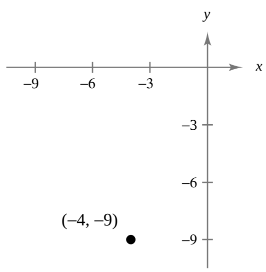
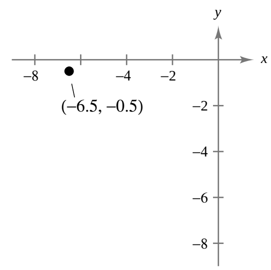
Review Exercises for Chapter P

Solutions to Even-Numbered Exercises

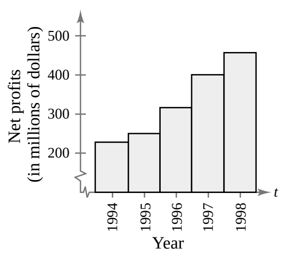
2. 

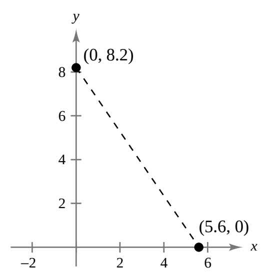
Quadrant III

4. 

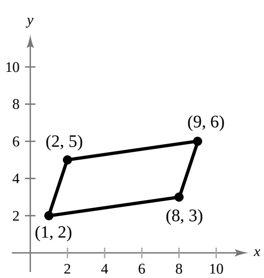
Quadrant III

6. If $xy = 4$ then the coordinates have the same sign. This happens in Quadrants I and III.

8. 

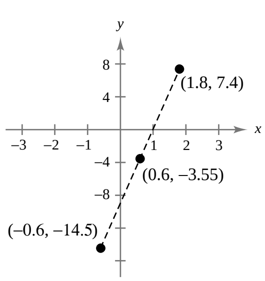
10. 

$$d = \sqrt{(5.6 - 0)^2 + (0 - 8.2)^2}$$
$$= \sqrt{31.36 + 67.24} = \sqrt{98.6} \approx 9.9$$

12. 

$$d_1 = \sqrt{(1 - 8)^2 + (2 - 3)^2} = \sqrt{49 + 1} = \sqrt{50} = 5\sqrt{2}$$
$$d_2 = \sqrt{(8 - 9)^2 + (3 - 6)^2} = \sqrt{1 + 9} = \sqrt{10}$$
$$d_3 = \sqrt{(9 - 2)^2 + (6 - 5)^2} = \sqrt{49 + 1} = \sqrt{50} = 5\sqrt{2}$$
$$d_4 = \sqrt{(1 - 2)^2 + (2 - 5)^2} = \sqrt{1 + 9} = \sqrt{10}$$

Opposite sides have equal lengths of $\sqrt{10}$ and $5\sqrt{2}$.

14. 

Midpoint:

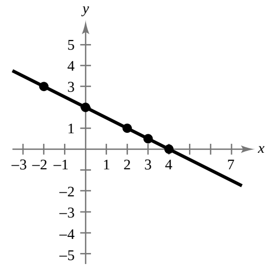
$$\left(\frac{1.8 - 0.6}{2}, \frac{7.4 - 14.5}{2}\right) = (0.6, -3.55)$$

16. Radius:

$$\sqrt{(3 - (-5))^2 + (-1 - 1)^2} = \sqrt{64 + 4} = \sqrt{68}$$
$$(x - 3)^2 + (x + 1)^2 = 68$$

18. $y = -\frac{1}{2}x + 2$

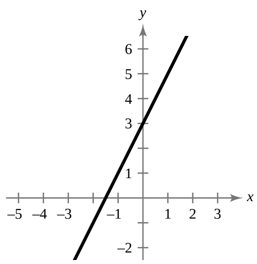
x	-2	0	2	3	4
y	3	2	1	$\frac{1}{2}$	0



20. $y - 2x - 3 = 0$

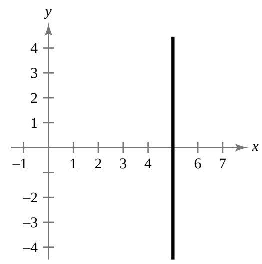
$y = 2x + 3$

Line with x-intercept $\left(-\frac{3}{2}, 0\right)$ and y-intercept $(0, 3)$



22. $x - 5 = 0$

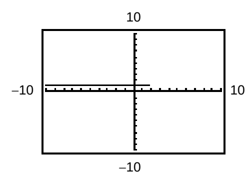
$x = 5$ is a vertical line through $(5, 0)$.



24. $y = \sqrt{5 - x}$

Domain: $(-\infty, 5]$

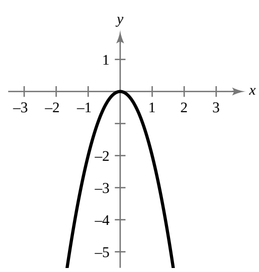
x	5	4	1	-4
y	0	1	2	3



26. $y + 2x^2 = 0$

$y = -2x^2$ is a parabola.

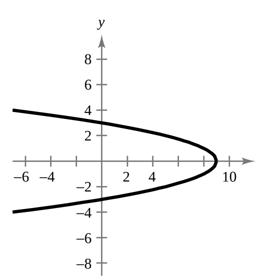
x	0	± 1	± 2
y	0	-2	-8



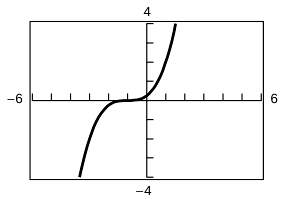
28. $x + y^2 = 9$

$x = 9 - y^2$

Parabola opening to the left Intercepts: $(9, 0)$, $(0, 3)$, $(0, -3)$

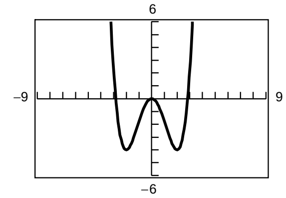


30. $y = \frac{1}{4}(x + 1)^3$



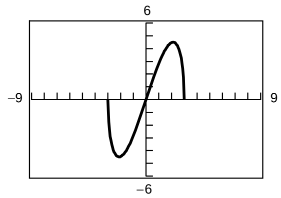
Intercepts: $(-1, 0), \left(0, \frac{1}{4}\right)$

32. $y = \frac{1}{4}x^4 - 2x^2$



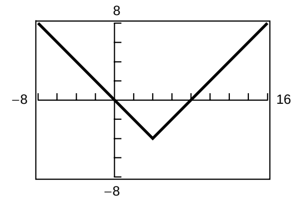
Intercepts: $(0, 0), \left(\pm 2\sqrt{2}, 0\right) \approx (\pm 2.83, 0)$

34. $y = x\sqrt{9 - x^2}$



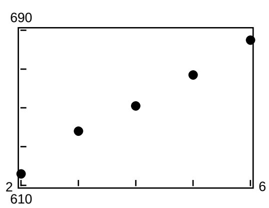
Intercepts: $(0, 0), (\pm 3, 0)$

36. $y = |x - 4| - 4$

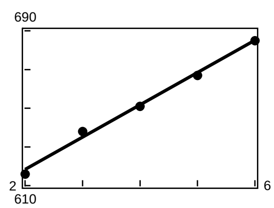


Intercepts: $(0, 0), (8, 0)$

38. (a)



(c)

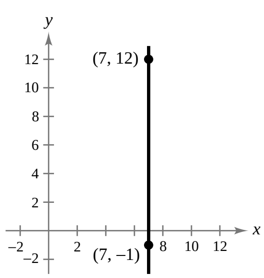


(b) $y = 16.7x + 584.6$

(d) For 2000, $t = 10$ and $y = 751.6$ dollars

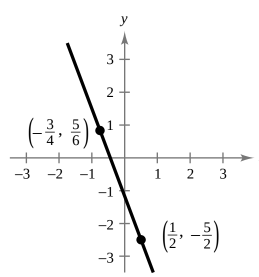
For 2002, $t = 12$ and $y = 785$ dollars

40.



$$\text{Slope} = \frac{12 - (-1)}{7 - 7}, \text{ undefined}$$

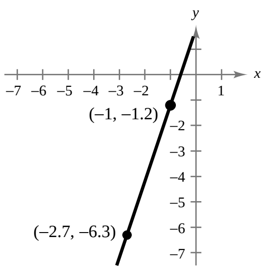
42.



$$\text{Slope} = \frac{\frac{5}{6} - \left(-\frac{5}{2}\right)}{-\frac{3}{4} - \frac{1}{2}} = \frac{\frac{5}{6} + \frac{15}{6}}{-\frac{3}{4} - \frac{2}{4}} = \frac{\frac{10}{3}}{-\frac{5}{4}}$$

$$= -\frac{10}{3} \cdot \frac{4}{5} = -\frac{8}{3}$$

44.



$$\text{Slope} = \frac{-1.2 + 6.3}{-1 + 2.7} = \frac{5.1}{1.7} = \frac{51}{17} = 3$$

46. $\text{Slope} = \dfrac{5 - 1}{10 - (-6)} = \dfrac{4}{16} = \dfrac{1}{4}$

$$\frac{1}{4} = \frac{t - 5}{1 - 10}$$

$$-\frac{9}{4} = t - 5$$

$$t = 5 - \frac{9}{4} = \frac{11}{4}$$

48. $\text{Slope} = \dfrac{6 - 3}{8 - (-3)} = \dfrac{3}{11}$

$$\frac{3}{11} = \frac{3 - (-1)}{-3 - t}$$

$$-9 - 3t = 44$$

$$3t = -53$$

$$t = -\frac{53}{3}$$

50. (a) $y - 5 = -\frac{3}{2}(x + 3)$

$2y - 10 = -3x - 9$

$2y + 3x = 1$

(b) Three additional points:

$(-3 + 2, 5 - 3) = (-1, 2)$

$(-1 + 2, 2 - 3) = (1, -1)$

$(1 + 2, -1 - 3) = (3, -4)$

(other answers possible)

52. (a) $y - 0 = -\frac{2}{3}(x - 3)$

$3y = -2x + 6$

$3y + 2x = 6$

(b) Three additional points:

$(3 - 3, 0 + 2) = (0, 2)$

$(0 - 3, 2 + 2) = (-3, 4)$

$(-3 - 3, 4 + 2) = (-6, 6)$

(other answers possible)

54. (a) $y - \frac{7}{8} = -\frac{4}{5}(x - 0)$

$40y - 35 = -32x$

$40y + 32x = 35$

(b) Three additional points:

$\left(0 + 5, \frac{7}{8} - 4\right) = \left(5, -\frac{25}{8}\right)$

$\left(5 + 5, -\frac{25}{8} - 4\right) = \left(10, -\frac{57}{8}\right)$

$\left(10 + 5, -\frac{57}{8} - 4\right) = \left(15, -\frac{89}{8}\right)$

(other answers possible)

56. (a) $y - 8 = 0(x + 8) = 0$

$y = 8$ (horizontal line)

(b) Three additional points: $(0, 8), (1, 8), (2, 8)$

(other answers possible)

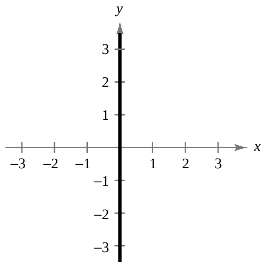
58. (a) Slope is undefined, line is vertical: $x = 5$

(b) Three additional points: $(5, 0), (5, 1), (5, 2)$

(other answers possible)

60. (a) Slope is undefined, line is vertical: $x = 0$.

(b)



62. (a) $y - 2 = \dfrac{2 - (-10)}{-2 - 3}(x + 2)$

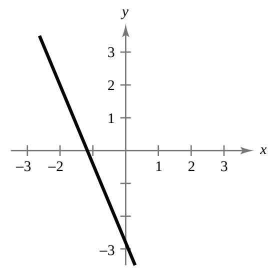
$$y - 2 = \frac{12}{-5}(x + 2)$$

$$-5y + 10 = 12x + 24$$

$$-5y = 12x + 14$$

$$y = -\frac{12}{5}x - \frac{14}{5}$$

(b)



64. (a) $y - 6 = \dfrac{6 - 2}{1 - 4}(x - 1)$

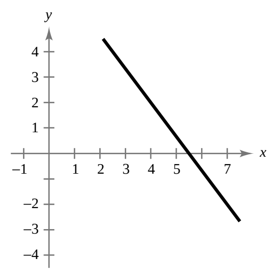
$$y - 6 = \frac{4}{-3}(x - 1)$$

$$-3y + 18 = 4x - 4$$

$$-3y = 4x - 22$$

$$y = -\frac{4}{3}x + \frac{22}{3}$$

(b)



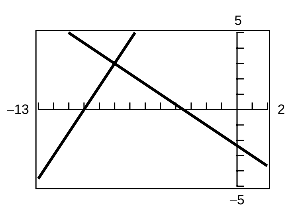
66. Slope of given line $m = -\frac{2}{3}$

(a) $y - 3 = -\frac{2}{3}(x + 8) \Longrightarrow 3y - 9 = -2x - 16$

$$\Longrightarrow 2x + 3y + 7 = 0$$

(b) $y - 3 = \frac{3}{2}(x + 8) \Longrightarrow 2y - 6 = 3x + 24$

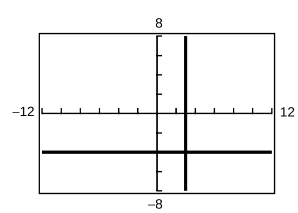
$$\Longrightarrow 3x - 2y + 30 = 0$$



68. $y = 2$ is a horizontal line.

(a) Parallel line through $(3, -4)$: $y = -4$

(b) Perpendicular line through $(3, -4)$: $x = 3$



70. $6 - \frac{11}{x} = 3 + \frac{7}{x}$

$$3 = \frac{18}{x}$$

$$3x = 18$$

$$x = 6$$

72. $\frac{5}{x-5} + \frac{1}{x+5} = \frac{2}{x^2 - 25}$

$$\frac{5(x+5) + (x-5)}{x^2 - 25} = \frac{2}{x^2 - 25}$$

$$6x + 20 = 2$$

$$6x = -18$$

$$x = -3$$

74. $x - 5y = 20$

Let $x = 0$: $-5y = 20 \Longrightarrow y = -4$. y-intercept $(0, -4)$

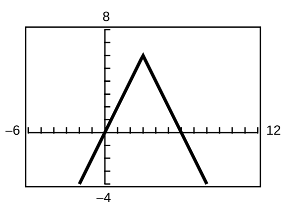
Let $y = 0$: $x = 20$. x-intercept $(20, 0)$

76. $y = 25 - x^2$

Let $x = 0$: $y = 25$. y-intercept $(0, 25)$

Let $y = 0$: $0 = 25 - x^2 = (5 - x)(5 + x)$. x-intercepts $(5, 0)$, $(-5, 0)$

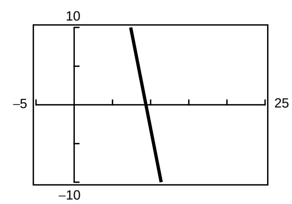
78. $y = 6 - 2|x - 3|$



x-intercepts: $(0, 0)$, $(6, 0)$

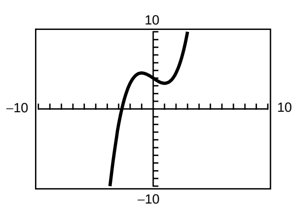
y-intercept: $(0, 0)$

80.



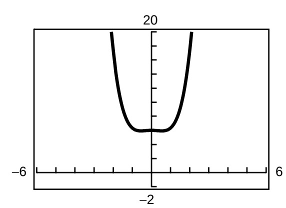
Solution: $x = 9.4$

82.



Solution: $x = -2.722$

84.



No solutions

86. $x - y = 3$

$2x + y = 12$

Adding,

$3x = 15 \Longrightarrow x = 5 \Longrightarrow y = x - 3 = 5 - 3 = 2$

Intersection point: $(5, 2)$

88. $y = -x + 7$

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

$$2x^3 - x + 9 = -x + 7$$

$$2x^3 + 2 = 0$$

$$x^3 + 1 = 0$$

$(x + 1)(x^2 - x + 1) = 0$

$\Longrightarrow x = -1 \Longrightarrow y = -(-1) + 7 = 8$

Intersection point: $(-1, 8)$

90. $15 + x - 2x^2 = 0$

$(5 + 2x)(3 - x) = 0$

$5 + 2 = 0 \Rightarrow x = -\frac{5}{2}$

$3 - x = 0 \Rightarrow x = 3$

92. $16x^2 = 25$

$x^2 = \frac{25}{16}$

$x = \pm\sqrt{\frac{25}{16}} = \pm\frac{5}{4}$

94. $x^2 + 6x - 3 = 0$

$a = 1, b = 6, c = -3$

$$x = \frac{-6 \pm \sqrt{6^2 - 4(1)(-3)}}{2(1)}$$

$$= \frac{-6 \pm \sqrt{48}}{2} = -3 \pm 2\sqrt{3}$$

96. $-x^2 - x + 15 = 0$

$x^2 + x - 15 = 0$

$$x = \frac{-1 \pm \sqrt{1 - 4(-15)}}{2} = \frac{-1 \pm \sqrt{61}}{2}$$

98. $-2x^2 - 13x = 0$

$-x(2x + 13) = 0$

$x = 0,\ x = -\frac{13}{2}$

100. $216x^4 - x = 0$

$x(216x^3 - 1) = 0$

$$x\left(x - \frac{1}{6}\right)\left(x^2 + \frac{1}{6}x + \frac{1}{36}\right) = 0$$

$x = 0,\ \frac{1}{6}$

102. $4x^3 - 6x^2 = 0$

$x^2(4x - 6) = 0$

$x^2 = 0 \Rightarrow x = 0$

$4x - 6 = 0 \Rightarrow x = \frac{3}{2}$

104. $\sqrt{x - 2} - 8 = 0$

$\sqrt{x - 2} = 8$

$x - 2 = 64$

$x = 66$

106. $5\sqrt{x} - \sqrt{x - 1} = 6$

$5\sqrt{x} = 6 + \sqrt{x - 1}$

$25x = 36 + 12\sqrt{x - 1} + x - 1$

$24x - 35 = 12\sqrt{x - 1}$

$576x^2 - 1680x + 1225 = 144(x - 1)$

$576x^2 - 1824x + 1369 = 0$

$$x = \frac{-(-1824) \pm \sqrt{(-1864)^2 - 4(576)(1369)}}{2(576)}$$

$$= \frac{1824 \pm \sqrt{172{,}800}}{1152} = \frac{1824 \pm 240\sqrt{3}}{1152}$$

$$x = \frac{38 + 5\sqrt{3}}{24}$$

$$x = \frac{38 - 5\sqrt{3}}{25}, \text{ extraneous}$$

108. $(x + 2)^{3/4} = 27$

$x + 2 = 27^{3/4}$

$x + 2 = 81$

$x = 79$

110. $\frac{1}{x - 2} = 3$

$1 = 3(x - 2)$

$1 = 3x - 6$

$7 = 3x$

$\frac{7}{3} = x$

112. $\dfrac{1}{(t+1)^2} = 1$

$1 = (t+1)^2$

$0 = t^2 + 2t$

$0 = t(t+2)$

$0 = t \Rightarrow t = 0$

$0 = t + 2 \Rightarrow t = -2$

114. $|2x + 3| = 7$

$2x + 3 = 7$ or $2x + 3 = -7$

$2x = 4$ $\qquad$ $2x = -10$

$x = 2$ $\qquad$ $x = -5$

116. $|x^2 - 6| = x$

$x^2 - 6 = x$ or $-(x^2 - 6) = x$

$x^2 - x - 6 = 0$

$(x-3)(x+2) = 0$

$x - 3 = 0 \Rightarrow x = 3$

$x + 2 = 0 \Rightarrow x = -2$, extraneous

$x^2 + x - 6 = 0$

$(x+3)(x-2) = 0$

$x - 2 = 0 \Rightarrow x = 2$

$x + 3 = 0 \Rightarrow x = -3$, extraneous

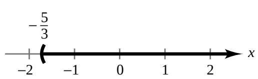
118. $\frac{1}{2}(3 - x) > \frac{1}{3}(2 - 3x)$

$3(3 - x) > 2(2 - 3x)$

$9 - 3x > 4 - 6x$

$3x > -5$

$x > -\frac{5}{3}, \left(-\frac{5}{3}, \infty\right)$



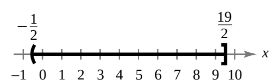
120.
$-6 \le 3 - 2(x - 5) < 14$

$-6 \le 13 - 2x < 14$

$-19 \le -2x < 1$

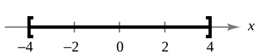
$\frac{19}{2} \ge x > -\frac{1}{2}$

$-\frac{1}{2} < x \le \frac{19}{2}$



122. $|x| \le 4$

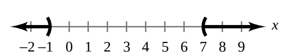
$-4 \le x \le 4$



124. $|x - 3| > 4$

$x - 3 > 4$ or $x - 3 < -4$

$x > 7$ or $x < -1$



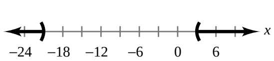
126. $|x + 9| + 7 > 19$

$|x + 9| > 12$

$x + 9 > 12$ or $x + 9 < -12$

$x > 3$ or $x < -21$

$(-\infty, -21), (3, \infty)$

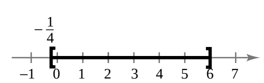


128. $4x^2 - 23x \le 6$

$4x^2 - 23x - 6 \le 0$

$(x - 6)(4x + 1) \le 0$

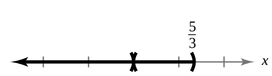
Critical numbers: $6, -\frac{1}{4}$. Testing the three intervals, we obtain $-\frac{1}{4} \le x \le 6$



130. $12x^3 - 20x^2 < 0$

$4x^2(3x - 5) < 0$

Since $4x^2 \ge 0$, $3x - 5 < 0 \Longrightarrow x < \frac{5}{3}$, $x \ne 0$

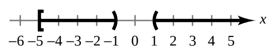


132. $\dfrac{2}{x+1} \le \dfrac{3}{x-1}$

$$\frac{2(x-1) - 3(x+1)}{(x+1)(x-1)} \le 0$$

$$\frac{-(x+5)}{(x+1)(x-1)} \le 0$$

Critical numbers: $-5, -1, 1$. Testing the four intervals, we obtain $[-5, -1) \cup (1, \infty)$.

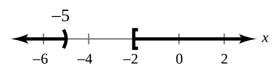


134. $\dfrac{x+8}{x+5} - 2 < 0$

$$\frac{x + 8 - 2(x+5)}{x+5} < 0$$

$$\frac{-x-2}{x+5} < 0$$

Critical numbers: $-5, -2$. Testing the three intervals, we obtain $(-\infty, -5) \cup [-2, \infty)$.



136. True. $ab = 0$ means $a = 0$ or $b = 0$.

138. An identity is an equation that is true for every real number in the domain of the variable. A conditional equation is true for just some (or even none) of the real numbers in the domain.