# Additional Functions, Conic Sections, and Nonlinear Systems - ANSWERS

C.1 Exercises
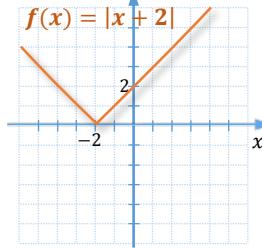
1. translating   **3.** dilating   **5.** zeros

7. **a.-V**; $y = x^2$; $D = \mathbb{R}$; range $= [0, \infty)$ **b.-III**; $y = x^3$; $D = \mathbb{R}$; range $= \mathbb{R}$
   c.-IV; $y = \sqrt{x}$; $D = [0, \infty)$; range $= [0, \infty)$ **d.-I**; $y = |x|$; $D = [0, \infty)$; range $= \mathbb{R}$
   e.-II; $y = [\![x]\!]$; $D = \mathbb{R}$; range $= \mathbb{Z}$ **f.-VI**; $y = \frac{1}{x}$; $D = \mathbb{R} \setminus \{0\}$; range $= \mathbb{R} \setminus \{0\}$

9. Translation: 5 units to the right, 3 units up
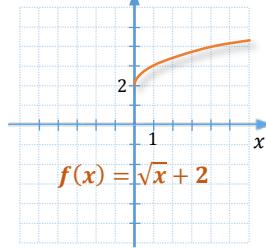
11.

$D = \mathbb{R}$
range $= [0, \infty)$
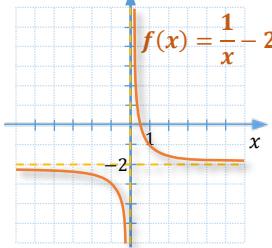
13.

$D = [0, \infty)$
range $= [2, \infty)$

15.
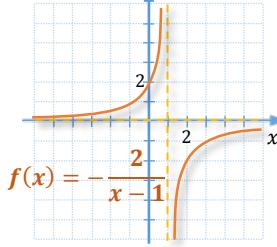
$D = \mathbb{R} \setminus \{0\}$
range $= \mathbb{R} \setminus \{-2\}$
VA: $x = 0$
HA: $y = -2$

17.
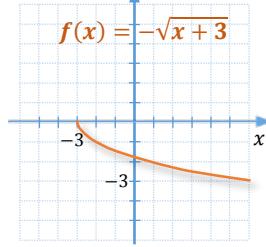
$D = \mathbb{R} \setminus \{0\}$
range $= \mathbb{R} \setminus \{-2\}$
VA: $x = 1$
HA: $y = 0$
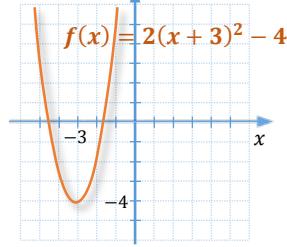
19.

$D = [-3, \infty)$
range $= (-\infty, 0]$

21.

$D = \mathbb{R}$
range $= [-4, \infty)$

23. 2   **25.** -2

27.

$f(x) = -[\![x]\!]$

29.

$f(x) = [\![x + 3]\!]$

31.

$g(x) = \dfrac{2}{x - 4}$

$f(x) = \dfrac{1}{2}x - 2$
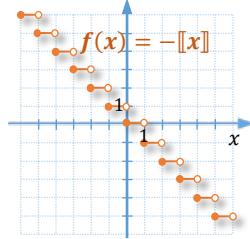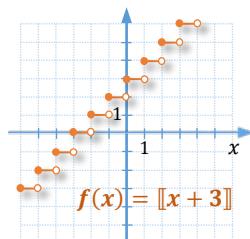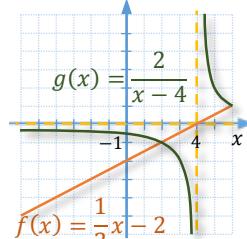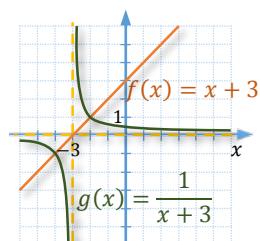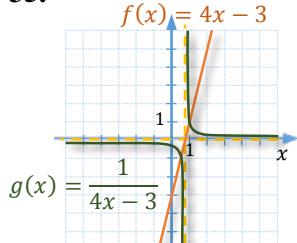
x-int. of f: $(4,0)$

VA of g: $x = 4$

33.
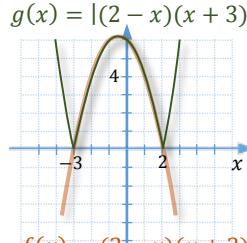
$f(x) = x + 3$

$g(x) = \dfrac{1}{x + 3}$

x-int. of f: $(-3,0)$

VA of g: $x = -3$

35.

$f(x) = 4x - 3$

$g(x) = \dfrac{1}{4x - 3}$

x-int. of f: $\left(\frac{3}{2},0\right)$

VA of g: $x = \dfrac{3}{2}$

37.
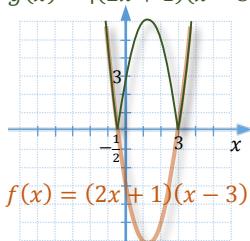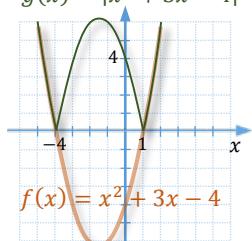
$g(x) = |(2 - x)(x + 3)|$
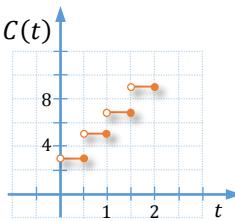
$f(x) = (2 - x)(x + 3)$
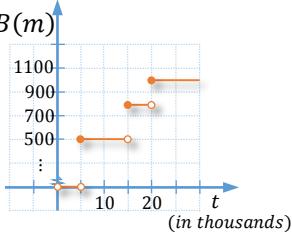
39. $g(x) = |(2x + 1)(x - 3)|$

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

41. $g(x) = |x^2 + 3x - 4|$

$f(x) = x^2 + 3x - 4$

43. $C(t)$

$$C(t) = \begin{cases} 3, & if \quad 0 < t \le \frac{1}{2} \\ 5, & if \quad \frac{1}{2} < t \le 1 \\ 7, & if \quad 1 < t \le \frac{3}{2} \\ 9, & if \quad \frac{3}{2} < t \le 2 \end{cases}$$

45. $B(m)$

$(in\ thousands)$

$$B(m) = \begin{cases} 0, & if \quad 0 < t < 5000 \\ 500, & if \quad 5000 \le t < 15000 \\ 800, & if \quad 15000 \le t < 20000 \\ 1000, & if \quad 20000 \le t \end{cases}$$

C.2 Exercises
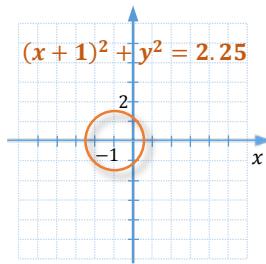
1. circle
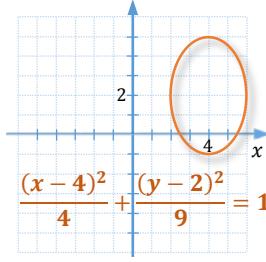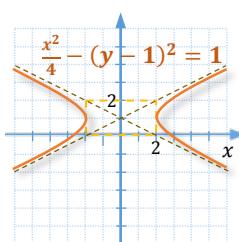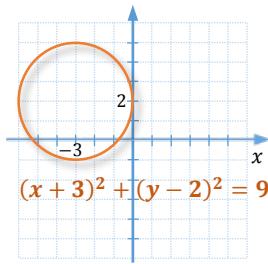
3. hyperbola
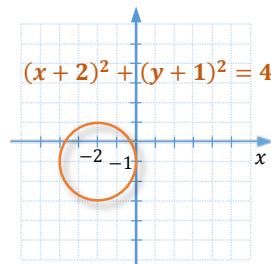
5. fundamental rectangle

7. focus

9. false

11. false

13. false

15. true

17. $(x-3)^2 + (y-1)^2 = 3$

19. $(x+2)^2 + (y-2)^2 = \frac{25}{4}$

21. $C(4,5); r = 6$

23. $C(6,0); r = 2\sqrt{6}$

25. $C(0,2); r = 2\sqrt{3}$

27. $C(-1,0); r = 1.5$

29. $C(-3,2); r = 3$

31. $C(-2,-1); r = 2$

$$(x+1)^2 + y^2 = 2.25$$

$$D = \left[-\frac{5}{2}, \frac{1}{2}\right]$$
$$\text{range} = \left[-\frac{3}{2}, \frac{3}{2}\right]$$

$$(x+3)^2 + (y-2)^2 = 9$$

$$D = [-6,0]$$
$$\text{range} = [-1,5]$$

$$(x+2)^2 + (y+1)^2 = 4$$

$$D = [-4,0]$$
$$\text{range} = [-3,1]$$

33. $(x+4)^2 + (y+3)^2 = 1$

35. $(x-3r)^2 + y^2 = 16r^2$

37. $C(-1,0); r_x = 1; r_y = 3$

$$(x+1)^2 + \frac{y^2}{9} = 1$$

39. $C(4,2); r_x = 2; r_y = 3$

$$\frac{(x-4)^2}{4} + \frac{(y-2)^2}{9} = 1$$

$$D = [2,6]$$
$$\text{range} = [-1,5]$$
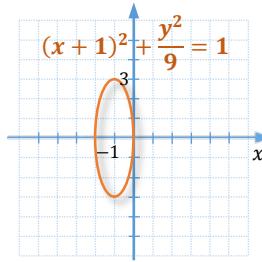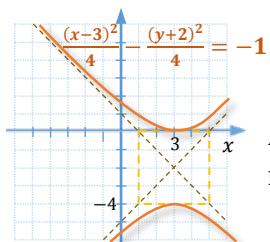
$$D = [-2,0]$$
$$\text{range} = [-3,3]$$

41. $\frac{(x-3)^2}{4} + \frac{(y+2)^2}{9} = 1$

43. $C(0,1); y = 0$

45. $C(3,-2); x = 3$

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

$$D = (-\infty, -2] \cup [2, \infty)$$
$$\text{range} = \mathbb{R}$$

$$\frac{(x-3)^2}{4} - \frac{(y+2)^2}{4} = -1$$
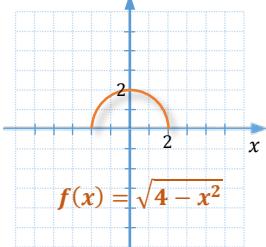
$$D = \mathbb{R}$$
$$\text{range} = (-\infty, -1] \cup [3, \infty)$$

47. $\dfrac{x^2}{9} - \dfrac{(y+1)^2}{9} = 1$

49. $\dfrac{x^2}{9} - \dfrac{(y-1)^2}{4} = -1$

51.

$f(x) = \sqrt{4 - x^2}$

$D = [-2,2]$
range $= [0,2]$

53.

$f(x) = -2\sqrt{1 - \dfrac{x^2}{9}}$

$D = [-3,3]$
range $= [-2,0]$

55.

$\dfrac{y}{3} = \sqrt{x^2 - 1}$
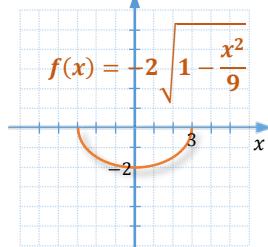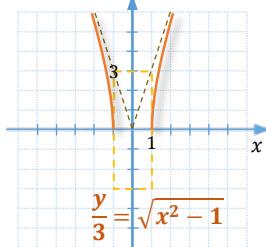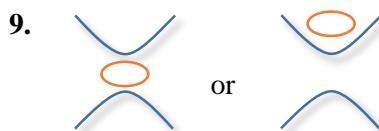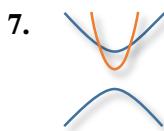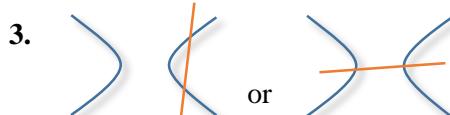
$D = (-\infty, -1] \cup [1, \infty)$
range $= [0, \infty)$

57. 24 m; 5 m

59. 50 m

C.3 Exercises

1.

3.

or

5.

7.

9.

or

11. a. 2; **b.** 2; **c.** 4; **d.** 0; **e.** 4

13. $\{(-4,0),(-3,1)\}$

15. $\left\{(-1,5),\left(\dfrac{5}{2},-2\right)\right\}$

17. $\left\{\left(-\dfrac{4}{3},-\dfrac{1}{3}\right),\left(\dfrac{4}{3},\dfrac{1}{3}\right)\right\}$

19. $\{(-\sqrt{5},-2),(\sqrt{5},-2),(0,3)\}$

21. $\left\{\left(\sqrt{2},\dfrac{\sqrt{2}}{2}\right),\left(-\sqrt{2},-\dfrac{\sqrt{2}}{2}\right)\right\}$

23. $\{(-\sqrt{3},0),(\sqrt{3},0)\}$

25. $\{(-\sqrt{5},-\sqrt{10}),(-\sqrt{5},\sqrt{10}),(\sqrt{5},-\sqrt{10}),(\sqrt{5},\sqrt{10})\}$

27. length: 20 m; width: 5 m
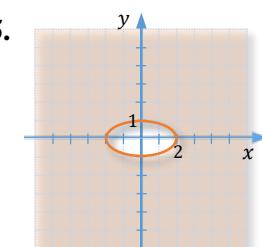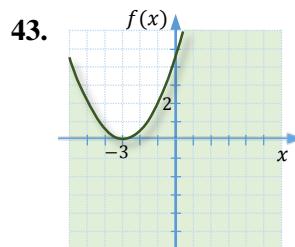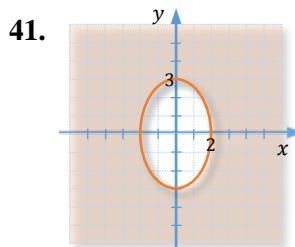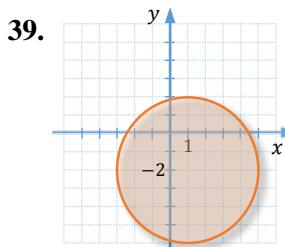
29. false

31. true

33. true
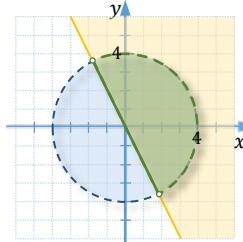
35. inside; above

37. a.-III; b.-II; c.-IV; d.-I

39.

41.

43.

45.

47.

49.

51.

no solution

53.

55.