Section 6.2 #11-23 odd, 33-71 E00, 40, 42, 54, 68

11. The function is one-to-one. Each output value corresponds to at most one input.

13. The function is not one-to-one. The inputs 20 hours and 25 hours both correspond to $200.

15. The function is not one-to-one. -3 and 2 both correspond to 6.

17. The function is one-to-one. Each output value corresponds to at most one input.

19. One-to-one: each horizontal line crosses the graph at most once.

21. Not one to one. Any line $y=c$, with $c>0$, crosses the graph twice.

23. One-to-one. Each horizontal line crosses the graph at most once.

33. $f(x)=3x+4$; $g(x)=\frac{1}{3}(x-4)$; The domains of both are all real numbers.

$(f\circ g)(x) = 3\left(\frac{1}{3}(x-4)\right)+4 = x-4+4 = x$

$(g\circ f)(x) = \frac{1}{3}\left((3x+4)-4\right) = \frac{1}{3}(3x) = x$

37. $f(x)=x^3-8$; $g(x)=\sqrt[3]{x+8}$; The domain of both is $\mathbb{R}$.

$f(g(x)) = \left(\sqrt[3]{x+8}\right)^3 - 8 = (x+8)-8 = x$

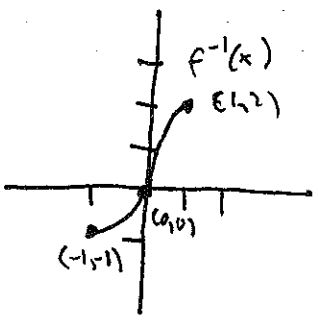
$g(f(x)) = \sqrt[3]{(x^3-8)+8} = \sqrt[3]{x^3} = x$

41. $f(x)=\frac{2x+3}{x+4}$; $g(x)=\frac{4x-3}{2-x}$

$$f(g(x)) = \frac{2\left(\frac{4x-3}{2-x}\right)+3}{\frac{4x-3}{2-x}+4} = \frac{2(4x-3)+3(2-x)}{4x-3+4(2-x)} = \frac{5x}{5} = x;\ \text{domain is } \{x \mid x\neq 2\}$$

$$g(f(x)) = \frac{4\left(\frac{2x+3}{x+4}\right)+3}{2-\frac{2x+3}{x+4}} = \frac{4(2x+3)-3(x+4)}{2(x+4)-(2x+3)} = \frac{5x}{5} = x;\ \text{domain is } \{x \mid x\neq -4\}$$

45.



49. $f(x)=3x$; switch the roles of y and x and solve for y

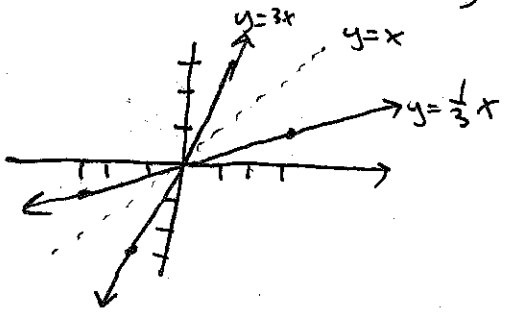
$y = 3x$

$x = 3y$

$f^{-1}(x): y = \frac{1}{3}x$

$f(f^{-1}(x)) = 3\left(\frac{1}{3}x\right) = x$

$f^{-1}(f(x)) = \frac{1}{3}(3x) = x$



53. $f(x) = x^3 - 1$

$y = x^3 - 1$

$x = y^3 - 1$

$x + 1 = y^3$

$\sqrt[3]{x+1} = y = f^{-1}(x)$

$f(f^{-1}(x)) = (\sqrt[3]{x+1})^3 - 1$

$= (x+1) - 1 = x$

$f^{-1}(f(x)) = \sqrt[3]{(x^3 - 1) + 1}$

$= \sqrt[3]{x^3} = x$

57. $f(x) = \frac{4}{x}$

$y = \frac{4}{x}$

$x = \frac{4}{y}$

$yx = 4$

$f^{-1}(x) = y = \frac{4}{x}$

$f(f^{-1}(x)) = \frac{4}{4/x} = 4 \cdot \frac{x}{4} = x$

$f^{-1}(f(x)) = \frac{4}{4/x} = 4 \cdot \frac{x}{4} = x$

61. $f(x) = \frac{2}{3+x}$

$y = \frac{2}{3+x}$ switch x, y and solve

$x = \frac{2}{3+y}$

$x(3+y) = 2$

$3 + y = \frac{2}{x}$

$y = \frac{2}{x} - 3 = \frac{2-3x}{x} = f^{-1}(x)$

$f(f^{-1}(x)) = \frac{2}{3 + \frac{2-3x}{x}}$

$= \frac{2x}{3x + 2 - 3x} = \frac{2x}{2} = x$

$f^{-1}(f(x)) = \frac{2 - 3\left(\frac{2}{3+x}\right)}{\frac{2}{3+x}}$

$= \frac{2(3+x) - 3(2)}{2} = \frac{2x}{2} = x$

65. $f(x) = \frac{2x}{3x-1}$

$y = \frac{2x}{3x-1}$

$x = \frac{2y}{3y-1}$

$3xy - x = 2y$

$3xy - 2y = x$

$(3x-2)y = x$

$f^{-1}(x) = y = \frac{x}{3x-2}$

$f(f^{-1}(x)) = \frac{2\left(\frac{x}{3x-2}\right)}{3\left(\frac{x}{3x-2}\right) - 1}$

$= \frac{2x}{3x - (3x-2)} = \frac{2x}{2} = x$

$f^{-1}(f(x)) = \frac{\frac{2x}{3x-1}}{3\left(\frac{2x}{3x-1}\right) - 2}$

$= \frac{2x}{3(2x) - 2(3x-1)} = \frac{2x}{2} = x$

69. $f(x) = \frac{2x+3}{x+2}$

$y = \frac{2x+3}{x+2}$

$x = \frac{2y+3}{y+2}$

$xy+2x = 2y+3$

$xy-2y = 3-2x$

$(x-2)y = 3-2x$

$f^{-1}(x) = y = \frac{3-2x}{x-2}$

$f(f^{-1}(x)) = \frac{2\left(\frac{3-2x}{x-2}\right)+3}{\left(\frac{3-2x}{x-2}\right)+2}$

$= \frac{2(3-2x)+3(x-2)}{3-2x+2(x-2)} = \frac{-x}{-1} = x$

$f^{-1}(f(x)) = \frac{3-2\left(\frac{2x+3}{x+2}\right)}{\left(\frac{2x+3}{x+2}\right)-2} = \frac{3(x+2)-2(2x+3)}{(2x+3)-2(x+2)}$

$= \frac{-x}{-1} = x$

70. $f(x) = x$; $g(x) = x$

$f(g(x)) = f(x) = x$ the domain of both is $\mathbb{R}$

$g(f(x)) = g(x) = x$

72. $F(x) = \frac{x-5}{2x+3}$; $g(x) = \frac{3x+5}{1-2x}$

$f(g(x)) = \frac{\frac{3x+5}{1-2x}-5}{2\left(\frac{3x+5}{1-2x}\right)+3} = \frac{3x+5-5(1-2x)}{2(3x+5)+3(1-2x)} = \frac{13x}{13} = x$ domain $\{x \mid x \neq \frac{1}{2}\}$

$g(f(x)) = \frac{3\left(\frac{x-5}{2x+3}\right)+5}{1-2\left(\frac{x-5}{2x+3}\right)} = \frac{3(x-5)+5(2x+3)}{2x+3-2(x-5)} = \frac{13x}{13}$ domain $\{x \mid x \neq \frac{-3}{2}\}$

54. $f(x) = x^3 + 1$

$y = x^3 + 1$

$x = y^3 + 1$

$x - 1 = y^3$

$\sqrt[3]{x-1} = y = f^{-1}(x)$

$f(f^{-1}(x)) = (\sqrt[3]{x-1})^3 + 1$

$= (x-1) + 1 = x$

$f^{-1}(f(x)) = \sqrt[3]{(x^3+1)-1}$

$= \sqrt[3]{x^3} = x$

68. $f(x) = \frac{2x-3}{x+4}$;

$y = \frac{2x-3}{x+4}$

$x = \frac{2y-3}{y+4}$

$xy + 4x = 2y - 3$

$xy - 2y = -3 - 4x$

$(x-2)y = -3 - 4x$

$f^{-1}(x) = y = \frac{-3-4x}{x-2}$

$f(f^{-1}(x)) = \frac{2\left(\frac{-3-4x}{x-2}\right) - 3}{\left(\frac{-3-4x}{x-2}\right) + 4}$

$= \frac{2(-3-4x) - 3(x-2)}{-3-4x+4(x-2)} = \frac{-11x}{-11} = x$

$f^{-1}(f(x)) = \frac{-3-4\left(\frac{2x-3}{x+4}\right)}{\left(\frac{2x-3}{x+4}\right) - 2}$

$= \frac{-3(x+4) - 4(2x-3)}{2x-3-2(x+4)}$

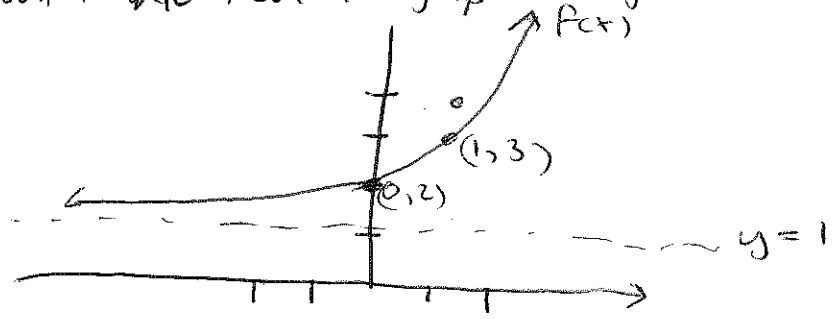
$= \frac{-11x}{-11} = x$

Section 6.3 #33-40, 41, 45, 49, 61-81 EOO

33. B
34. F
35. D
36. H
37. A
38. C
39. F
40. G

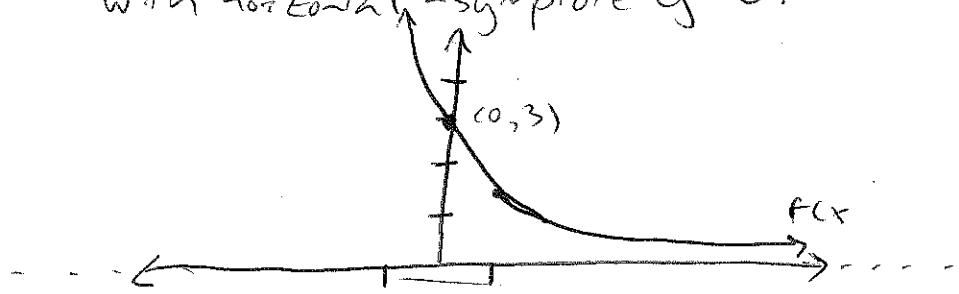
41. $f(x) = 2^x + 1$

The graph will be the graph of 2^x, shifted up 1 unit. The domain is all real numbers, and the range $\{y \mid y > 1\}$, with horizontal asymptote $y = 1$

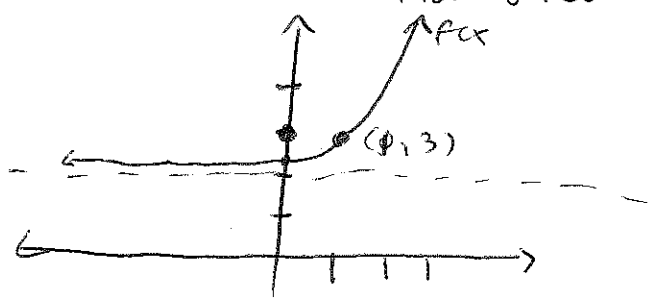


45. $f(x) = 3 \cdot \left(\frac{1}{2}\right)^x = 3 \cdot 2^{-x}$

The graph will be that of 2^x reflected over the y-axis, stretched vert. by a factor of 3. The domain is all real numbers, the range $\{y \mid y > 0\}$, with horizontal asymptote $y = 0$.



49. $f(x) = 2 + 4^{x-1}$ The graph is that of 4^x, shifted up 2 units and right 1 unit. Domain is $\mathbb{R}$, range $\{y \mid y > 0\}$ and horizontal asymptote $y = 2$.



61. $7^x = 7^3 \Rightarrow \boxed{x = 3}$

65. $\left(\frac{1}{5}\right)^x = \frac{1}{25} \Rightarrow \frac{1}{5}^x = \frac{1}{5^2} = \left(\frac{1}{5}\right)^2 \Rightarrow \boxed{x = 2}$

69. $3^{x^3} = 9^x \Rightarrow 3^{x^3} = (3^2)^x \Rightarrow x^3 = 2x \Rightarrow x^3 - 2x = 0$

$\Rightarrow x(x^2 - 2) = 0$

$\Rightarrow \boxed{x = 0, \sqrt{2} \text{ or } -\sqrt{2}}$

73. $3^{x^2-7} = 27^{2x} \Rightarrow 3^{x^2-7} = (3^3)^{2x} \Rightarrow 3^{x^2-7} = 3^{6x}$

$\Rightarrow x^2 - 7 = 6x \Rightarrow x^2 - 6x - 7 = 0$

$\Rightarrow (x - 7)(x + 1) = 0$

$\Rightarrow \boxed{x = -1 \text{ or } 7}$

77. $e^x = e^{3x+8} \Rightarrow x = 3x + 8 \Rightarrow 0 = 2x + 8 \Rightarrow 2x = -8$

$\Rightarrow \boxed{x = -4}$

81. $4^x = 7 \Rightarrow 4^{-2x} = (4^x)^{-2} = (7)^{-2} = \frac{1}{7^2} = \boxed{\frac{1}{49}}$

Section 6.4 #9-42, 87-107 EOO

9. $\log_3 9 = 2$ 10. $\log_4 16 = 2$ 11. $\log_a 1.6 = 2$

12. $\log_a 2.1 = 3$ 13. $\log_2 7.2 = x$ 14. $\log_3 4.6 = x$

15. $\ln 8 = x$ 16. $\ln M = 2.2$

17. $2^3 = 8$ 18. $3^{-2} = \frac{1}{9}$ 19. $a^6 = 3$

20. $6^2 = 4$ 21. $3^x = 2$ 22. $2^x = 6$

23. $e^x = 4$ 24. $e^4 = x$

25. $\log_2 1 = \log_2 2^0 = 0$ 26. $\log_8 8 = \log_8 8^1 = 1$

27. $\log_5 25 = \log_5 5^2 = 2$ 28. $\log_3 \frac{1}{9} = \log_3 \frac{1}{3^2} = \log_3 3^{-2} = -2$

29. $\log_{1/2} 16 = \log_{1/2} 2^4 = \log_{1/2} (1/2)^{-4} = -4$ 30. $\log_{1/3} 9 = \log_{1/3} 3^2 = \log_{1/3} (\frac{1}{3})^{-2} = -2$

31. $\log_{10} \sqrt{10} = \log_{10} 10^{1/2} = \frac{1}{2}$ 32. $\log_5 \sqrt[3]{25} = \log_5 25^{1/3} = \log_5 5^{2/3} = \frac{2}{3}$

33. $\log_{\sqrt{2}} 4 = \log_{\sqrt{2}} 2^2 = \log_{\sqrt{2}} (\sqrt{2})^4 = 4$ 34. $\log_{\sqrt{3}} 9 = \log_{\sqrt{3}} (3)^2 = \log_{\sqrt{3}} (\sqrt{3})^4 = 4$

35. $\log \sqrt{e} = \ln e^{1/2} = \frac{1}{2}$ 36. $\ln e^3 = 3$

37. $\text{dom}(\ln(x-3)) = \{x \mid x-3>0\} = \{x \mid x>3\}$

38. $\text{dom}(\ln(x-1)) = \{x \mid x-1>0\} = \{x \mid x>1\}$

39. $\text{dom}(\log_2 x^2) = \{x \mid x^2>0\} = \mathbb{R}$

40. $\text{dom}(\log_5 x^3) = \{x \mid x^3>0\} = \{x \mid x>0\}$

41. $\text{dom}(3-2\log_4(\frac{x}{2}-5)) = \{x \mid \frac{x}{2}-5>0\} = \{x \mid x>10\}$

42. $\text{dom}(8+5\ln(2x+3)) = \{x \mid 2x+3>0\} = \{x \mid x>\frac{3}{2}\}$

87. $\log_3 x = 2 \iff 3^2 = x \iff x = 9$

91. $\log_x 4 = 2 \iff x^2 = 4 \iff x = \pm 2$ but the base of a log must be > 0, so discard $x = -2$. Thus $x = 2$

95. $\log_4 64 = x \iff \log_4 4^3 = x \iff x = 3$

99. $e^{3x} = 10 \iff 3x = \ln 10 \iff x = \frac{\ln 10}{3}$

103. $\log_3 (x^2+1) = 2 \iff 3^2 = x^2 + 1 \iff x^2 - 8 = 0 \iff x = \pm 2\sqrt{2}$

107. $5e^{0.2x} = 7 \iff e^{0.2x} = \frac{7}{5} = 1.4 \iff 0.2x = \ln 1.4 \iff x = \frac{\ln 1.4}{0.2}$

$\iff x = 5 \ln 1.4$