (l). $l(x) = 0$

22. Let $f(x) = \sqrt{x-1}$ and $g(x) = x^2 - 4$. Find the domain of $\left(\dfrac{g}{f}\right)(x)$.

23. Let $f(x) = \sqrt{x-1}$ and $g(x) = x^2 - 4$. Find the domain of $\left(\dfrac{f}{g}\right)(x)$.

24. Let $f(x) = \dfrac{2x+3}{4-5x}$. Find $f^{-1}(x)$.

25. Let $f(x) = 2x^2 + 7x$. Find $\dfrac{f(x+h) - f(x)}{h}$.

    Possibilities:

    (a) $-4x - 2h - 7$

    (b) $\dfrac{2h^2 + 7h}{h}$

    (c) $2h^2 + 7h$

    (d) $4x + 2h + 7$

    (e) $\dfrac{4xh + 2h^2 + 14x + 7h}{h}$

26. $\log\left(\dfrac{x^{-2}}{y^5 z^8}\right) =$

    Possibilities:

    (a) $-2\log(x)/(5\log(y) * 8\log(z))$

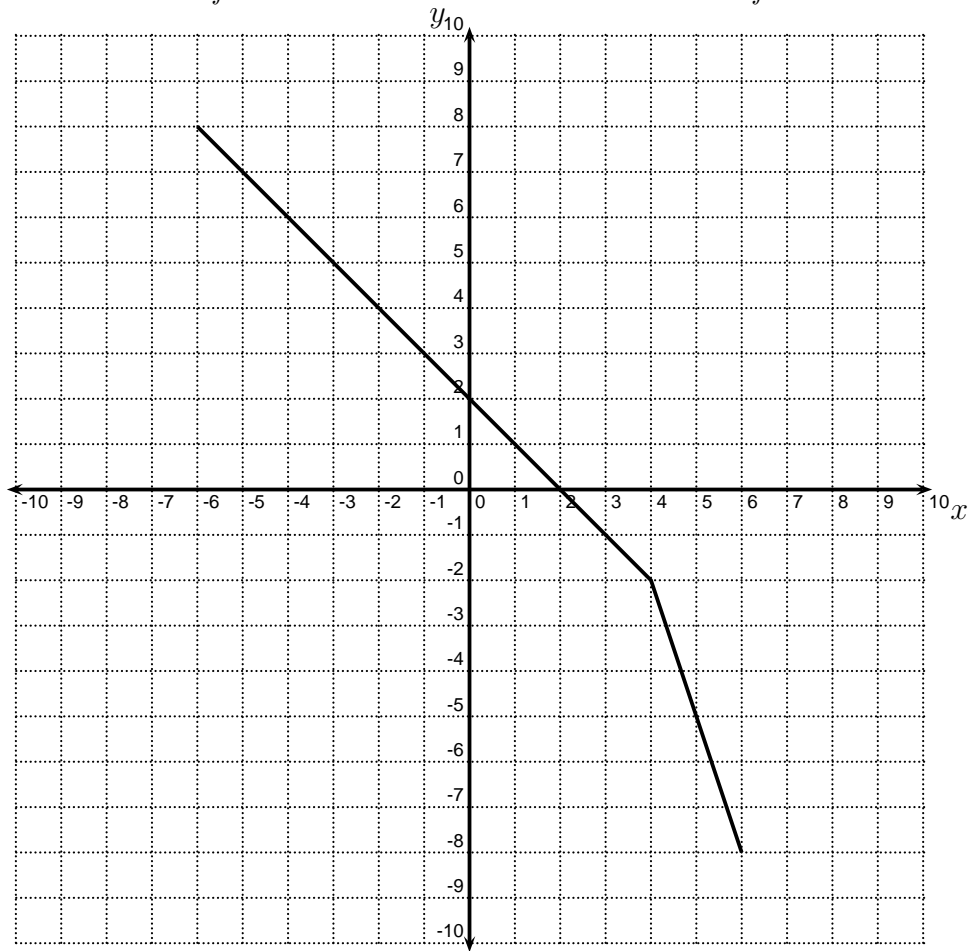   (b) $-2\log(x) - 5\log(y) + 8\log(z)$

    (c) $-2\log(x) + 5\log(y) - 8\log(z)$

    (d) $-2\log(x) - 5\log(y) - 8\log(z)$

    (e) $-2\log(x)/5\log(y) * 8\log(z)$

27. Let $f(x) = \log_2(x+7) - 3$. Find $f^{-1}(x)$.

28. The graph of the one-to-one function f is shown below. Find the domain of f^{-1}.

29. Joni invests $4000 at an interest rate of 4% per year compounded continuously. How much time will it take for the value of the investment to quadruple? Round your answer to the nearest tenth of a year.
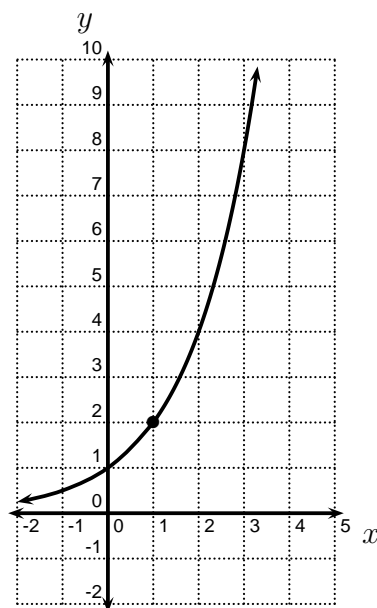
Possibilities:

(a) 17.3 years

(b) 27.5 years

(c) 16.0 years

(d) 34.7 years

(e) 40.2 years

30. The graph of the one-to-one function f is shown below. Find the range of f^{-1}.
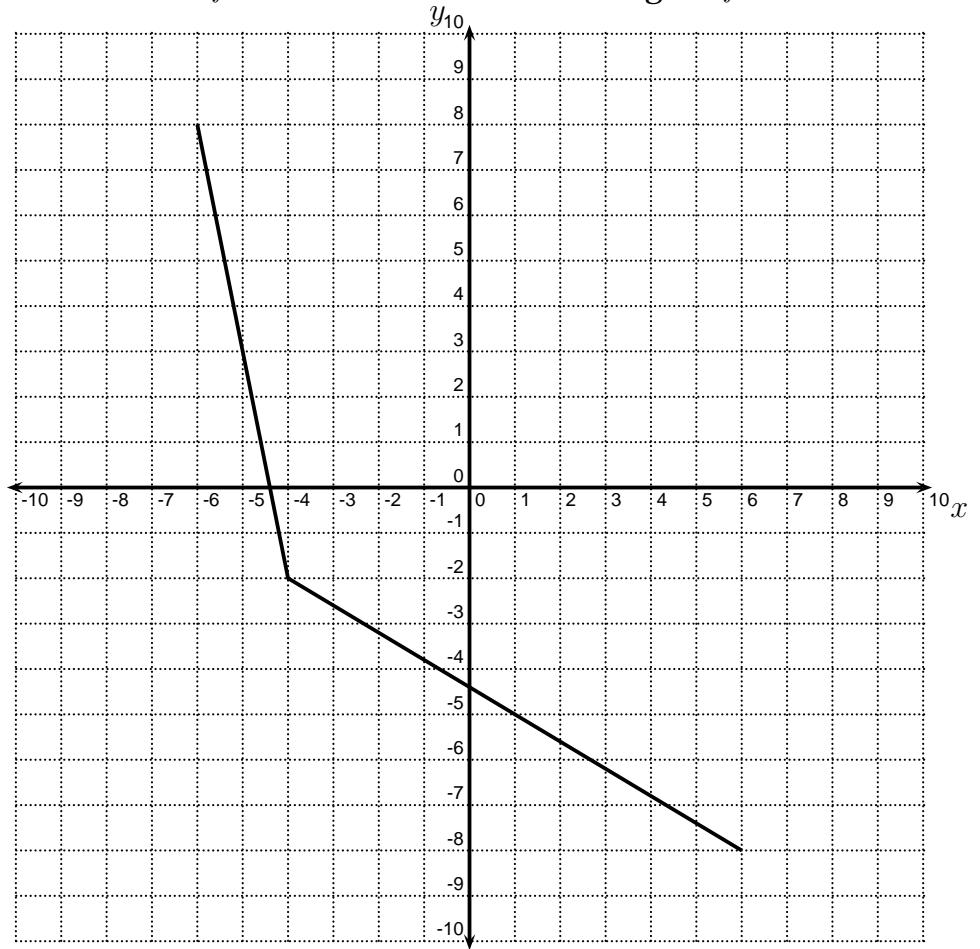
31. The graph of an exponential function, $f(x) = a^x$ is shown below. Find a.

Possibilities:

(a) 4

(b) $\dfrac{1}{2}$
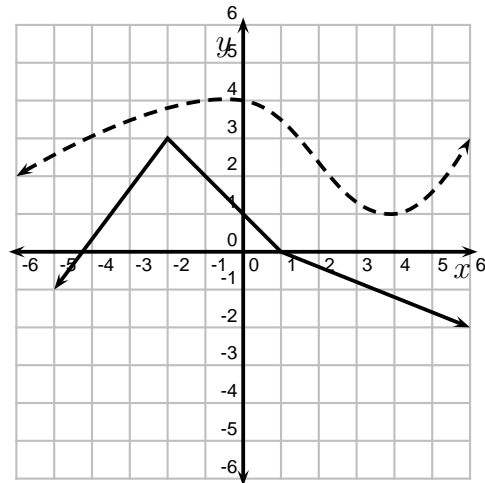
(c) 3

(d) $\dfrac{1}{3}$

(e) 2

8

32. Solve.
$$\log_8(x-5) + \log_8(x+2) = 1$$

   Possibilities:

   (a) $x_1 = 6$

   (b) $x_1 = 5$ and $x_2 = -2$

   (c) $x_1 = 5$

   (d) $x_1 = 6$ and $x_2 = 3$

   (e) $x_1 = 6$ and $x_2 = -3$

33. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Use the graphs to evaluate $g(f(1))$.

   Possibilities:

   (a) -1

   (b) 0

   (c) -2

   (d) 4

   (e) 3

34. Let $f(x) = \log_4(-15 - x)$. Find the domain of $f(x)$.

   Possibilities:

   (a) $(-\infty, -15]$

   (b) $(-15, 15)$

   (c) $[-15, 4)$

   (d) $(4, \infty)$

   (e) $(-\infty, -15)$

35. Find the domain and range of $y = \ln(x - 7)$.

Possibilities:

(a) Domain: $(-\infty, \infty)$ Range: $[7, \infty)$

(b) Domain: $(-\infty, \infty)$ Range: $(7, \infty)$

(c) Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$

(d) Domain: $[7, \infty)$ Range: $(-\infty, \infty)$

(e) Domain: $(7, \infty)$ Range: $(-\infty, \infty)$

36.

$$\log_5 \left(\frac{x^3 \sqrt{z}}{y^2} \right) =$$

Possibilities:

(a) $3 \log_5(x) + \dfrac{1}{2} \log_5(z) - 2 \log_5(y)$

(b) $\dfrac{(3 \log_5(x)) \left(\dfrac{1}{2} \log_5(z) \right)}{2 \log_5(y)}$

(c) $3x + \dfrac{1}{2}z - 2y$

(d) $2 \log_5(y) - 3 \log_5(x) - \dfrac{1}{2} \log_5(z)$

(e) $\dfrac{(3x) \left(\dfrac{1}{2}z \right)}{2y}$

37. Solve for x.

$$8 \log (x + 5) = 16$$

Possibilities:

(a) $x = \dfrac{16}{8 - \log(5)}$

(b) $x = 10^2 - 5$

(c) $x = \dfrac{10^{16}}{8} - 5$

(d) $x = \dfrac{10^{16} - 5}{8}$

(e) $x = \dfrac{16}{8 \log(5)}$

38. Let $f(x) = 2x + 1$. Find $f^{-1}(5)$.

   Possibilities:

   (a) 12

   (b) 1

   (c) 11

   (d) 3

   (e) 2

39. Let $f(x) = 2x - 5$ and $g(x) = x^2$. Find $g(f(x))$.

   Possibilities:

   (a) $4x^2 - 20x + 25$

   (b) $2x^2 - 5$

   (c) $4x^2 - 25$

   (d) $2x^3 - 5x^2$

   (e) $4x^2 + 25$

40. Let $f(x) = 3x + 4$. Find the average rate of change of $f(x)$ from $x = -5$ to $x = 9$.

   Possibilities:

   (a) 5

   (b) 3

   (c) 6

   (d) 2

   (e) 4

41. Which of the following functions are one-to-one?

$$f(x) = x^2 + 3 \qquad\qquad g(x) = x^3 \qquad\qquad h(x) = 3x - 9$$

Possibilities:

(a) Only $f(x)$ and $g(x)$ are one-to-one.

(b) Only $g(x)$ and $h(x)$ are one-to-one.

(c) Only $h(x)$ is one-to-one.

(d) None of the functions are one-to-one.

(e) All of the functions are one-to-one.

42. Use a calculator to approximate $\log_{13}(15)$. Your answer should be correct to 5 decimal places.

Possibilities:

(a) 0.14310

(b) 1.05579

(c) 0.94716

(d) 1.15385

(e) 1.76611

43. Let $f(x) = 3x^2 + 2x + 1$. Find $\dfrac{f(x+h) - f(x)}{h}$

44. Let $f(x) = \sqrt{x+5}$ and $g(x) = x - 4$. Find the domain of $\left(\dfrac{f}{g}\right)(x)$.

Possibilities:

(a) $(-4, 5]$

(b) $(-\infty, -4) \cup (-4, 5]$

(c) $[-5, \infty)$

(d) $[-5, 4)$

(e) $[-5, 4) \cup (4, \infty)$

45. You are going to purchase some memory for your computer. The original price of the memory is x dollars You have two coupons. The first coupon allows you to take 20% off of the price. The second coupon allows you to deduct $10 from the price. Suppose that you use the first coupon to take 20% off and then you use the second coupon to deduct $10 from the price. Find a formula for the final price P in terms of x.

Possibilities:

(a) $P(x) = 0.20x - 2$

(b) $P(x) = 0.80x - 10$

(c) $P(x) = 0.80x - 8$

(d) $P(x) = 0.80x - 8$

(e) $P(x) = 0.20x - 10$

46. Find the inverse function of $f(x) = 5x - 3$.

47. Explain how the graph of $g(x) = (x+1)^3 - 9$ is obtained from the graph of $f(x) = x^3$.

   Possibilities:

   (a) Shift left 9 units and shift down 1 units.

   (b) Shift right 1 units and shift up 9 units.

   (c) Shift right 1 units and shift down 9 units.

   (d) Shift right 9 units and shift up 1 units.

   (e) Shift left 1 units and shift down 9 units.

48. Express the equation in logarithmic form.

$$8^3 = 512$$

   Possibilities:

   (a) $\log_{512} 3 = 8$

   (b) $\log_3 8 = 512$

   (c) $\log_3 512 = 8$

   (d) $\log_8 3 = 512$

   (e) $\log_8 512 = 3$

49. Which of the following statements are true?

   (I) $2^{\log_2(5)} = 5$

   (II) $\log(\frac{a}{b}) = \log(a) - \log(b)$ for all positive a and b.

   (III) $\ln(a + b) = (\ln(a))(\ln(b))$ for all positive a and b.

   Possibilities:

   (a) Only (I) and (II) are true.

   (b) Only (III) is true.

   (c) Only (I) and (III) are true.

   (d) Only (I) is true.

   (e) Statements (I), (II), and (III) are all true.

50. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Find a formula for $g(x)$.
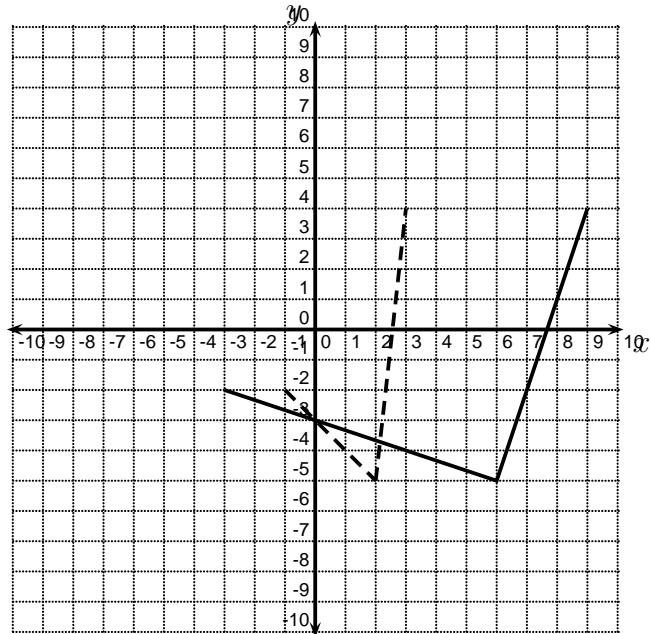
Possibilities:

(a) $g(x) = f\left(\frac{1}{3}x\right)$

(b) $g(x) = f(3x)$

(c) $g(x) = \frac{1}{3}f(x)$

(d) $g(x) = -3f(x)$

(e) $g(x) = 3f(x)$

51. Let $f(x) = \log_4(8 - x)$. Find the domain of $f(x)$.

Possibilities:

(a) $(4, \infty)$

(b) $[4, 8)$

(c) $(-8, 8)$

(d) $(-\infty, 8]$

(e) $(-\infty, 8)$

52. Use a calculator to approximate $\log_{13}(12)$. Your answer should be correct to 5 decimal places.

Possibilities:

(a) 0.92308

(b) 1.03221

(c) 1.54297

(d) -0.08004

(e) 0.96879

15