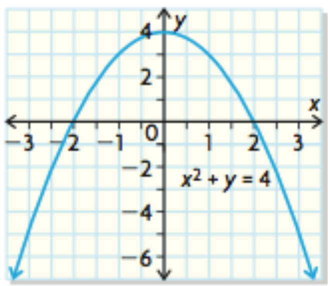
Mid-Chapter Review, p. 40

1. **a)** Not a function
b) Function; each x-value goes to a single y-value
c) Function; passes vertical line test
d) Not a function
e) Function; each x-value determines a single y-value
f) Function; each x-value determines a single y-value

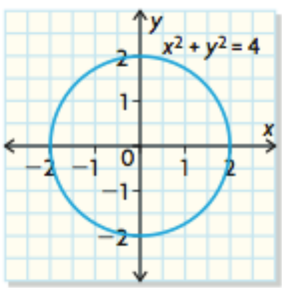
2. $x^2 + y = 4$:

x	y
−3	−5
−2	0
−1	3
0	4
1	3
2	0
3	−5

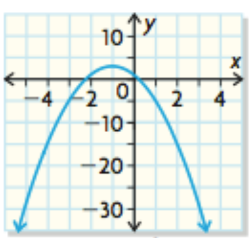


$x^2 + y^2 = 4$:

x	y
−2	0
0	±2
2	0



3. **a)**

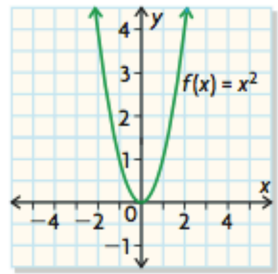


$f(x) = -2(x + 1)^2 + 3$

b) −5
c) y-coordinate of the point on the graph with x-coordinate −3
d) **i)** −6 **ii)** −50 **iii)** $-2(3 - x)^2 + 3$

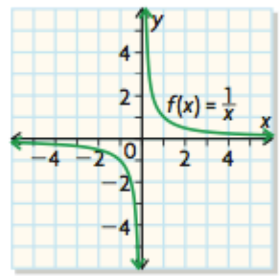
4. **a)** $f(x) = (20 - 5x)x$ **b)** 15, −25, −105 **c)** 20

5. **a)**



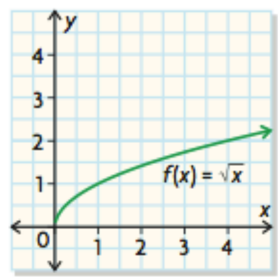
domain = $\{x \in \mathbf{R}\}$,
range = $\{y \in \mathbf{R} \mid y \geq 0\}$

b)



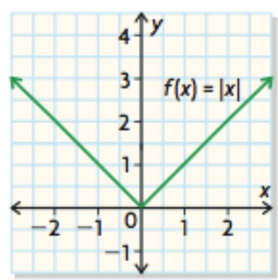
domain = $\{x \in \mathbf{R} \mid x \neq 0\}$,
range = $\{y \in \mathbf{R} \mid y \neq 0\}$

c)



domain = $\{x \in \mathbf{R} \mid x \geq 0\}$,
range = $\{y \in \mathbf{R} \mid y \geq 0\}$

d)



domain = $\{x \in \mathbf{R}\}$,
range = $\{y \in \mathbf{R} \mid y \geq 0\}$

6. **a)** domain = $\{1, 2, 4\}$, range = $\{2, 3, 4, 5\}$
b) domain = $\{-2, 0, 3, 7\}$, range = $\{-1, 1, 3, 4\}$
c) domain = $\{-4, -3, -2, -1, 0, 1, 2, 3, 4, 5\}$,
range = $\{-4, -3, -2, -1, 0, 1, 2, 3, 4, 5\}$
d) domain = $\{x \in \mathbf{R} \mid x \geq -3\}$, range = $\{y \in \mathbf{R}\}$
e) domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R} \mid y \leq 5\}$
f) domain = $\{x \in \mathbf{R} \mid x \geq 4\}$, range = $\{y \in \mathbf{R} \mid y \geq 0\}$

7. **a)** $A = \left(\frac{600 - 4w}{2}\right)w$
b) domain = $\{w \in \mathbf{R} \mid 0 < w < 150\}$,
range = $\{A \in \mathbf{R} \mid 0 < A \leq 11\,250\}$
c) $l = 150$ m, $w = 75$ m

8. **a)** domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R} \mid y \leq 5\}$
b) domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R} \mid y \geq 4\}$
c) domain = $\{x \in \mathbf{R} \mid -7 \leq x \leq 7\}$,
range = $\{y \in \mathbf{R} \mid -7 \leq y \leq 7\}$
d) domain = $\{x \in \mathbf{R} \mid -2 \leq x \leq 6\}$,
range = $\{y \in \mathbf{R} \mid 1 \leq y \leq 9\}$

Chapter Review, pp. 76–77

1. **a)** domain = $\{-3, -1, 0, 4\}$, range = $\{0, 1, 5, 6\}$; not a function, because two y-values are assigned to $x = 0$

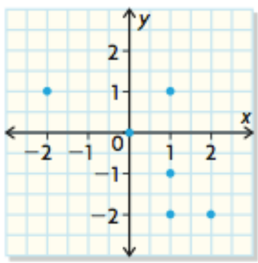
b) domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R}\}$; function, because each x-value has only one y-value assigned

c) domain = $\{x \in \mathbf{R} \mid x \geq -4\}$, range = $\{y \in \mathbf{R}\}$; not a function, because each $x > -4$ has two y-values assigned

d) domain = $\{x \in \mathbf{R} \mid -4 \leq x \leq 4\}$, range = $\{y \in \mathbf{R} \mid -4 \leq y \leq 4\}$; not a function, because each x except ± 4 has two y-values assigned

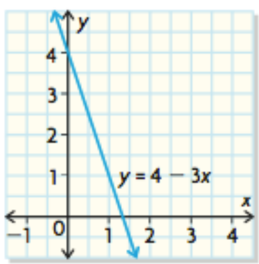
2. Vertical-line test

a)



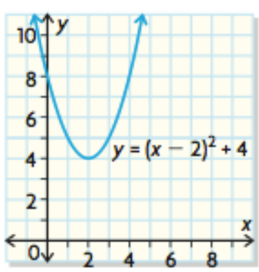
Not a function

b)



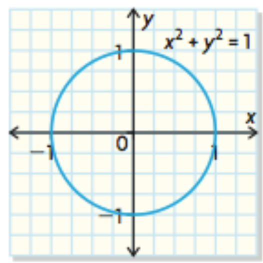
Function

c)



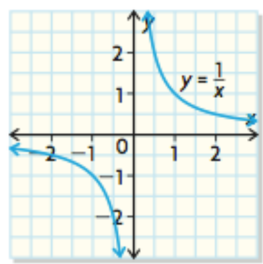
Function

d)



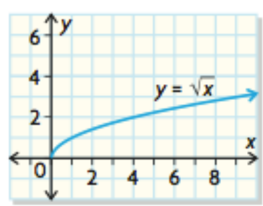
Not a function

e)



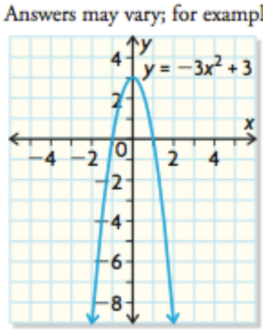
Function

f)



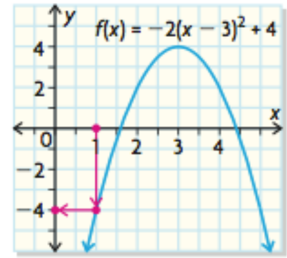
Function

3. Answers may vary; for example:



4. **a)** -7 **b)** -5 **c)** -2 **d)** $4b^2 + 6b - 5$ **e)** $-8a - 1$ **f)** 1 or -2

5. **a), b)**



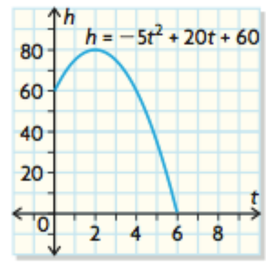
a) domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R} \mid y \leq 4\}$

b) $f(1)$ represents the y-coordinate corresponding to $x = 1$.

c) **i)** 2 **ii)** -1 **iii)** $-2(-x - 2)^2 + 4$

6. 5, -1

7. **a)**



b) domain = $\{t \in \mathbf{R} \mid 0 \leq t \leq 6\}$, range = $\{h \in \mathbf{R} \mid 0 \leq h \leq 80\}$

c) $h = -5t^2 + 20t + 60$

8. **a)** domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R} \mid y \geq 3\}$

b) domain = $\{x \in \mathbf{R} \mid x \geq -2\}$, range = $\{y \in \mathbf{R} \mid y \geq 0\}$

9. **a)** $A(w) = \left(\dfrac{540 - 3w}{2}\right)w$

b) domain = $\{w \in \mathbf{R} \mid 0 < w < 180\}$, range = $\{A \in \mathbf{R} \mid 0 < A \leq 12\,150\}$

c) $l = 270$ m, $w = 90$ m

10. **a)** Graph $y = 2x - 5$, and reflect it in the line $y = x$ to get graph of inverse. Use graph to determine the slope-intercept form of inverse; slope is 0.5 and y-intercept is 2.5, so $f^{-1}(x) = 0.5x + 2.5$.

b) Switch x and y, then solve for y:

$$y = \frac{x + 3}{7}$$
$$x = \frac{y + 3}{7}$$
$$7x = y + 3$$
$$7x - 3 = y$$
$$f^{-1}(x) = 7x - 3$$

c) Reverse operations: for f, divide by 2 and subtract from 4, so for f^{-1}, subtract from 4 (operation is self-inverse) and multiply by 2. Therefore, $f^{-1}(x) = 2(4 - x)$.

11. **a)** $f(x) = 30x + 15\,000$

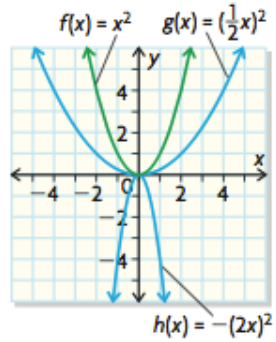
b) domain = $\{x \in \mathbf{R} \mid x \geq 0\}$, range = $\{y \in \mathbf{R} \mid y \geq 15\,000\}$; number of people cannot be negative, and income cannot be less than corporate sponsorship

c) $f^{-1}(x) = \dfrac{x - 15\,000}{30}$; domain = $\{x \in \mathbf{R} \mid x \geq 15\,000\}$

12. **a)** $y = \sqrt{4x}$

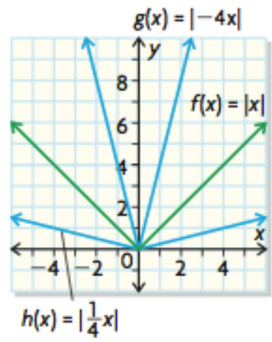
b) $y = \dfrac{1}{-\frac{1}{5}x}$

13. a)



$f(x)$: domain $= \{x \in \mathbf{R}\}$, range $= \{y \in \mathbf{R} \mid y \geq 0\}$;
$g(x)$: domain $= \{x \in \mathbf{R}\}$, range $= \{y \in \mathbf{R} \mid y \geq 0\}$;
$h(x)$: domain $= \{x \in \mathbf{R}\}$, range $= \{y \in \mathbf{R} \mid y \leq 0\}$

b)

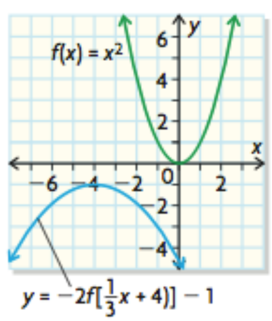


$f(x)$: domain $= \{x \in \mathbf{R}\}$, range $= \{y \in \mathbf{R} \mid y \geq 0\}$;
$g(x)$: domain $= \{x \in \mathbf{R}\}$, range $= \{y \in \mathbf{R} \mid y \geq 0\}$;
$h(x)$: domain $= \{x \in \mathbf{R}\}$, range $= \{y \in \mathbf{R} \mid y \geq 0\}$

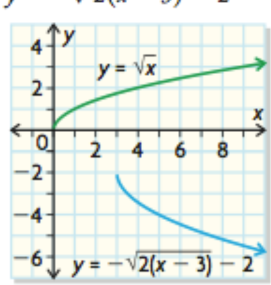
14. a) Yes; vertical stretch must be done before vertical translation
b) Yes: vertical stretch with factor 2, translation 4 units down, and translation 3 units right

15. $\left(-\frac{5}{4}, 10\right)$

16. a) Reflection in x-axis, vertical stretch factor 2, horizontal stretch factor 3, then translation left 4 and down 1
b)

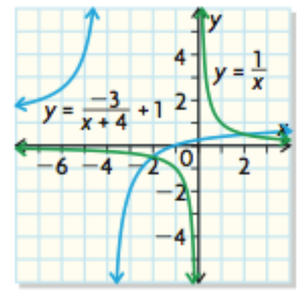


17. a) $y = -\sqrt{2(x-3)} - 2$



domain $= \{x \in \mathbf{R} \mid x \geq 3\}$, range $= \{y \in \mathbf{R} \mid y \leq -2\}$

b) $y = \dfrac{-3}{x+4} + 1$



domain $= \{x \in \mathbf{R} \mid x \neq -4\}$, range $= \{y \in \mathbf{R} \mid y \neq 1\}$

18. a) 4, −3 **b)** 4, −3 **c)** −8, 6 **d)** −5, 2

19. a) domain $= \{x \in \mathbf{R} \mid x \geq -4\}$, range $= \{y \in \mathbf{R} \mid y < -2\}$
b) domain $= \{x \in \mathbf{R} \mid x \leq 4\}$, range $= \{y \in \mathbf{R} \mid y < -1\}$
c) domain $= \{x \in \mathbf{R} \mid x \geq -5\}$, range $= \{y \in \mathbf{R} \mid y < 1\}$
d) domain $= \{x \in \mathbf{R} \mid x \leq 9\}$, range $= \{y \in \mathbf{R} \mid y > 3\}$

Chapter Self-Test, p. 78

1. a) domain = $\{-5, -2, 0, 3\}$, range = $\{-1, 1, 7\}$; function, because each x-value has only one y-value assigned

b) domain = $\{x \in \mathbf{R} \mid x \geq -2\}$, range = $\{y \in \mathbf{R} \mid y \geq 0\}$; function, same reason as part (a)

2. a) $f(x) = 0.004x + 0.65$, $g(x) = 0.001x + 3.50$

b) f: domain = $\{x \in \mathbf{R} \mid x \geq 0\}$, range = $\{y \in \mathbf{R} \mid y \geq 0.65\}$; g: domain = $\{x \in \mathbf{R} \mid x \geq 0\}$, range = $\{y \in \mathbf{R} \mid y \geq 3.50\}$

c) 950 h

d) Regular bulb costs \$3.72 more than fluorescent.

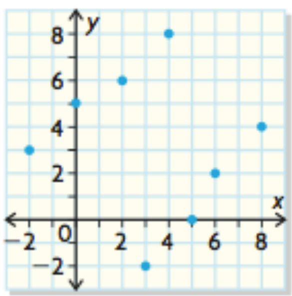
3. a) domain = $\{x \in \mathbf{R} \mid x \neq 2\}$, range = $\{y \in \mathbf{R} \mid y \neq 0\}$

b) domain = $\{x \in \mathbf{R} \mid x \leq 3\}$, range = $\{y \in \mathbf{R} \mid y \geq -4\}$

c) domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R} \mid y \leq 3\}$

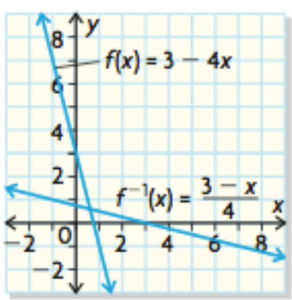
4. The inverse of a linear function is either the linear function obtained by reversing the operations of the original function, or if the original function is $f(x) = c$ constant, the relation $x = c$. Domain and range are exchanged for the inverse.

5. a) $\{(3, -2), (5, 0), (6, 2), (8, 4)\}$



Function: domain = $\{-2, 0, 2, 4\}$, range = $\{3, 5, 6, 8\}$; inverse: domain = $\{3, 5, 6, 8\}$, range = $\{-2, 0, 2, 4\}$

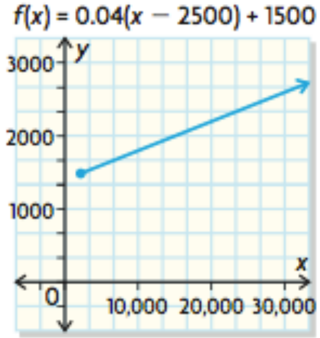
b) $f^{-1}(x) = \dfrac{3 - x}{4}$



Function: domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R}\}$;

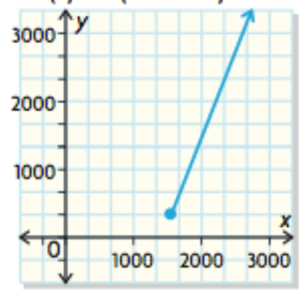
inverse: domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R}\}$

6. a) $f(x) = 0.04(x - 2500) + 1500$



b) $f(x) = 0.04(x - 2500) + 1500$ for $x \geq 2500$

c) $f^{-1}(x) = 25(x - 1500) + 2500$

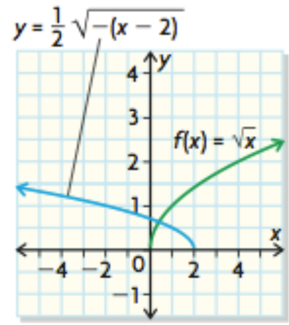


d) $f^{-1}(x) = 25(x - 1500) + 2500$ for $x \geq 1500$

e) $f^{-1}(1740) = 25(1740 - 1500) + 2500 = \$8500$

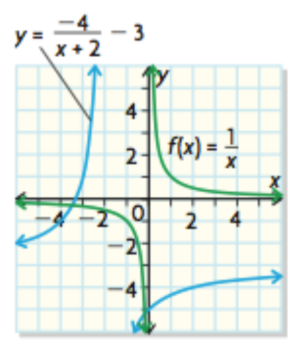
7. a) $\dfrac{1}{5}$ b) -3

8. a) $a = \frac{1}{2}$, $k = -1$, $c = 0$, $d = 2$; $y = \frac{1}{2}\sqrt{-(x-2)}$



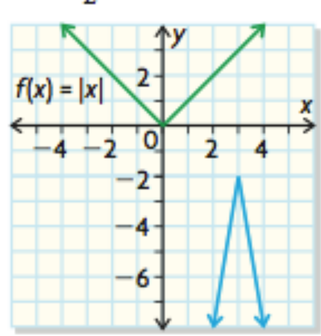
domain = $\{x \in \mathbf{R} \mid x \leq 2\}$, range = $\{y \in \mathbf{R} \mid y \geq 0\}$

b) $a = -4$, $k = 1$, $c = -3$, $d = -2$; $y = \dfrac{-4}{x + 2} - 3$



domain = $\{x \in \mathbf{R} \mid x \neq -2\}$, range = $\{y \in \mathbf{R} \mid y \neq -3\}$

c) $a = -\frac{3}{2}$, $k = 4$, $c = -2$, $d = 3$



$y = -\frac{3}{2}f[4(x - 3)] - 2$

domain = $\{x \in \mathbf{R}\}$, range = $\{y \in \mathbf{R} \mid y \leq -2\}$