Equations may be solved in a variety of ways. These sections in the textbook use three methods that allow students to solve complex equations in more efficient ways. The methods are called **Rewriting**, **Looking Inside**, and **Undoing**.

For additional information, see the Math Notes box in Lesson 3.3.3.

Example 1 Rewriting

Solve: $\dfrac{x}{2} + \dfrac{x}{5} = 3$

This problem can be rewritten without fractions by using Fraction Busters. Begin by determining the common denominator of the fractions.

$$10 \cdot \left(\tfrac{x}{2} + \tfrac{x}{5}\right) = 10(3)$$
$$5x + 2x = 30$$
$$7x = 30$$
$$x = \tfrac{30}{7} \approx 4.29$$

Example 2 Looking Inside

Solve: $\sqrt{x} + 1 = 6$

This problem has a square root and a sum, so looking inside can solve this.

$$\sqrt{x} + 1 = 6$$
$$\sqrt{x} = 5$$
$$\text{therefore}$$
$$x = 25$$

Example 3 Undoing

Solve: $\frac{2}{3}x + 1 = 7$

Undoing the addition and then the multiplication by a fraction can solve this problem.

$$\tfrac{2}{3}x + 1 - 1 = 7 - 1$$
$$\tfrac{2}{3}x = 6$$
$$\tfrac{3}{2}\left(\tfrac{2}{3}x\right) = \tfrac{3}{2}(6)$$
$$x = 9$$

Example 4 Rewriting

Solve $(x-3)(x+6) = x^2 - 12x - 6$

Rewriting the left side of the equation using an area model can solve this problem.

$\times$	x	$+6$
x	x^2	$+6x$
-3	$-3x$	-18

$$(x-3)(x+6) = x^2 - 12x - 6$$
$$x^2 - 3x + 6x - 18 = x^2 - 12x - 6$$
$$\underline{-x^2 \qquad\qquad\qquad\quad -x^2}$$
$$3x - 18 = -12x - 6$$
$$\underline{\qquad +18 \qquad\qquad +18 \qquad}$$
$$15x = 12$$
$$\tfrac{15x}{15} = \tfrac{12}{15}$$
$$x = \tfrac{12}{15} = \tfrac{4}{5}$$

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Example 5 Rewriting and Looking Inside to Solve Exponential Equations

Solve: $10^{-5x+7} = 100^x$

Rewriting so that the bases are the same and then looking inside the exponents can solve this problem. Once the equations are rewritten such that the bases are the same, then the exponents need to be the same.

Rewriting:
$$10^{-5x+7} = 100^x$$
$$10^{-5x+7} = (10^2)^x = 10^{2x}$$

Looking Inside:
$$\Rightarrow \quad 10^{-5x+7} = 10^{2x}$$
$$-5x + 7 = 2x$$
$$7 = 7x$$
$$x = 1$$

Problems

Solve each equation. Find all solutions.

1. $\frac{3x}{2} + \frac{1}{2} = 5$

2. $(x-1)(x+3) = x^2 - 2x + 13$

3. $\sqrt{2x+5} = 10$

4. $625 = 5^{-6x+5}$

5. $3(2x-7) = -21$

6. $2^{4x-1} = 32$

7. $\sqrt{x} - 3 = 7$

8. $(x+1)^2 = 81$

9. $\frac{x}{2} - \frac{x}{5} = 3$

10. $3^{x+3} = 27$

11. $2\sqrt{x-3} = 8$

12. $0.04(x-1) = 0.16$

13. $400 + 300x = 1300$

14. $10 - (x+7) = 5$

15. $\frac{m}{3} - \frac{2m}{5} = \frac{1}{5}$

16. $x^2 + 5 = 4$

17. $x(3x-1) + 8 = (3x+1)(x-5)$

18. $0.2x - 0.4 = 1.2$

19. $(y-1)^2 = 9$

20. $20{,}000 - (3000x) = 10{,}000$

Answers

1. $x = 3$

2. $x = 4$

3. $x = \frac{95}{2} = 47.5$

4. $x = -\frac{1}{6}$

5. $x = 0$

6. $x = 1.5$

7. $x = 100$

8. $x = 8$ or -10

9. $x = 10$

10. $x = 0$

11. $x = 19$

12. $x = 5$

13. $x = 3$

14. $y = -2$

15. $m = -3$

16. no solution

17. $x = -1$

18. $x = 8$

19. $y = 4$ or -2

20. $x = \frac{10}{3}$