STUDENT'S SOLUTIONS MANUAL

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COLLEGE ALGEBRA: GRAPHS AND MODELS

FIFTH EDITION

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Contents

$$x = -3 - 4 \quad or \quad x = -3 + 4$$
$$x = -7 \quad or \quad x = 1$$

The solutions are -7 and 1.

31.
$$\begin{aligned} x^2 &= 8x - 9 \\ x^2 - 8x &= -9 && \text{Subtracting } 8x \\ x^2 - 8x + 16 &= -9 + 16 && \text{Completing the square: } \tfrac{1}{2}(-8) = -4 \text{ and } (-4)^2 = 16 \\ (x-4)^2 &= 7 && \text{Factoring} \\ x - 4 &= \pm\sqrt{7} && \text{Using the principle of square roots} \\ x &= 4 \pm \sqrt{7} \end{aligned}$$

The solutions are $4 - \sqrt{7}$ and $4 + \sqrt{7}$, or $4 \pm \sqrt{7}$.

33. $x^2 + 8x + 25 = 0$
$$\begin{aligned} x^2 + 8x &= -25 && \text{Subtracting 25} \\ x^2 + 8x + 16 &= -25 + 16 && \text{Completing the square: } \tfrac{1}{2}\cdot 8 = 4 \text{ and } 4^2 = 16 \\ (x+4)^2 &= -9 && \text{Factoring} \\ x + 4 &= \pm 3i && \text{Using the principle of square roots} \\ x &= -4 \pm 3i \end{aligned}$$

The solutions are $-4 - 3i$ and $-4 + 3i$, or $-4 \pm 3i$.

35.
$$\begin{aligned} 3x^2 + 5x - 2 &= 0 \\ 3x^2 + 5x &= 2 && \text{Adding 2} \\ x^2 + \frac{5}{3}x &= \frac{2}{3} && \text{Dividing by 3} \\ x^2 + \frac{5}{3}x + \frac{25}{36} &= \frac{2}{3} + \frac{25}{36} && \text{Completing the square: } \tfrac{1}{2}\cdot\tfrac{5}{3} = \tfrac{5}{6} \text{ and } (\tfrac{5}{6})^2 = \tfrac{25}{36} \\ \left(x + \frac{5}{6}\right)^2 &= \frac{49}{36} && \text{Factoring and simplifying} \\ x + \frac{5}{6} &= \pm\frac{7}{6} && \text{Using the principle of square roots} \\ x &= -\frac{5}{6} \pm \frac{7}{6} \end{aligned}$$

$$x = -\frac{5}{6} - \frac{7}{6} \quad or \quad x = -\frac{5}{6} + \frac{7}{6}$$
$$x = -\frac{12}{6} \quad or \quad x = \frac{2}{6}$$
$$x = -2 \quad or \quad x = \frac{1}{3}$$

The solutions are -2 and $\frac{1}{3}$.

37.
$$\begin{aligned} x^2 - 2x &= 15 \\ x^2 - 2x - 15 &= 0 \\ (x-5)(x+3) &= 0 && \text{Factoring} \end{aligned}$$
$$x - 5 = 0 \quad or \quad x + 3 = 0$$
$$x = 5 \quad or \quad x = -3$$

The solutions are 5 and -3.

39.
$$\begin{aligned} 5m^2 + 3m &= 2 \\ 5m^2 + 3m - 2 &= 0 \\ (5m-2)(m+1) &= 0 && \text{Factoring} \end{aligned}$$
$$5m - 2 = 0 \quad or \quad m + 1 = 0$$
$$m = \frac{2}{5} \quad or \quad m = -1$$

The solutions are $\frac{2}{5}$ and -1.

41.
$$\begin{aligned} 3x^2 + 6 &= 10x \\ 3x^2 - 10x + 6 &= 0 \end{aligned}$$

We use the quadratic formula. Here $a = 3$, $b = -10$, and $c = 6$.

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-10) \pm \sqrt{(-10)^2 - 4\cdot 3\cdot 6}}{2\cdot 3} && \text{Substituting} \\ &= \frac{10 \pm \sqrt{28}}{6} = \frac{10 \pm 2\sqrt{7}}{6} \\ &= \frac{2(5 \pm \sqrt{7})}{2\cdot 3} = \frac{5 \pm \sqrt{7}}{3} \end{aligned}$$

The solutions are $\frac{5 - \sqrt{7}}{3}$ and $\frac{5 + \sqrt{7}}{3}$, or $\frac{5 \pm \sqrt{7}}{3}$.

43. $x^2 + x + 2 = 0$

We use the quadratic formula. Here $a = 1$, $b = 1$, and $c = 2$.

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-1 \pm \sqrt{1^2 - 4\cdot 1\cdot 2}}{2\cdot 1} && \text{Substituting} \\ &= \frac{-1 \pm \sqrt{-7}}{2} \\ &= \frac{-1 \pm \sqrt{7}i}{2} = -\frac{1}{2} \pm \frac{\sqrt{7}}{2}i \end{aligned}$$

The solutions are $-\frac{1}{2} - \frac{\sqrt{7}}{2}i$ and $-\frac{1}{2} + \frac{\sqrt{7}}{2}i$, or $-\frac{1}{2} \pm \frac{\sqrt{7}}{2}i$.

45.
$$\begin{aligned} 5t^2 - 8t &= 3 \\ 5t^2 - 8t - 3 &= 0 \end{aligned}$$

We use the quadratic formula. Here $a = 5$, $b = -8$, and $c = -3$.

$$\begin{aligned} t &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-8) \pm \sqrt{(-8)^2 - 4\cdot 5(-3)}}{2\cdot 5} \\ &= \frac{8 \pm \sqrt{124}}{10} = \frac{8 \pm 2\sqrt{31}}{10} \\ &= \frac{2(4 \pm \sqrt{31})}{2\cdot 5} = \frac{4 \pm \sqrt{31}}{5} \end{aligned}$$

The solutions are $\frac{4 - \sqrt{31}}{5}$ and $\frac{4 + \sqrt{31}}{5}$, or

Solve the second equation for l: $l = 9 - w$

Substitute $9 - w$ for l in the first equation and solve for w.

$$\begin{aligned}(9-w)w &= 20\\ 9w - w^2 &= 20\\ 0 &= w^2 - 9w + 20\\ 0 &= (w-5)(w-4)\end{aligned}$$

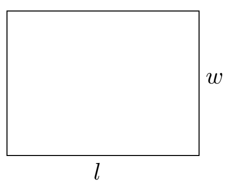
$w = 5$ or $w = 4$

If $w = 5$, then $l = 9 - w$, or 4. If $w = 4$, then $l = 9 - 4$, or 5. Since length is usually considered to be longer than width, we have the solution $l = 5$ and $w = 4$, or $(5, 4)$.

Check. If $l = 5$ and $w = 4$, the area is $5 \cdot 4$, or 20. The perimeter is $2 \cdot 5 + 2 \cdot 4$, or 18. The numbers check.

State. The length of the brochure is 5 in. and the width is 4 in.

63. ***Familiarize***. We make a drawing of the dog run. Let $l =$ the length and $w =$ the width.



Since it takes 210 yd of fencing to enclose the run, we know that the perimeter is 210 yd.

Translate.

Perimeter: $2l + 2w = 210$, or $l + w = 105$

Area: $lw = 2250$

Carry out. We solve the system:

Solve the first equation for l: $l = 105 - w$

Substitute $105 - w$ for l in the second equation and solve for w.

$$\begin{aligned}(105-w)w &= 2250\\ 105w - w^2 &= 2250\\ 0 &= w^2 - 105w + 2250\\ 0 &= (w-30)(w-75)\end{aligned}$$

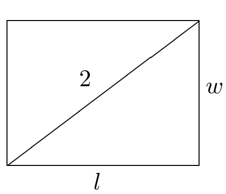
$w = 30$ or $w = 75$

If $w = 30$, then $l = 105 - 30$, or 75. If $w = 75$, then $l = 105 - 75$, or 30. Since length is usually considered to be longer than width, we have the solution $l = 75$ and $w = 30$, or $(75, 30)$.

Check. If $l = 75$ and $w = 30$, the perimeter is $2\cdot 75 + 2\cdot 30$, or 210. The area is $75(30)$, or 2250. The numbers check.

State. The length is 75 yd and the width is 30 yd.

65. ***Familiarize***. We first make a drawing. Let $l =$ the length and $w =$ the width.



Translate.

Area: $lw = \sqrt{3}$ (1)

From the Pythagorean theorem: $l^2 + w^2 = 2^2$ (2)

Carry out. We solve the system of equations.

We first solve equation (1) for w.

$$\begin{aligned}lw &= \sqrt{3}\\ w &= \frac{\sqrt{3}}{l}\end{aligned}$$

Then we substitute $\dfrac{\sqrt{3}}{l}$ for w in equation 2 and solve for l.

$$\begin{aligned}l^2 + \left(\frac{\sqrt{3}}{l}\right)^2 &= 4\\ l^2 + \frac{3}{l^2} &= 4\\ l^4 + 3 &= 4l^2\\ l^4 - 4l^2 + 3 &= 0\\ u^2 - 4u + 3 &= 0 \quad \text{Letting } u = l^2\\ (u-3)(u-1) &= 0\end{aligned}$$

$u = 3$ or $u = 1$

We now substitute l^2 for u and solve for l.

$l^2 = 3$ or $l^2 = 1$

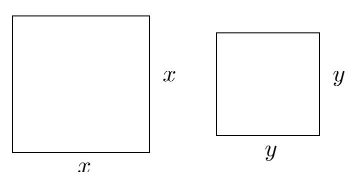
$l = \pm\sqrt{3}$ or $l = \pm 1$

Measurements cannot be negative, so we only need to consider $l = \sqrt{3}$ and $l = 1$. Since $w = \sqrt{3}/l$, if $l = \sqrt{3}$, $w = 1$ and if $l = 1$, $w = \sqrt{3}$. Length is usually considered to be longer than width, so we have the solution $l = \sqrt{3}$ and $w = 1$, or $(\sqrt{3}, 1)$.

Check. If $l = \sqrt{3}$ and $w = 1$, the area is $\sqrt{3} \cdot 1 = \sqrt{3}$. Also $(\sqrt{3})^2 + 1^2 = 3 + 1 = 4 = 2^2$. The numbers check.

State. The length is $\sqrt{3}$ m, and the width is 1 m.

67. ***Familiarize***. We let $x =$ the length of a side of one test plot and $y =$ the length of a side of the other plot. Make a drawing.



Area: x^2 Area: y^2

Translate.

$$\underbrace{\text{The sum of the areas}}_{x^2 + y^2} \quad \underbrace{\text{is}}_{=} \quad \underbrace{832 \text{ ft}^2}_{832}.$$

$$\underbrace{\text{The difference of the areas}}_{x^2 - y^2} \quad \underbrace{\text{is}}_{=} \quad \underbrace{320 \text{ ft}^2}_{320}.$$

Carry out. We solve the system of equations.