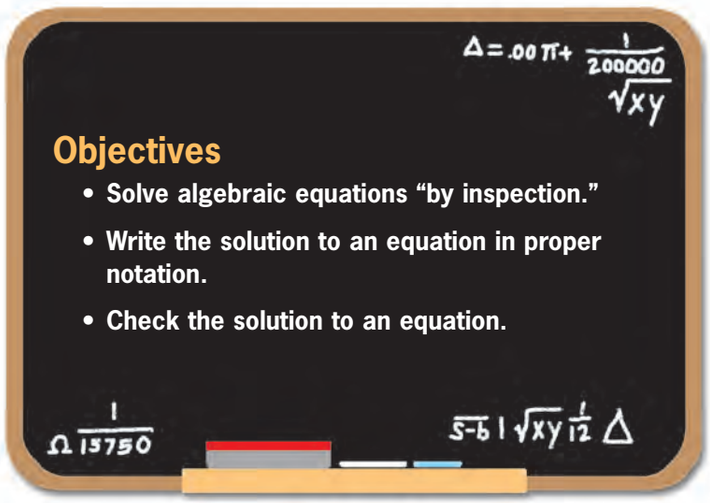
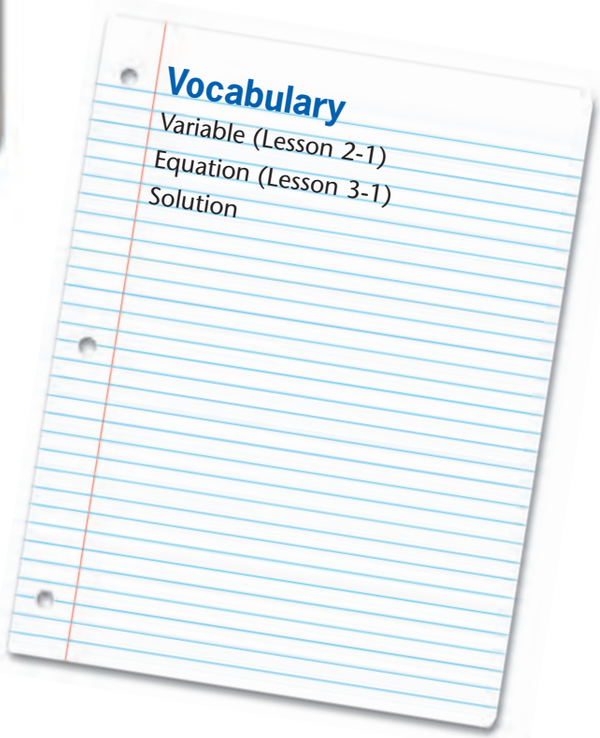
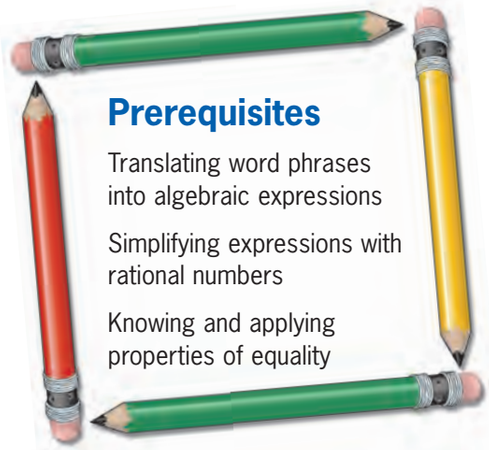
3.2 teacher notes







Get Started

List the number sentences on the board. Ask students to write down the numbers for each sentence that make it true. Ask volunteers to explain how they found each missing number. Then, replace all the squares with variables. Ask students whether or not their answers or methods for finding the answers will change. The response should be "no."

- $4 + \square = 7$. 3
- $\square - 3 = 2$. 5
- $4 \cdot \square = 12$. 3
- $\square \div 4 = 5$. 20

Section 1

Expand Their Horizons

In Section 1, students will solve one-step equations using addition and subtraction. They will be solving these equations by inspection only. In future lessons students will be required to solve equations algebraically, showing the necessary steps.

Common Error Alert

When an expression such as 2^3 is simplified, the answer is still an expression. Simplifying 2^3 produces 8. Equations always have an equal sign between two expressions. When an equation such as $25 + b = 35$ is solved, the answer, $b = 10$, is still an equation. Be sure that students are careful about writing answers to solving equations as equations and not as a single expression.

The concept of mental math is a concept that the students probably used in solving the Getting Started problems. Note that the numbers used in these lessons are easy to compute mentally and do not require pencil and paper to complete the operations. Also, all of the equations are one step. This method of inspection will not be practical as the difficulty of equations increases and rational numbers are used more frequently.

To emphasize the use of symbols in equations, have students in small groups write symbols for various objects. Objects such as coins, books, cows, and plants can be used. Discuss the advantages of using symbols to represent objects. Certain advantages might include the fact that the symbol requires less space to write than the actual object. Also, the symbol can represent a mental image rather than the actual object.

Help students see the value of checking solutions by leading a discussion about tasks in which having accurate numerical answers is vital. Accounting, tax return preparation, equations for space shuttle launches, and food supplies are all important. Remind students that although the equations in this lesson are simple and checking may appear unnecessary, creating the habit now will help them throughout this course and in future math and science classes.

Remind students of the times that they were required to check their solutions in elementary school. For instance, when learning subtraction, they checked their answers using addition; when learning division, they checked their answers using multiplication.

1 $10 + b = 15$. What number is added to 10 to get 15? The solution is $b = 5$. Check this solution. $10 + 5 = 15$ is a true statement.

A Manipulatives Section is provided with this lesson. Many students need concrete objects to help them understand equations in the beginning. Manipulatives can easily be used to solve the first Guided Practice example. Solve $10 + b = 15$ using beans for the numbers and a paper cup to represent the variable. Make an equal sign. On the left of the equal sign have 10 beans, a plus sign, and a paper cup in that order. On the right side of the equal sign, have 15 beans. Ask, "How many beans must be placed in the cup so that there are the same number of beans on both sides of the equal sign?" The answer to this question is five. Therefore, $b = 5$.

Help Roxie find the number of tickets that she sold. $40 - t = 13$. Ask students what number is subtracted from 40 to get 13. $40 - 13 = 27$. This example shows the value of checking the solution.

Substitution may be another term that needs clarification. Role-playing can be helpful to show the value of substitution. Students can act out a team sports game (baseball, football, soccer, basketball, etc) when a player gets tired and another player replaces the first player. Emphasize that the replacement player serves the same role as the original player. Relate this scene to substituting values for variables to test for a true statement.

Additional Examples

1. Solve by inspection and check: $5 + p = 13$

Think: The sum of what number and 5 is 13? $5 + 8 = 13$, so p must equal 8.

$p = 8$

Check: $5 + p \stackrel{?}{=} 13$

$5 + 8 \stackrel{?}{=} 13$

$13 = 13$ ✓

2. Solve by inspection and check: $r - 8 = 12$

Think: 12 is the difference of what number and 8?

$20 - 8 = 12$, so r must equal 8.

$r = 20$

Check: $r - 8 \stackrel{?}{=} 12$

$20 - 8 \stackrel{?}{=} 12$

$12 = 12$ ✓

Some students may have gotten 4 as the answer. Note that in this case, the check step would have been

Check: $r - 8 \stackrel{?}{=} 12$

$4 - 8 \stackrel{?}{=} 12$

$-4 \neq 12$ ✗

So, the equation would not check and the solution of $r = 4$ is incorrect.

Section 2

Expand Their Horizons

In Section 2, students will be solving equations by inspection using multiplication and division.

Be sure students understand that "twice a number" or "doubling a number" is the same as multiplying the number by two. "Tripling a number" is the same as multiplying the number by three.

2 $4k = 28$. What number is multiplied by four to get 28? 7, so k must equal 7. Check: $4(7) = 28$.

These problems can also be solved using manipulatives. If each student does not have 28 beans, have students work in groups. To do the second Guided Practice problem, the left side of the equation should have four paper cups to represent $4k$. The right side of the equation should have 28 beans. Ask, "If the 28 beans are divided into four equal groups so that each cup has the same number of beans, how many beans will be in each cup?"

Ask, "18 divided by what number is 3?" The answer is 6. $\frac{18}{6} = 3$. Help students see that this problem can also be written as $18 = 3C$.

Additional Examples

1. Solve by inspection and check: $3m = 21$

Think: What number is multiplied by 3 to get 21? $3 \times 7 = 21$, so m must equal 7.
$m = 7$
Check: $3m = 21$
$3(7) \stackrel{?}{=} 21$
$21 = 21$ ✓

2. Solve by inspection and check: $\frac{32}{y} = 4$

Think: 32 divided by what number is 4?
$32 \div 8 = 4$, so y must equal 8.
$y = 8$
Check: $\frac{32}{y} = 4$
$\frac{32}{8} \stackrel{?}{=} 4$
$4 = 4$ ✓
Remind students that a variable expression in a denominator cannot have a value of zero.

Section 3

Expand Their Horizons

In Section 3, students will use square roots and exponents to solve one-step equations by inspection. Remember to emphasize that with an equation with a squared variable there are usually two solutions. A review of multiplying and squaring signed numbers will increase the students' confidence and understanding of both positive and negative solution possibilities.

Solve $n^2 = 25$. There are two numbers that can be squared to get 25, 5 and –5. $5(5) = 25$. $(-5)(-5) = 25$. The solutions are $n = 5$ and $n = -5$. Remind students to check for all possible solutions.

The symbol, $\pm$ may be confusing to students at first. Help them see that ± 5 is a short way of writing $+5$ or -5. Students may read the symbol as "plus or minus". Remind them that the symbol can be used to indicate sign or an operation. In these solutions, the $\pm$ symbol represents the sign of the numbers and is read "positive or negative".

Additional Examples

1. Solve by inspection and check: $v^2 = 4$

Think: What number or numbers multiplied by itself is equal to 4? positive 2 and negative 2
$v = \pm 2$
Check: $v^2 = 4$ $\quad$ $v^2 = 4$
$2^2 \stackrel{?}{=} 4$ $\quad$ $(-2)^2 \stackrel{?}{=} 4$
$2(2) \stackrel{?}{=} 4$ $\quad$ $(-2)(-2) \stackrel{?}{=} 4$
$4 = 4$ ✓ $\quad$ $4 = 4$ ✓

2. Solve by inspection and check: $s^2 = 144$

Think: What number or numbers multiplied by itself is equal to 144? positive 12 and negative 12
$s = \pm 12$
Check: $s^2 = 144$ $\quad$ $s^2 = 144$
$12^2 \stackrel{?}{=} 144$ $\quad$ $(-12)^2 \stackrel{?}{=} 144$
$12(12) \stackrel{?}{=} 144$ $\quad$ $(-12)(-12) \stackrel{?}{=} 144$
$144 = 144$ ✓ $\quad$ $144 = 144$ ✓