88. 1997 sales: $\left(\frac{1996 + 1998}{2}, \frac{696.5 + 1308.7}{2}\right) = (1997, 100.26)$

The sales in 1997 were approximately \$1002.6 million.

90. False, it would be sufficient to use the midpoint formula 15 times.

92. False, the polygon could be a rhombus. For example, consider the points $(4, 0)$, $(0, 6)$, $(-4, 0)$ and $(0, -6)$.

94. No, the scales can be different. The scales depend on the magnitude of the coordinates. See figure P.20.

Section P.2 Graphs of Equations

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

(a) $(2, 0)$: $(2)^2 - 3(2) + 2 \stackrel{?}{=} 0$

$4 - 6 + 2 \stackrel{?}{=} 0$

$0 = 0$

Yes, the point *is* on the graph.

(b) $(-2, 8)$: $(-2)^2 - 3(-2) + 2 \stackrel{?}{=} 8$

$4 + 6 + 2 \stackrel{?}{=} 8$

$12 \neq 8$

No, the point *is not* on the graph.

4. $y = \dfrac{1}{x^2 + 1}$

(a) $(0, 0)$: $\dfrac{1}{0^2 + 1} \stackrel{?}{=} 0$

$\dfrac{1}{1} \stackrel{?}{=} 0$

$1 \neq 0$

No, the point *is not* on the graph.

(b) $(3, 0.1)$: $\dfrac{1}{3^2 + 1} \stackrel{?}{=} 0.1$

$\dfrac{1}{9 + 1} \stackrel{?}{=} 0.1$

$\dfrac{1}{10} \stackrel{?}{=} 0.1$

$0.1 = 0.1$

Yes, the point *is* on the graph.

6. $x^2 + y^2 = 20$

(a) $(3, -2)$: $3^2 + (-2)^2 \stackrel{?}{=} 20$

$9 + 4 \stackrel{?}{=} 20$

$13 \neq 20$

No, the point *is not* on the graph.

(b) $(-4, 2)$: $(-4)^2 + 2^2 \stackrel{?}{=} 20$

$16 + 4 \stackrel{?}{=} 20$

$20 = 20$

Yes, the point *is* on the graph.

8. $y = \frac{1}{3}x^3 - 2x^2$

(a) $\left(2, -\frac{16}{3}\right)$: $\frac{1}{3}(2)^3 - 2(2)^2 \stackrel{?}{=} -\frac{16}{3}$

$\frac{1}{3} \cdot 8 - 2 \cdot 4 \stackrel{?}{=} -\frac{16}{3}$

$\frac{8}{3} - 8 \stackrel{?}{=} -\frac{16}{3}$

$\frac{8}{3} - \frac{24}{3} \stackrel{?}{=} -\frac{16}{3}$

$-\frac{16}{3} = -\frac{16}{3}$

Yes, the point *is* on the graph.

(b) $(-3, 9)$: $\frac{1}{3}(-3)^3 - 2(-3)^2 \stackrel{?}{=} 9$

$\frac{1}{3}(-27) - 2(9) \stackrel{?}{=} 9$

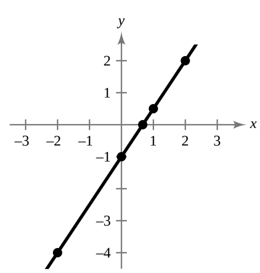
$-9 - 18 \stackrel{?}{=} 9$

$-27 \neq 9$

No, the point *is not* on the graph.

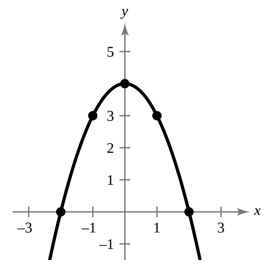
10. $y = \frac{3}{2}x - 1$

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



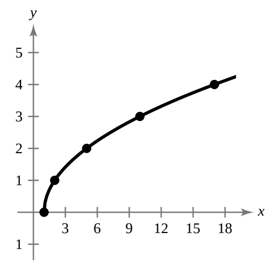
12. $y = 4 - x^2$

x	-2	-1	0	1	2
y	0	3	4	3	0



14. $y = \sqrt{x - 1}$

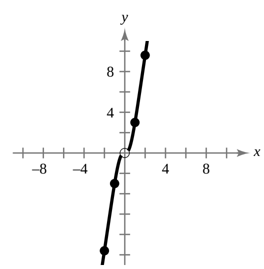
x	1	2	5	10	17
y	0	1	2	3	4



16. (a) $y = \dfrac{6x}{x^{-2} + 1}$

x	-2	-1	0	1	2
y	$-\frac{48}{5}$	-3	undef.	3	$\frac{48}{5}$

(b)



(c)

x	5	10	20	40
y	28.8	59.4	119.7	239.9

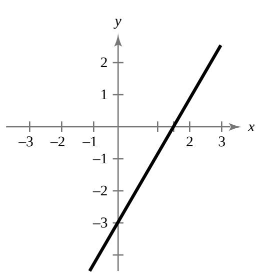
The values of y are increasing without bound (approaching infinity). In fact, the values of y are approaching $6x$ as x gets large. No, y cannot be negative for positive values of x.

18. $y = x^2 - 2x$ is a parabola. Matches (c).

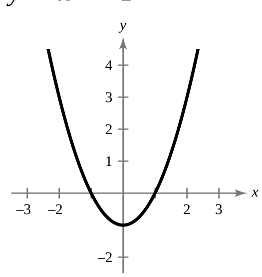
20. $y = 2\sqrt{x}$ passes through the origin. Matches (e).

22. $y = |x| - 3$ involves an absolute value. Matches (b).

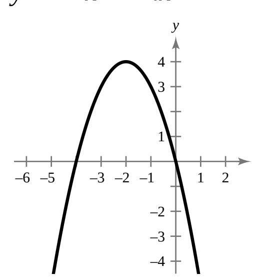
24. $y = 2x - 3$



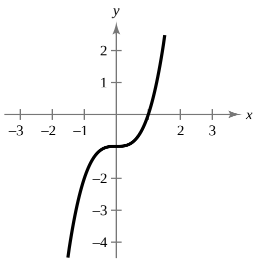
26. $y = x^2 - 1$



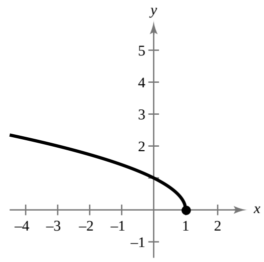
28. $y = -x^2 - 4x$



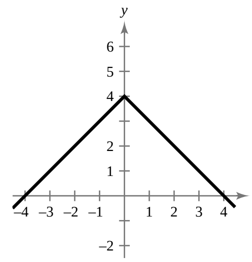
30. $y = x^3 - 1$



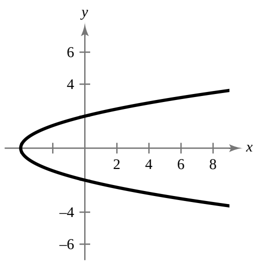
32. $y = \sqrt{1 - x}$



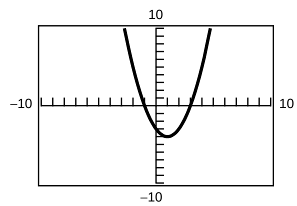
34. $y = 4 - |x|$



36. $x = y^2 - 4$

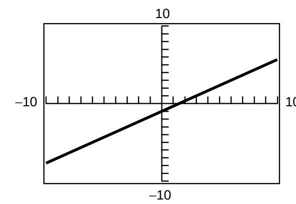


38. $y = (x + 1)(x - 3)$

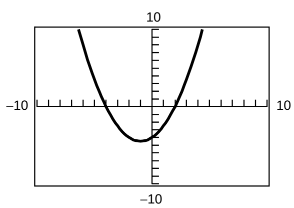


Intercepts:
$(-1, 0), (0, -3), (3, 0)$

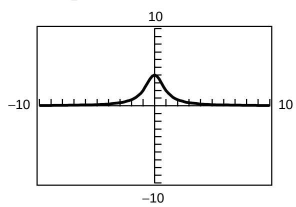
40. Intercepts: $(0, -1), \left(\frac{3}{2}, 0\right)$



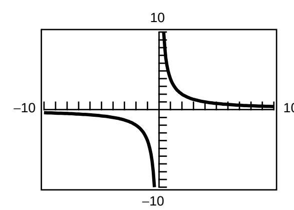
42. Intercepts:
$(-4, 0), (2, 0), (0, -4)$



44. Intercept: $(0, 4)$

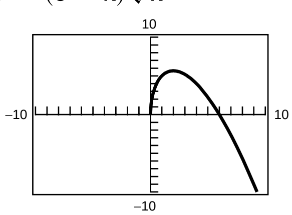


46. $y = \dfrac{4}{x}$



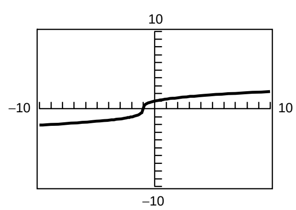
No intercepts

48. $y = (6 - x)\sqrt{x}$

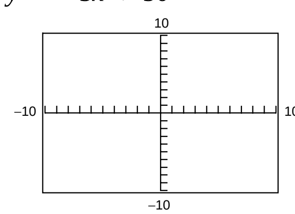


Intercepts: $(0, 0), (6, 0)$

50. Intercepts: $(-1, 0), (0, 1)$

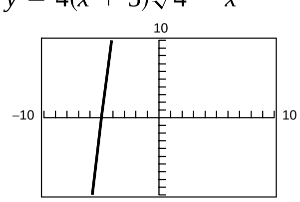


52. $y = -3x + 50$



The specified setting gives a more complete graph. (The *y*-intercept is visible.)

54. $y = 4(x + 5)\sqrt{4 - x}$



The specified setting gives a more complete graph.

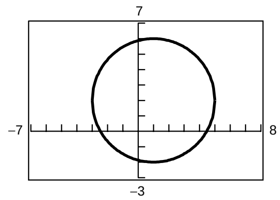
56. $y = x^3 - 3x^2 + 4$
Range/Window

Xmin = -3
Xmax = 5
Xscl = 1
Ymin = -3
Ymax = 5
Yscl = 1

58. $y = 8\sqrt[3]{x - 6}$
Range/Window

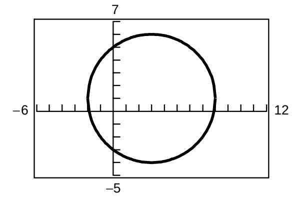
Xmin = -40
Xmax = 40
Xscl = 10
Ymin = -40
Ymax = 40
Yscl = 10

60. $y_1 = 2 + \sqrt{16 - (x - 1)^2}$
$y_2 = 2 - \sqrt{16 - (x - 1)^2}$



A circle is bounded by their graphs.

62. $y_1 = 1 + \sqrt{25 - (x - 3)^2}$
$y_2 = 1 - \sqrt{25 - (x - 3)^2}$



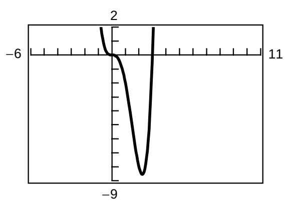
64. $y_1 = \frac{1}{2}x + (x + 1)$
$y_2 = \frac{3}{2}x + 1$

Graphing these with a graphing utility shows that their graphs are identical. The Associative Property of addition is illustrated.

66. $y_1 = (x - 3) \cdot \dfrac{1}{x - 3}$
$y_2 = 1$

Graphing these with a graphing utility shows that their graphs are identical. The Multiplicative Inverse Property is illustrated. (Except for hole at $x = 3$ for y_1.)

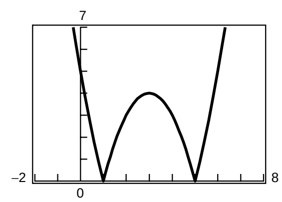
68.



(a) $(2.25, -8.54)$

(b) $(-1.63, 20)$, $(3.48, 20)$

70.



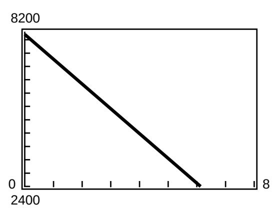
(a) $(2, 3)$

(b) $(0.65, 1.5)$, $(1.42, 1.5)$
$(4.58, 1.5)$, $(5.35, 1.5)$

72. (a)

Xmin = 0
Xmax = 8
Xscl = 1
Ymin = 2400
Ymax = 8200
Yscl = 500

(b)



(c) For $y = 5545.25$, $t = 2.75$, Algebraically,

$8100 - 929t = 5545.25$

$2554.75 = 929t$

$t = 2.75$ years

(d) For $t = 5.5$, $y = 2990.5$. Algebraically, $y = 8100 - 929(5.5) = \$2990.5$

74. (a) For 1975, $t = 25$ and $y \approx \$2907.31$

For 1992, $t = 42$ and $y \approx 13{,}779.34$

(b) Graphing the model y together with $y_2 = 10{,}200$, $y > 10{,}200$ when $t > 38.2$ or 1988.

(c) For 2002, $t = 52$ and $y \approx \$27{,}142$

For 2004, $t = 54$ and $y \approx \$30{,}589$

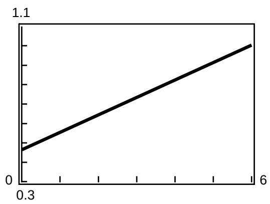
76. $y = 0.464 + 0.091t, \ 0 \le t \le 6$

(a)

Year	1992	1993	1994	1995	1996	1997	1998
t	0	1	2	3	4	5	6
Dividend	.464	.555	.646	.737	.828	.919	1.01

The dividend was 0.65 in 1994 $(t = 2)$.

(b)



(c) $y = 0.65$ when $t \approx 2$ (1994)

(d) For 1997, $t = 5$ and $y = 0.464 + 0.091(5) = 0.464 + 0.455 = 0.919 = 0.92$

(e) For 2002, $t = 10$ and $y = .464 + 0.091(10) = 1.37$

78. False. A parabola can 0, 1 or 2 x-intercepts. For example, $y = x^2 - 4$ has 2 x-intercepts: $(2, 0)$ and $(-2, 0)$.

80. $y = (x - a)(x - b)$

$(-2, 0)$: $0 = (x + 2)(x - 6) \implies a = -2$

$(5, 0)$: $0 = (x + 2)(x - 5) \implies b = 5$

Section P.3 Lines in the Plane

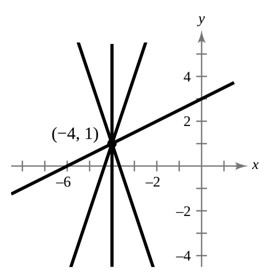
Solutions to Even-Numbered Exercises

2. (a) $m = 0$. The line is horizontal. Matches L_2.

(b) $m = -\frac{3}{4}$. Because the slope is negative, the line falls. Matches L_1.

(c) $m = 1$. Because the slope is positive, the line rises. Matches L_3.

4.



6. The line appears to go through $(1, 0)$ and $(3, 5)$.

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 0}{3 - 1} = \frac{5}{2}$$

8. The line appears to go through $(0, 7)$ and $(7, 0)$.

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 7}{7 - 0} = -1$$