40. a. $f(x) = 4x - 3$

$y = 4x - 3$

Interchange x and y and solve for y.

$x = 4y - 3$

$x + 3 = 4y$

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

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

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

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

$= x + 3 - 3 = x$

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

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

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

41. a. $f(x) = -\frac{1}{x}$

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

Interchange x and y and solve for y.

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

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

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

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

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

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

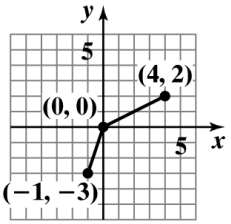
42. Since the graph satisfies the horizontal line test, it has an inverse function.

43. Since the graph does not satisfy the horizontal line test, it does not have an inverse function.

44. Since the graph satisfies the horizontal line test, it has an inverse function.

45. Since the graph does not satisfy the horizontal line test, it does not have an inverse function.

46. Since the points $(-3,-1), (0,0)$ and $(2,4)$ lie on the graph of the function, the points $(-1,-3)$, $(0,0)$ and $(4,2)$ lie on the inverse function.



Chapter 8 Test

1. The relation is a function.
Domain {1, 3, 5, 6}
Range {2, 4, 6}

2. The relation is not a function.
Domain {2, 4, 6}
Range {1, 3, 5, 6}

3. $f(a+4) = 3(a+4) - 2$

$= 3a + 12 - 2 = 3a + 10$

4. $f(-2) = 4(-2)^2 - 3(-2) + 6$

$= 4(4) + 6 + 6 = 16 + 6 + 6 = 28$

5. The vertical line test shows that this is the graph of a function.

6. The vertical line test shows that this is not the graph of a function.

7. $f(6) = -3$

8. $f(x) = 0$ when $x = -2$ and $x = 3$.

9. The domain of f is $(-\infty, \infty)$.

10. The range of f is $(-\infty, 3]$.

11. The domain of f is $(-\infty, 10)$ or $(10, \infty)$.

12. $f(x)=x^2+4x$ and $g(x)=x+2$

$$(f+g)(x)=f(x)+g(x)$$
$$=\left(x^2+4x\right)+(x+2)$$
$$=x^2+4x+x+2$$
$$=x^2+5x+2$$
$$(f+g)(3)=(3)^2+5(3)+2=9+15+2=26$$

13. $f(x)=x^2+4x$ and $g(x)=x+2$

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

14. $(fg)(x)=f(x)\cdot g(x)$

$$=(x^2+4x)(x+2)$$
$$=x^3+6x^2+8x$$
$$(fg)(-5)=(-5)^3+6(-5)^2+8(-5)$$
$$=-125+150-40$$
$$=-15$$

15. $f(x)=x^2+4x$ and $g(x)=x+2$

$$\left(\frac{f}{g}\right)(x)=\frac{x^2+4x}{x+2}$$
$$\left(\frac{f}{g}\right)(2)=\frac{(2)^2+4(2)}{2+2}=\frac{4+8}{4}=\frac{12}{4}=3$$

16. Domain of $\frac{f}{g}$ is $(-\infty,-2)$ or $(-2,\infty)$.

17. $f(x)=x^2+x$ and $g(x)=3x-1$

$$(f\circ g)(x)=f\left(g(x)\right)=f(3x-1)$$
$$=(3x-1)^2+(3x-1)$$
$$=9x^2-6x+1+3x-1$$
$$=9x^2-3x$$

$$(g\circ f)(x)=g\left(f(x)\right)=g\left(x^2+x\right)$$
$$=3\left(x^2+x\right)-1=3x^2+3x-1$$

18. $f(x)=5x-7$

$$y=5x-7$$

Interchange x and y and solve for y.

$$x=5y-7$$
$$x+7=5y$$
$$\frac{x+7}{5}=y$$

$$f^{-1}(x)=\frac{x+7}{5}$$

19. a. The function passes the horizontal line test (i.e., no horizontal line intersects the graph of f in more than one point), so we know its inverse is a function.

b. $f(80)=2000$

c. $f^{-1}(2000)$ represents the income, \$80 thousand, of a family that gives \$2000 to charity.

Cumulative Review Exercises (Chapters 1 – 8)

1. $2x+3x-5+7=10x+3-6x-4$

$$5x+2=4x-1$$
$$x+2=-1$$
$$x=-3$$

The solution set is $\{-3\}$.

2. $2x^2+5x=12$

$$2x^2+5x-12=0$$
$$(2x-3)(x+4)=0$$
$2x-3=0$ or $x+4=0$

$2x=3$ $\qquad$ $x=-4$

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

The solution set is $\left\{-4,\frac{3}{2}\right\}$.