

31.  $x = 3(2) = 6, y = 2^2 + 5 = 9$

32.  $x = 5(-2) - 7 = -17, y = 17 - 3(-2) = 23$

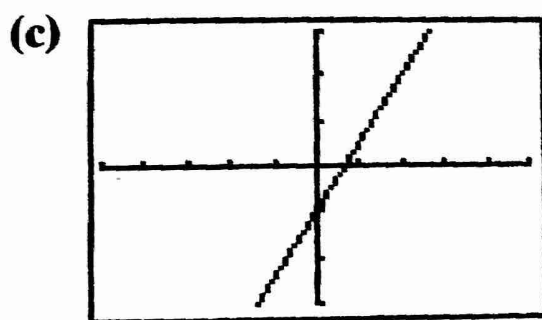
33.  $x = 3^3 - 4(3) = 15, y = \sqrt{3 + 1} = 2$

34.  $x = |-8 + 3| = 5, y = \frac{1}{-8} = -\frac{1}{8}$

35. (a)

$t$	$(x, y) = (2t, 3t - 1)$
-3	$(-6, -10)$
-2	$(-4, -7)$
-1	$(-2, -4)$
0	$(0, -1)$
1	$(2, 2)$
2	$(4, 5)$
3	$(6, 8)$

(b)  $t = \frac{x}{2}, y = 3\left(\frac{x}{2}\right) - 1 = 1.5x - 1$ . This is a function.



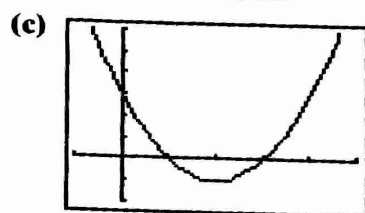
$[-5, 5]$  by  $[-3, 3]$

36. (a)

$t$	$(x, y) = (t + 1, t^2 - 2t)$
-3	$(-2, 15)$
-2	$(-1, 8)$
-1	$(0, 3)$
0	$(1, 0)$
1	$(2, -1)$
2	$(3, 0)$
3	$(4, 3)$

$$\begin{aligned}
 \text{(b)} \quad t = x - 1, y &= (x - 1)^2 - 2(x - 1) \\
 &= x^2 - 2x + 1 - 2x + 2 \\
 &= x^2 - 4x + 3
 \end{aligned}$$

This is a function.

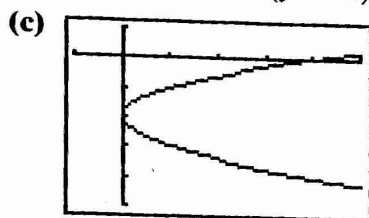


$[-1, 5]$  by  $[-2, 6]$

37. (a)

$t$	$(x, y) = (t^2, t - 2)$
-3	(9, -5)
-2	(4, -4)
-1	(1, -3)
0	(0, -2)
1	(1, -1)
2	(4, 0)
3	(9, 1)

(b)  $t = y + 2, x = (y + 2)^2$ . This is not a function.

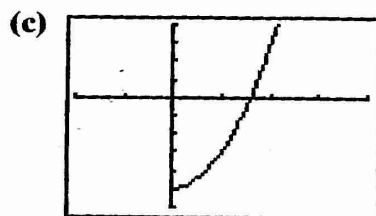


$[-1, 5]$  by  $[-5, 1]$

38. (a)

$t$	$(x, y) = (\sqrt{t}, 2t - 5)$
-3	$\sqrt{-3}$ not defined
-2	$\sqrt{-2}$ not defined
-1	$\sqrt{-1}$ not defined
0	(0, -5)
1	(1, -3)
2	$(\sqrt{2}, -1)$
3	$(\sqrt{3}, 1)$

(b)  $t = x^2, y = 2x^2 - 5$ . This is a function.



$[-2, 4]$  by  $[-6, 4]$

39. (a) By the vertical line test, the relation is not a function.

(b) By the horizontal line test, the relation's inverse is a function.

40. (a) By the vertical line test, the relation is a function.

(b) By the horizontal line test, the relation's inverse is not a function.

41. (a) By the vertical line test, the relation is a function.

(b) By the horizontal line test, the relation's inverse is a function.

42. (a) By the vertical line test, the relation is not a function.

(b) By the horizontal line test, the relation's inverse is a function.

$$\begin{aligned} 43. y = 3x - 6 &\rightarrow & x &= 3y - 6 \\ & & 3y &= x + 6 \\ f^{-1}(x) = y &= \frac{x + 6}{3} = \frac{1}{3}x + 2; (-\infty, \infty) \end{aligned}$$

$$\begin{aligned} 44. y = 2x + 5 &\rightarrow & x &= 2y + 5 \\ & & 2y &= x - 5 \\ f^{-1}(x) = y &= \frac{x - 5}{2} = \frac{1}{2}x - \frac{5}{2}; \\ & & & (-\infty, \infty) \end{aligned}$$

$$\begin{aligned} 45. y = \frac{2x - 3}{x + 1} &\rightarrow & x &= \frac{2y - 3}{y + 1} \\ x(y + 1) &= 2y - 3 \\ xy + x &= 2y - 3 \\ xy - 2y &= -x - 3 \\ y(x - 2) &= -(x + 3) \\ f^{-1}(x) = y &= -\frac{x + 3}{x - 2} = \frac{x + 3}{2 - x}; \\ & & & (-\infty, 2) \cup (2, \infty) \end{aligned}$$

$$\begin{aligned} 46. y = \frac{x + 3}{x - 2} &\rightarrow & x &= \frac{y + 3}{y - 2} \\ x(y - 2) &= y + 3 \\ xy - 2x &= y + 3 \\ xy - y &= 2x + 3 \\ y(x - 1) &= 2x + 3 \\ f^{-1}(x) = y &= \frac{2x + 3}{x - 1}; \\ & & & x \neq 1 \text{ or } (-\infty, 1) \cup (1, \infty) \end{aligned}$$

$$\begin{aligned} 47. y = \sqrt{x - 3}, x \geq 3, y \geq 0 &\rightarrow \\ & x = \sqrt{y - 3}, x \geq 0, y \geq 3 \\ & x^2 = y - 3, x \geq 0, y \geq 3 \\ f^{-1}(x) = y &= x^2 + 3, x \geq 0 \end{aligned}$$

$$\begin{aligned} 48. y = \sqrt{x + 2}, x \geq -2, y \geq 0 &\rightarrow \\ & x = \sqrt{y + 2}, x \geq 0, y \geq -2 \\ & x^2 = y + 2, x \geq 0, y \geq -2 \\ f^{-1}(x) = y &= x^2 - 2, x \geq 0 \end{aligned}$$

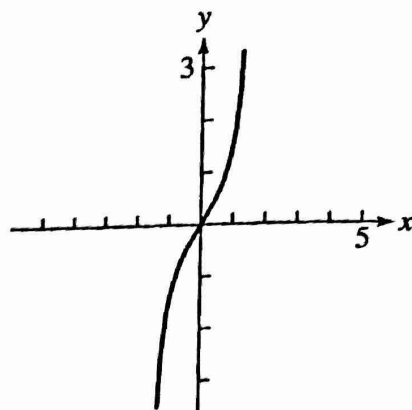
$$\begin{aligned} 49. y = x^3 &\rightarrow & x &= y^3 \\ f^{-1}(x) = y &= \sqrt[3]{x}; (-\infty, \infty) \end{aligned}$$

$$\begin{aligned} 50. y = x^3 + 5 &\rightarrow & x &= y^3 + 5 \\ & & x - 5 &= y^3 \\ f^{-1}(x) = y &= \sqrt[3]{x - 5}; (-\infty, \infty) \end{aligned}$$

$$\begin{aligned} 51. y = \sqrt[3]{x + 5} &\rightarrow & x &= \sqrt[3]{y + 5} \\ & & x^3 &= y + 5 \\ f^{-1}(x) = y &= x^3 - 5; (-\infty, \infty) \end{aligned}$$

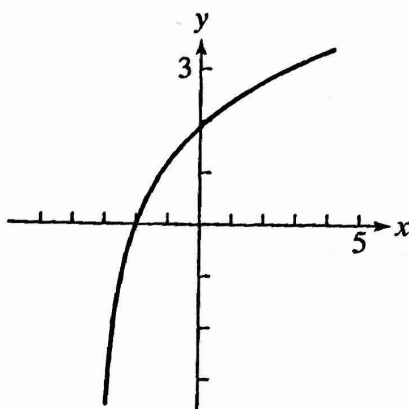
$$\begin{aligned} 52. y = \sqrt[3]{x - 2} &\rightarrow & x &= \sqrt[3]{y - 2} \\ & & x^3 &= y - 2 \\ f^{-1}(x) = y &= x^3 + 2; (-\infty, \infty) \end{aligned}$$

53. One-to-one



54. Not one-to-one

55. One-to-one



56. Not one-to-one

$$57. f(g(x)) = 3\left[\frac{1}{3}(x+2)\right] - 2 = x + 2 - 2 = x;$$

$$g(f(x)) = \frac{1}{3}[(3x-2)+2] = \frac{1}{3}(3x) = x$$

$$58. f(g(x)) = \frac{1}{4}[(4x-3)+3] = \frac{1}{4}(4x) = x;$$

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

$$59. f(g(x)) = [(x-1)^{1/3}]^3 + 1 = (x-1)^1 + 1 = x - 1 + 1 = x;$$

$$g(f(x)) = [(x^3 + 1) - 1]^{1/3} = (x^3)^{1/3} = x^1 = x$$

$$60. f(g(x)) = \frac{7}{\frac{7}{x}} = \frac{7}{1} \cdot \frac{x}{7} = x; g(f(x)) = \frac{7}{\frac{7}{x}} = \frac{7}{1} \cdot \frac{x}{7} = x$$

$$61. f(g(x)) = \frac{\frac{1}{x-1} + 1}{\frac{1}{x-1}} = (x-1)\left(\frac{1}{x-1} + 1\right) =$$

$$1 + x - 1 = x;$$

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

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

$$62. f(g(x)) = \frac{\frac{2x+3}{x-1} + 3}{\frac{2x+3}{x-1} - 2} = \left( \frac{\frac{2x+3}{x-1} + 3}{\frac{2x+3}{x-1} - 2} \right) \cdot \left( \frac{x-1}{x-1} \right)$$

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

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

$$\left[ \frac{2\left(\frac{x+3}{x-2}\right) + 3}{\frac{x+3}{x-2} - 1} \right] \cdot \left( \frac{x-2}{x-2} \right) =$$

$$\frac{2(x+3) + 3(x-2)}{x+3 - (x-2)} = \frac{5x}{5} = x$$