Section P.2 Graphs of Equations

- You should be able to use the point-plotting method of graphing.
- You should be able to find x- and y-intercepts.
  (a) To find the x-intercepts, let $y = 0$ and solve for x.
  (b) To find the y-intercepts, let $x = 0$ and solve for y.
- You should know how to graph an equation with a graphing utility. You should be able to determine an appropriate viewing rectangle.
- You should be able to use the zoom and trace features of a graphing utility.

Solutions to Odd-Numbered Exercises

1. $y = \sqrt{x+4}$

(a) $(0, 2)$: $2 \stackrel{?}{=} \sqrt{0+4}$

$2 = 2$ ✓

Yes, the point *is* on the graph.

(b) $(5, 3)$: $3 \stackrel{?}{=} \sqrt{5+4}$

$3 = \sqrt{9}$ ✓

Yes, the point *is* on the graph.

3. $y = 4 - |x - 2|$

(a) $(1, 5)$: $5 \stackrel{?}{=} 4 - |1 - 2|$

$5 \neq 4 - 1$

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

(b) $(1.2, 3.2)$: $3.2 \stackrel{?}{=} 4 - |1.2 - 2|$

$3.2 \stackrel{?}{=} 4 - |-.8|$

$3.2 \stackrel{?}{=} 4 - .8$

$3.2 \stackrel{?}{=} 3.2$ ✓

Yes, the point *is* on the graph.

5. $2x - y - 3 = 0$

(a) $(1, 2)$: $2(1) - (2) - 3 \stackrel{?}{=} 0$

$-3 \neq 0$

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

(b) $(1, -1)$: $2(1) - (-1) - 3 \stackrel{?}{=} 0$

$2 + 1 - 3 = 0$ ✓

Yes, the point *is* on the graph.

7. $x^2y - x^2 + 4y = 0$

(a) $\left(1, \frac{1}{5}\right)$: $(1)^2\left(\frac{1}{5}\right) - (1)^2 + 4\left(\frac{1}{5}\right) \stackrel{?}{=} 0$

$\frac{1}{5} - 1 + \frac{4}{5} = 0$ ✓

Yes, the point *is* on the graph.

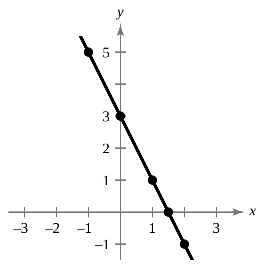
(b) $\left(2, \frac{1}{2}\right)$: $(2)^2\left(\frac{1}{2}\right) - (2)^2 + 4\left(\frac{1}{2}\right) \stackrel{?}{=} 0$

$2 - 4 + 2 = 0$ ✓

Yes, the point *is* on the graph.

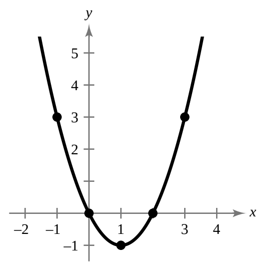
9. $y = -2x + 3$

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



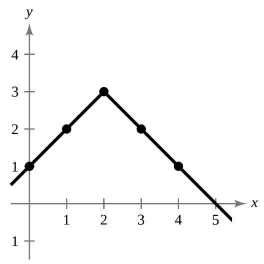
11. $y = x^2 - 2x$

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



13. $y = 3 - |x - 2|$

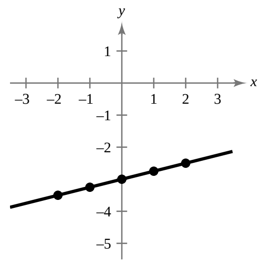
x	0	1	2	3	4
y	1	2	3	2	1



15. (a) $y = \frac{1}{4}x - 3$

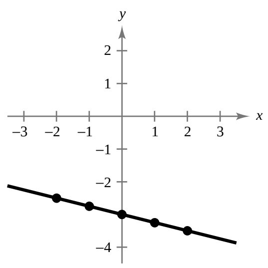
x	-2	-1	0	1	2
y	$-\frac{7}{2}$	$-\frac{13}{4}$	-3	$-\frac{11}{4}$	$-\frac{5}{2}$

(b)



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

x	-2	-1	0	1	2
y	$-\frac{5}{2}$	$-\frac{11}{4}$	-3	$-\frac{13}{4}$	$-\frac{7}{2}$



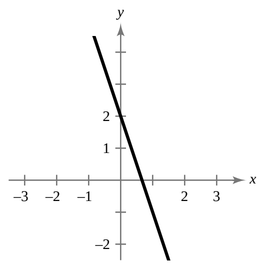
Both graphs are lines. The first graph rises to the right, whereas the second falls. Both pass through $(0, -3)$.

17. $y = 1 - x$ has intercepts $(1, 0)$ and $(0, 1)$. Matches graph (d).

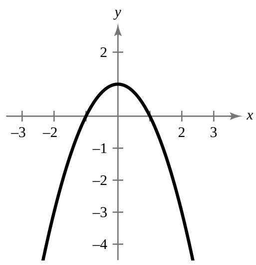
19. $y = \sqrt{9 - x^2}$ has intercepts $(\pm 3, 0)$ and $(0, 3)$. Matches graph (f).

21. $y = x^3 - x + 1$ has a y-intercept of $(0, 1)$ and the points $(1, 1)$ and $(-2, -5)$ are on the graph. Matches (a).

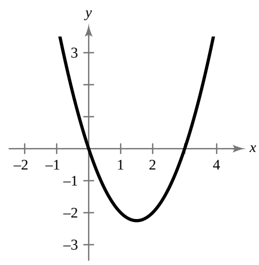
23. $y = -3x + 2$



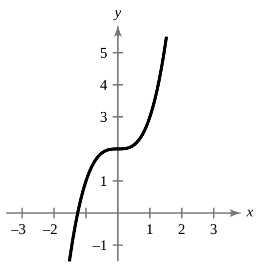
25. $y = 1 - x^2$



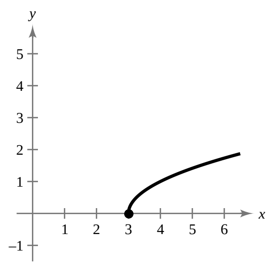
27. $y = x^2 - 3x$



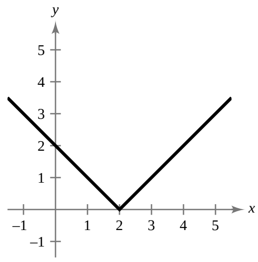
29. $y = x^3 + 2$



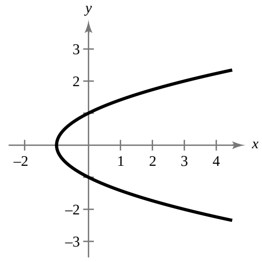
31. $y = \sqrt{x - 3}$



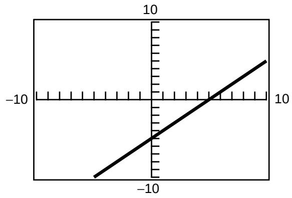
33. $y = |x - 2|$



35. $x = y^2 - 1$

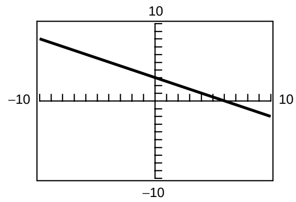


37. $y = x - 5$



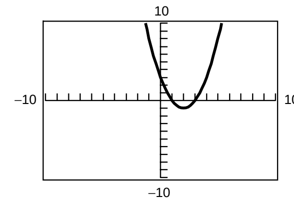
Intercepts: $(0, -5)$, $(5, 0)$

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



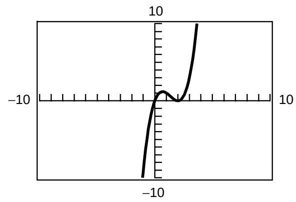
Intercepts: (6,0), (0, 3)

41. $y = x^2 - 4x + 3$



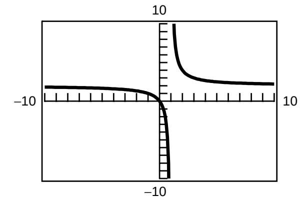
Intercepts: (3, 0), (1, 0), (0, 3)

43. $y = x(x - 2)^2$



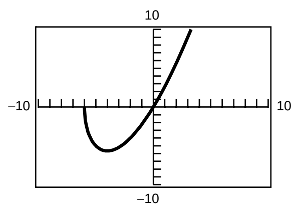
Intercepts: (0, 0), (2, 0)

45. $y = \dfrac{2x}{x - 1}$



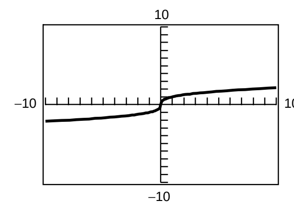
Intercept: (0, 0)

47. $y = x\sqrt{x + 6}$



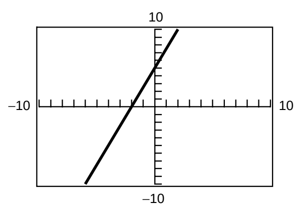
Intercepts: (0, 0), (−6, 0)

49. $y = \sqrt[3]{x}$

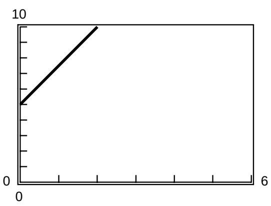


Intercept: (0, 0)

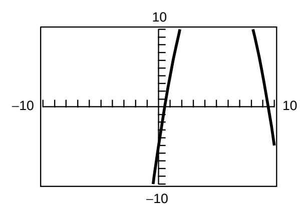
51. $y = \frac{5}{2}x + 5$

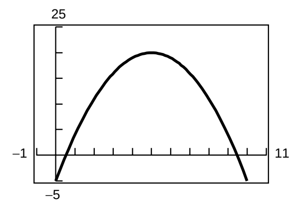


Both settings show the line and its intercept. The first setting is better.



53. $y = -x^2 + 10x - 5$





The second viewing window is better because it shows mor of the essential features of the func-tion.

55. $y = 4x^2 - 25$

Range/Window

Xmin=-5
Xmax=5
Xscl=1
Ymin=-30
Ymax=10
Yscl=5

57. $y = |x| + |x - 10|$

Range/Window

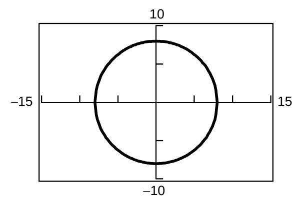
Xmin=-30
Xmax=30
Xscl=5
Ymin=-10
Ymax=50
Yscl=5

59. $x^2 + y^2 = 64$

$$y^2 = 64 - x^2$$
$$y = \pm\sqrt{64 - x^2}$$

Use: $y_1 = \sqrt{64 - x^2}$

$$y_2 = -\sqrt{64 - x^2}$$

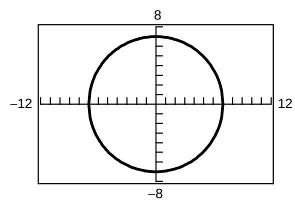


61. $x^2 + y^2 = 49$

$$y^2 = 49 - x^2$$
$$y = \pm\sqrt{49 - x^2}$$

Use: $y_1 = \sqrt{49 - x^2}$

$$y_2 = -\sqrt{49 - x^2}$$



63. $y_1 = \frac{1}{4}(x^2 - 8)$

$y_2 = \frac{1}{4}x^2 - 2$

The graphs are identical.
The Distributive Property is illustrated.

65. $y_1 = \frac{1}{5}[10(x^2 - 1)]$

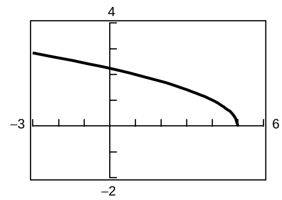
$y_2 = 2(x^2 - 1)$

The graphs are identical.
The Associative Property of Multiplication is illustrated

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

(a) $(2, y) \approx (2, 1.73)$

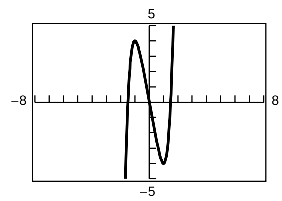
(b) $(x, 3) = (-4, 3)$



69. $y = x^5 - 5x$

(a) $(-0.5, y) \approx (-0.5, 2.47)$

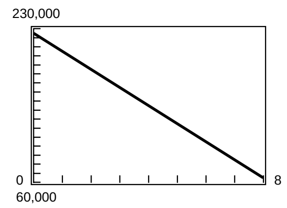
(b) $(x, -4) = (1, -4)$ or $(x, -4) \approx (-1.65, -4)$



71. (a) $y = 225{,}000 - 20{,}000t\ ,\ 0 \le t \le 8$

Window
$X_{\min} = 0$
$X_{\max} = 8$
$X_{\text{scl}} = 1$
$Y_{\min} = 60{,}000$
$Y_{\max} = 230{,}000$
$Y_{\text{scl}} = 10{,}000$

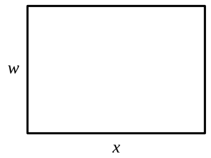
(b)



(c) When $t = 5.8$, $y = 109{,}000$. Algebraically, $225{,}000 - 20{,}000(5.8) = \$109{,}000$.

(d) When $t = 2.35$, $y = 178{,}000$. Algebraically, $225{,}000 - 20{,}000(2.35) = \$178{,}000$.

73. (a)



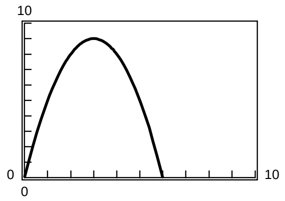
(b) Perimeter: $12 = 2x + 2w$

$$12 = 2(x + w)$$
$$6 = x + w$$

Thus, $w = 6 - x$.

Area: $xw = x(6 - x) \Longrightarrow A = x(6 - x)$

(c)



(d) When $w = 4.9$, $x = 1.1$ and Area $= 5.39$ meters.
Algebraically, Area $= xw = (1.1)(4.9) = 5.39$ meters.

(e) The maximum area corresponds to the highest point on the graph, which appears to be $(3, 9)$. Thus, $x = 3$ and $w = 3$, and the rectangle is a square.

75. (a) The y-intercept $(0, 66.93)$ indicates the model's estimate of the life expectancy in 1950 $(t = 0)$.

(b) $y = 73.2$ when $t = 23.40$, which corresponds to 1973. Algebraically,

$$\frac{66.93 + t}{1 + 0.01t} = 73.2$$
$$66.93 + t = 73.2 + 0.732t$$
$$0.268t = 6.27$$
$$t \approx 23.4$$

(c) 1948 corresponds to $t = -2$. Graphically, $y = 66.26$ when $t = -2$. Algebraically,

$$\frac{66.93 + (-2)}{1 + 0.01(-2)} = \frac{64.93}{0.98} = 66.26 \text{ years}$$

(d) 2005 corresponds to $t = 55$:

$$\frac{66.93 + 55}{1 + 0.01(55)} = \frac{121.93}{1.55} = 78.66 \text{ years}$$