Lesson 28: Chapter 3 Opener

Linear Equations

CCSS K–12.MP2, 7

Objectives

- Determine whether equations are equivalent.
- Write a linear equation to represent a real-world situation.

Books & Materials

- *Math in Focus* A

Assignments

- ❑ Complete Warm-up.
- ❑ Read and complete pp. 92–93, *Math in Focus* A.
- ❑ Complete Math Checkpoint.

Warm-up

Use mental math to solve each equation.

1. $6x = 30$

2. $x + 9 = 40$

3. $2(x - 3) = 14$

4. $0.1x = 3$

Instruction

Today's lesson covers important ideas you need to understand before beginning the lessons in this chapter.

Read p. 92 in ***Math in Focus***. Explain in words or a number statement how much it would cost for you and your friends to play 1 game. Then show how much it would cost if you all played 4 games.

Read **Understanding equivalent equations** on p. 93. You should be able to use mental math to find each unknown value of x.

Read **Expressing the relationship between two quantities with a linear equation** on p. 93. Remember that the value of the dependent variable is calculated using the value of the independent variable.

To the Learning Guide

As you discuss these pages with your student, take note of the skills that seem familiar and those that may need review. Do not provide detailed instruction at this point; simply preview the material to prepare for the **Quick Check** sections.

Skills Check

Complete the **Quick Check** sections on p. 93 in ***Math in Focus***.

To the Learning Guide

Notice that in the first **Quick Check** section, all problems use the variable x. Make sure your student understands that the value of x he finds in one problem does not carry over to the next problem.

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Review your student's answers to the **Quick Check** sections, noting the problems that your student answered incorrectly. Then go online through your student's portal to today's lesson. Click on the link to access the appropriate **Reteach** activity that your student should complete for the remainder of this lesson.

Wrap-up

Today you reviewed how to identify whether two equations are equivalent. Two equations are equivalent when they have the same solution.

$x + 8 = 15$ and $x - 1 = 6$ are equivalent equations because you can subtract 9 from both sides of $x + 8 = 15$ to obtain $x - 1 = 6$. The solution to both equations is $x = 7$.

You also learned how to write a linear equation for a given situation. To do this, define independent and dependent variables and write an equation that expresses the relationship between the quantities.

Suppose each light bulb costs \$3.50. The cost, C, of n light bulbs is $C = \$3.50n$.

✅ **Complete Math Checkpoint**

CHAPTER

3

Algebraic Linear Equations

- Linear equations can be used to solve mathematical and real-world problems. A linear equation with one variable can have one solution, no solution, or infinitely many solutions.

Who wants to go bowling?

You and three friends want to go bowling. The bowling alley charges \$3.25 for each pair of shoes you rent and \$1.75 per game. All three of you need to rent shoes, and you aren't sure yet how many games you'll play. What will be your group's total cost?

In this situation, there are two quantities that can vary: the number of games your group plays and the group's total cost. In this chapter, you will learn how to write linear equations to represent situations in which there are two variables.

Recall Prior Knowledge

Understanding equivalent equations

Equivalent equations are equations that have the same solution. Performing the same operation on both sides of an equation produces an equivalent equation.

For example, $x = 8$ and $x - 2 = 6$ are equivalent equations. If you subtract 2 from both sides of $x = 8$, you get $x - 2 = 6$. The solution to both equations is 8.

Quick Check

Explain why each pair of equations is equivalent or not equivalent.

1. $x + 4 = 10$ and $x - 1 = 3$
2. $\frac{1}{5}x = 4$ and $x = 20$
3. $0.5x + 1 = 1.5x$ and $2x = 2$
4. $2(x + 9) = 14$ and $2(x - 7) = -18$

Expressing the relationship between two quantities with a linear equation

A wall has width w feet and length $2w$ feet. The perimeter P of the wall is $2w + 2w + w + w = 6w$ feet.

You can express the relationship between the perimeter and the width of the wall with a linear equation $P = 6w$. In the equation, w is the independent variable and P is the dependent variable because the value of P depends on the value of w.

Quick Check

Write a linear equation for each situation. State the independent and dependent variables for each equation.

5. A manufacturer produces drinks in small and large bottles. Each small bottle contains s liters of drinks. Each large bottle contains t liters, which is 1 more liter than the quantity in the small bottle. Express t in terms of s.
6. Hazel is 4 years younger than Alphonso. Express Alphonso's age, a, in terms of Hazel's age, h.
7. A bouquet of lavender costs $12. Find the cost, C, of n bouquets of lavender.
8. The distance, d (in miles), traveled by a bus is 40 times the time, t (in hours), used for the journey. Find d in terms of t.

Lesson 29

Solving Equations and Renaming Fractions

CCSS K–12.MP2, 7

Objectives
- Solve linear equations in one variable.
- Rename rational numbers as terminating or repeating decimals.

Books & Materials
- *Math in Focus* A

Assignments
- ❑ Complete Warm-up.
- ❑ Read and complete pp. 94–95, *Math in Focus* A.
- ❑ Complete Math Checkpoint.

Warm-up

Perform long division to simplify each expression.

1. 1,143 ÷ 3
2. 4,575 ÷ 5
3. 5,292 ÷ 14
4. 87,494 ÷ 82

Instruction

Today's lesson covers important ideas you need to understand before beginning the lessons in this chapter.

Read **Solving algebraic equations** on p. 94 in ***Math in Focus***. Remember that the goal in solving an equation is isolating the variable. In the first example, you need to get $4x$ by itself before you can get x by itself. Likewise, in the second example, you need to get $8x$ by itself before you can get x by itself.

Read **Representing fractions as repeating decimals** on p. 95. You can stop the long division process once you are sure of the pattern in repeating digits.

To the Learning Guide

As you discuss these pages with your student, take note of the skills that seem familiar and those that may need review. Do not provide detailed instruction at this point; simply preview the material to prepare for the **Quick Check** sections.

Skills Check

Complete the **Quick Check** sections on pp. 94–95 in ***Math in Focus***.

To the Learning Guide

Be sure your student shows all work in **Quick Check** on p. 94. It is tempting to combine multiple steps and use mental math skills, but it is best for your student to show work with one step completed on each line to help as he progresses through more advanced math topics. It is also important as you will be able to see if any errors are because of a miscalculation or because he does not fully understand the process.

Review your student's answers to the **Quick Check** sections, noting the problems that your student answered incorrectly. Then go online through your student's portal to today's lesson. Click on the link to access the appropriate **Reteach** activity that your student should complete for the remainder of this lesson.

Wrap-up

Today you reviewed how to solve algebraic equations. If possible, simplify both sides of an equation before performing an operation on both sides. When choosing which operation to do to both sides, choose one that will help isolate the variable term.

Solve $4(x + 3) = 32 + 2x$.

$4(x + 3) = 32 + 2x$	
$4x + 12 = 32 + 2x$	Use the Distributive Property.
$4x - 2x + 12 = 32 + 2x - 2x$	Subtract $2x$ from both sides.
$2x + 12 = 32$	Simplify.
$2x + 12 - 12 = 32 - 12$	Subtract 12 from both sides.
$2x = 20$	Simplify.
$\frac{2x}{2} = \frac{20}{2}$	Divide both sides by 2.
$x = 10$	Simplify.

You also reviewed how to represent fractions as repeating decimals. Use long division to divide the numerator of a fraction by the denominator. Use bar notation to indicate which digits repeat.

To write $\frac{16}{3}$ as a repeating decimal, divide 16 by 3.

$$\frac{16}{3} = 3\overline{)16.00}\ \Rightarrow\ 5.33$$

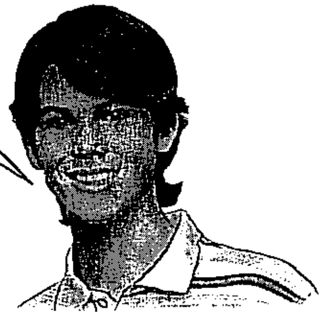
```
      5.33
3 ) 16.00
    15
     10
      9
      10
       9
       1
```

So, $\frac{16}{3} = 5.33\ldots = 5.\overline{3}$.

✅ **Complete Math Checkpoint**

Solving algebraic equations

To solve an equation, you transform it into simpler equivalent equations until you find its solution. To produce simpler equivalent equations, you can add, subtract, multiply, or divide both sides of the equation by the same nonzero number.



When an equation has variables on both sides, you group the variable terms on one side of the equation.

$4x + 7 = 3x + 14$	
$4x - 3x + 7 = 3x - 3x + 14$	Subtract $3x$ from both sides.
$x + 7 = 14$	Simplify.
$x + 7 - 7 = 14 - 7$	Subtract 7 from both sides.
$x = 7$	Simplify.

To solve the equation $5x + 3(x - 2) = 8$, which includes an expression with parentheses, you need to use the distributive property.

$5x + 3(x - 2) = 50$	
$5x + 3x - 6 = 50$	Use the distributive property.
$8x - 6 = 50$	Combine like terms.
$8x - 6 + 6 = 50 + 6$	Add 6 to both sides.
$8x = 56$	Simplify.
$\frac{8x}{8} = \frac{56}{8}$	Divide both sides by 8.
$x = 7$	Simplify.

Quick Check

Solve each equation.

9 $4x = 14 + 2x$

10 $\frac{1}{3}v = 2 - \frac{2}{9}v$

11 $c + 2(1 - c) = 10 - 3c$

12 $3(2 + 3x) = 13(x + 2)$

Representing fractions as repeating decimals

A repeating decimal has a group of one or more digits that repeat endlessly. Use bar notation to show the digits that repeat.

Write the decimal form of each fraction.

a) $\frac{5}{12}$

b) $\frac{40}{33}$

a)

```
      0.4166
12 ) 5.0000
     4 8
     ---
      20
      12
      ---
       80
       72
       ---
        80      Divide until the remainders start repeating.
        72
        ---
         8
```

So, $\frac{5}{12} = 0.4166... = 0.41\overline{6}$.

b)

```
      1.2121
33 ) 40.0000
     33
     ---
      7 0
      6 6
      ---
        40
        33
        ---
        70
        66
        ---
         40
         33
         ---
          7
```

So, $\frac{40}{33} = 1.2121... = 1.\overline{21}$.

Quick Check

Write the decimal for each fraction. Use bar notation.

13. $\frac{3}{18}$

14. $\frac{16}{99}$

15. $\frac{13}{12}$

16. $\frac{5}{27}$

Lesson 30

Solving Linear Equations

CCSS 8.EE.7b
K–12.MP2

Objectives
- Solve linear equations in one variable.

Books & Materials
- *Math in Focus* A

Assignments
- ❑ Complete Warm-up.
- ❑ Read and complete pp. 96–98, *Math in Focus* A.
- ❑ Complete problems 1–18, p. 102, *Math in Focus* A.
- ❑ Complete Math Checkpoint.

Warm-up

Simplify each expression.

1. $4x + 2(2x - 5)$
2. $-6(9 - 3x)$
3. $\frac{3}{4} + 5(x + 2)$
4. $0.4(1.2x + 10)$

Instruction

Read p. 96 in ***Math in Focus***. Remember that the goal when solving equations is to isolate the variable on one side of the equation by itself. Notice the first step is to combine both terms that include the variable x. The next step is to multiply both sides by the same number to eliminate the coefficient of the variable.

Review **Example 1** on p. 97. Even though many steps are shown, the basic concept involves two steps:

1. Combine like terms.
2. Isolate the variable.

Notice how only one step is completed from one line to the next. It is good practice to show this detail of work when solving equations.

Complete **Guided Practice** on p. 97.

Review **Example 2** on p. 98. Notice that 10 was chosen to be the number by which to multiply both sides because there is one digit that repeats. For a number that has two digits that repeat, multiply both sides by 100. For a number that has three digits that repeat, multiply both sides by 1,000, and so on. This way, when you subtract the infinite string of digits, the difference is 0.

Complete **Guided Practice** on p. 98. Be sure to multiply both sides by a power of 10 that will allow you to eliminate the infinite string of repeating digits.

To the Learning Guide

There are often multiple ways to solve a linear equation involving fractions. Your student may choose to rewrite two fractions as a single fraction, or he may choose to use multiplication to eliminate the fractions altogether.

For example, the problem $\frac{5x}{3} + \frac{x+2}{6} = 4$ can be approached in various ways. The expressions on the left side of the equation can be written as a single fraction with a common denominator. The equation becomes $\frac{10x + x + 2}{6} = 4$, which can be simplified further to $\frac{11x + 2}{6} = 4$. Alternatively, your student may prefer to immediately eliminate the fractions by multiplying both sides of the equation by 6. This results in the equation $10x + x + 2 = 24$, which can be simplified to $11x + 2 = 24$. Both methods lead to the same solution.

Watch For These Common Errors

! Remind your student that the fraction bar acts like a grouping symbol, so care must be taken when working with fractions preceded by a negative sign. For example, in the problem $\frac{2x}{3} - \frac{4x+2}{3} = 9$, your student might make the mistake of rewriting the problem as $\frac{2x - 4x + 2}{3} = 9$. To avoid this error, instruct him to group the expression $4x + 2$ in parentheses when rewriting as a single fraction. This would look like: $\frac{2x - (4x+2)}{3} = 9$.

Practice

Complete problems 1–18 of **Practice 3.1** on p. 102 in ***Math in Focus***.

To the Learning Guide

If your student struggles with determining what number to multiply the variable by to eliminate the repeating digits, point out that he can multiply by 10^n, with n being the number of repeated digits. If 2 digits repeat, he will multiply the variable by 10^2, or 100.

Wrap-up

Today you learned how to solve linear equations. You can follow these simplified steps as a guide to solving linear equations.

Step 1: Simplify both sides of the equation to combine like terms.

Step 2: Perform inverse operations to both sides in the reverse order of operations until the variable is isolated.

✅ **Complete Math Checkpoint**

3.1 Solving Linear Equations with One Variable

Lesson Objectives

- Solve linear equations with one variable.
- Solve real-world problems involving linear equations with one variable.

Solve Linear Equations with One Variable.

You have learned how to solve linear equations with one variable. For example, you can solve the equation $x + \frac{x}{10} = 44$ using the steps shown below.

$$x + \frac{x}{10} = 44$$

$$\frac{10x}{10} + \frac{x}{10} = 44 \qquad \text{Write terms with a common denominator.}$$

$$\frac{11x}{10} = 44 \qquad \text{Combine into a single fraction in } x.$$

$$\frac{^{1}\cancel{11}x}{_{1}\cancel{10}} \cdot \frac{\cancel{10}^{1}}{\cancel{11}_{1}} = {^{4}}\cancel{44} \cdot \frac{10}{\cancel{11}_{1}} \qquad \text{Multiply both sides by } \frac{10}{11}.$$

$$x = 40 \qquad \text{Simplify.}$$

You can factor $x + \frac{x}{10}$ to get $x\left(1 + \frac{1}{10}\right)$, which is $\frac{11x}{10}$.

Math Note

The coefficients and constants in linear equations may involve integers, fractions, and decimals. When solving equations, you use the same number properties and properties of equality as you do when working with numbers.

Example 1 Solve linear equations involving the distributive property.

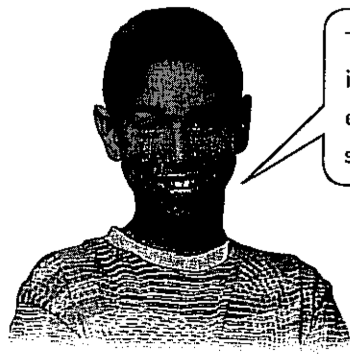
Solve the equation $\frac{3x}{4} - \frac{2x+1}{4} = -1.5$.

Solution

$\frac{3x}{4} - \frac{2x+1}{4} = -1.5$	
$\frac{3x-(2x+1)}{4} = -1.5$	Rewrite the left side as a single fraction.
$\frac{3x-2x-1}{4} = -1.5$	Use the distributive property.
$\frac{x-1}{4} = -1.5$	Simplify the numerator.
$\frac{x-1}{4} \cdot 4 = -1.5 \cdot 4$	Multiply both sides by 4.
$x - 1 = -6$	Simplify.
$x - 1 + 1 = -6 + 1$	Add 1 to both sides.
$x = -5$	Simplify.

Math Note

Notice that $2x + 1$ is placed in parentheses, because the fraction bar acts as a grouping symbol. So, $-\frac{2x+1}{4}$ can be written as $\frac{-(2x+1)}{4}$.



Guided Practice

Solve each linear equation.

1 $\frac{2x}{3} - \frac{2+x}{3} = -4$

$\frac{2x}{3} - \frac{2+x}{3} = -4$	
$\frac{?}{3} = -4$	Rewrite the left side as a single fraction.
$\frac{?}{3} = -4$	Use the distributive property.
$\frac{?}{3} = -4$	Simplify the numerator.
$\frac{?}{3} \cdot \underline{?} = -4 \cdot \underline{?}$	Multiply both sides by $\underline{?}$.
$\underline{?} = \underline{?}$	Simplify.
$\underline{?} + \underline{?} = \underline{?} + \underline{?}$	Add $\underline{?}$ to both sides.
$x = \underline{?}$	Simplify.

2 $0.6(1 - x) + 0.2(x - 5) = 10$

3 $\frac{3x}{5} + \frac{x-1}{3} = \frac{2}{15}$

Example 2 Write repeating decimals as fractions using linear equations.

Write the decimal $0.1\overline{6}$ as a fraction.

Solution

STEP 1 Assign a variable to the repeating decimal.

Let $x = 0.1\overline{6}$.

$x = 0.166666...$ $10x = 1.6666666...$

Notice that if you multiply both sides of this equation by 10, the infinite number of repeating digits does not change. So you can subtract one equation from the other to eliminate the infinite string of digits.

STEP 2 Subtract x from $10x$ to get a terminating decimal.

$$10x - x = 1.\overline{6} - 0.1\overline{6}$$
$$9x = 1.5$$

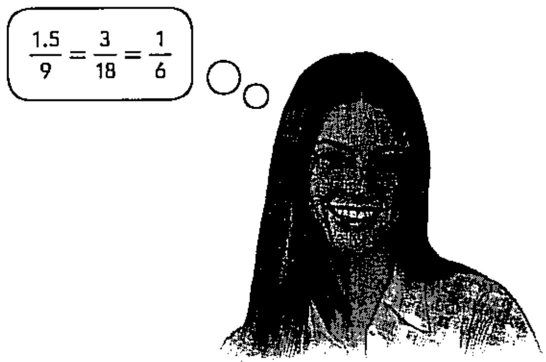
or

$$\begin{array}{rrl} & 10x = & 1.6666666... \\ - & x = & -0.1666666... \\ \hline & 9x = & 1.50000 \end{array}$$

STEP 3 Solve for x.

$\frac{9x}{9} = \frac{1.5}{9}$ Divide both sides by 9.

$x = \frac{1}{6}$ Simplify.



So, $0.1\overline{6} = \frac{1}{6}$.

Think Math

If a decimal, x, has two digits that repeat instead of one, what number do you multiply x by before subtracting? Explain.

Guided Practice

Write each repeating decimal as a fraction by using a variable.

4 $0.\overline{09}$

5 $0.\overline{8}$

6 $0.0\overline{6}$

Practice 3.1

Solve each equation. Show your work.

1 $4x - (10 - x) = \frac{15}{2}$

2 $0.5(x + 1) - 1 = 0.2$

3 $2(x - 1) - 6 = 10(1 - x) + 6$

4 $8(x - 3) - (x - 3) = 0.7$

5 $2(x - 4) + 0.5(2 + 8x) = 0$

6 $5 - 3(x - 7) = 2(2 - x) - 8$

7 $3x - 0.4(5 - 2x) = 5.6$

8 $6 + \frac{1}{3}(x - 9) = \frac{1}{2}(2 - x)$

9 $\frac{3x - 2}{8} + \frac{2 - x}{4} = -\frac{1}{2}$

10 $-\frac{x + 1}{6} - \frac{5 - 3x}{4} = \frac{1}{3}$

11 $\frac{5(x + 2)}{3} - \frac{x - 1}{3} = 1$

12 $\frac{4(2x + 3)}{5} - \frac{x + 1}{4} = \frac{31}{5}$

Express each decimal as a fraction. Show your work.

13 $0.8\overline{3}$

14 $0.0\overline{8}$

15 $0.\overline{1}$

16 $0.08\overline{3}$

17 $0.0\overline{5}$

18 $0.0\overline{45}$

Solve each problem algebraically. Show your work.

19 Logan saves \$5.50 in dimes and quarters over a week. He has 20 more dimes than quarters. Find the number of dimes and quarters he saves.

20 Maggie makes some fruit punch. She mixes $2\frac{1}{2}$ quarts of grape juice with $1\frac{1}{2}$ quarts of orange juice. One quart of grape juice costs \$1 less than one quart of orange juice. She finds that the total cost of making the fruit punch is \$12.50. Calculate the cost of each quart of grape juice and each quart of orange juice.

21 Ms. Handler walks to work at an average speed of 5 kilometers per hour. If she increases her speed to 6 kilometers per hour, she will save 10 minutes.

a) Complete the table.

Speed (km/h)	Distance (km)	Time (h)	Time (min)
5	d	?	?
6	d	?	?

b) Find the distance she walks.

Lesson 31

Real-World Problems Involving Linear Equations

CCSS 8.EE.7b
K–12.MP2, 3, 4

Objectives
- Solve real-world problems by using linear equations in one variable.

Books & Materials
- *Math in Focus* A

Assignments
- ❑ Complete Warm-up.
- ❑ Read and complete pp. 99–101, ***Math in Focus*** A.
- ❑ Complete problems 19–28, pp. 102–103, ***Math in Focus*** A.
- ❑ Complete Math Checkpoint.

Warm-up

Solve each equation.

1. $3x + 3 = 2x + 5$

2. $\frac{4x}{6} + \frac{x}{3} = \frac{1}{2}$

3. $\frac{8x}{3} - \frac{12x - 18}{6} = 17$

Instruction

Read p. 99 in ***Math in Focus***. The bar model first shows the ratio of the costs of the shirt and jeans, or how the costs relate to one another. The bar model then shows that adding 30 to the cost of the belt equals the cost of the jeans. The total adds the three costs together (1 block for the shirt, 2 blocks for the jeans, and the part representing the belt).

If you have difficulty understanding where the equation comes from, draw lines from the *Total* row in the bar model to the parts of the equation. Each orange block represents an x in the equation.

Review **Example 3** on p. 100. The equation has 3 parts on the left side: the distance from the bottom of the wall to the mirror (x), the height of the mirror $\left(28\frac{1}{4}\right)$, and the distance from the top of the mirror to the top of the wall $\left(\frac{1}{2}x\right)$. Follow the steps for solving the equation. Like terms are combined and then the variable is isolated.

Complete **Guided Practice** on p. 101. Fill in the blanks in problem 7. Draw a bar model to help you write the equation in problem 8. Show your work.

To the Learning Guide

Once your student is able to translate a real-world problem into an equation involving a variable, he can solve the linear equation he wrote. Your student may struggle in generating an equation to solve. You can help him develop this skill by writing a list of phrases commonly used in translating words into variable expressions. Some examples you might have on the list are: *$15 more than twice the cost of jeans* (15 + 2*c*) and *5 minutes less than half his time* ($t \div 2 - 5$).

Watch For These Common Errors

! Your student may solve an equation he wrote for the variable, but this may not answer the question. Have him check to see what his variable represents. Then check to see what the question is asking. These may not always be the same.

Practice

Complete problems 19–28 of **Practice 3.1** on pp. 102–103 in ***Math in Focus***.

Wrap-up

Today you learned how to solve real-world problems involving linear equations. This guided example shows the basic steps that can be taken to solve this type of problem.

Tony has \$2.65 in quarters and nickels. The number of nickels is 4 more than twice the number of quarters. How many quarters and nickels does Tony have?

Let q be the number of quarters and n be the number of nickels.	Assign a variable.
$n = 4 + 2q$	Relate the variables.
$0.25q + 0.05(4 + 2q) = 2.65$	Write an equation for the problem.
$0.25q + 0.2 + 0.1q = 2.65$	Use the Distributive Property.
$0.35q + 0.2 = 2.65$	Combine like terms.
$0.35q + 0.2 - 0.2 = 2.65 - 0.2$	Subtract 0.2 from both sides.
$0.35q = 2.45$	Simplify.
$\frac{0.35q}{0.35} = \frac{2.45}{0.35}$	Divide both sides by 0.35.
$q = 7$	Simplify.

Find the number of nickels.

$n = 4 + 2q = 4 + 2(7) = 18$

Tony has 7 quarters and 18 nickels.

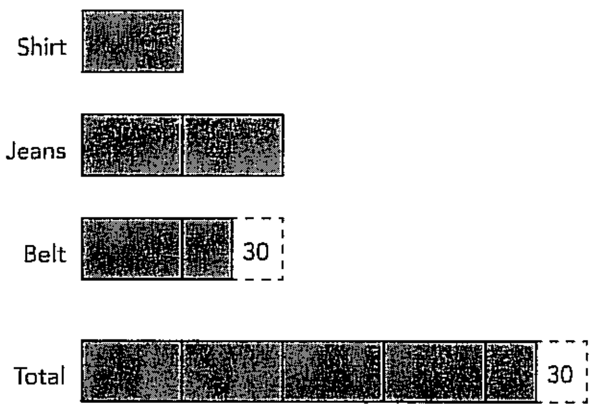
✅ **Complete Math Checkpoint**

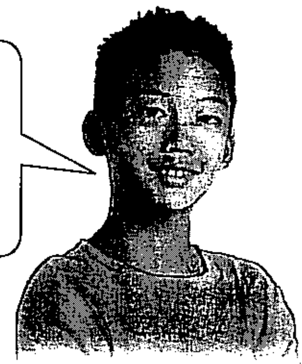
Solve Real-World Problems Involving Linear Equations with One Variable.

You have learned that to solve real-world problems algebraically, you represent unknown quantities with variables and model the problems with algebraic equations.

A belt costs \$30 less than a pair of jeans. The ratio of the cost of the jeans to the cost of a shirt is 2 : 1. If the total cost of the three items is \$75, find the cost of the jeans.

You represent the costs using bar models as shown below.





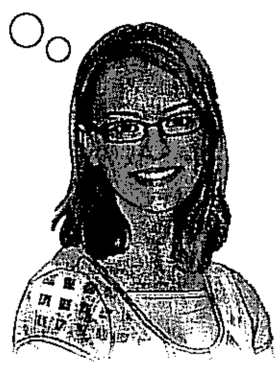
Let the cost of the shirt be x dollars. Then the pair of jeans costs $2x$ dollars and the belt costs $(2x - 30)$ dollars. So, the total cost of the three items is $(x + 2x + 2x - 30)$ dollars.

Because they cost \$75 altogether,

$x + 2x + 2x - 30 = 75$	Write an equation.
$5x - 30 = 75$	Add the like terms.
$5x - 30 + 30 = 75 + 30$	Add 30 to both sides.
$5x = 105$	Simplify.
$\frac{5x}{5} = \frac{105}{5}$	Divide both sides by 5.
$x = 21$	Simplify.

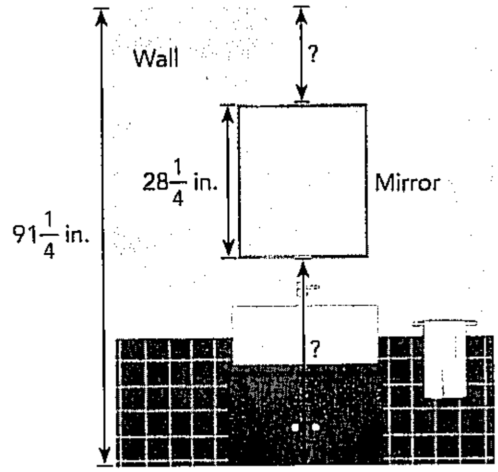
Cost of the jeans: $\$21 \cdot 2 = \$42$

The jeans cost \$42.



Example 3 Solve real-world problems involving linear equations with one variable.

Mr. Gates' bathroom walls are $91\frac{1}{4}$ inches tall. He wants to mount a mirror with a height of $28\frac{1}{4}$ inches on the wall. The distance from the top of the mirror to the ceiling should be $\frac{1}{2}$ the distance from the bottom of the mirror to the floor. Find the distance of the mirror from the floor.



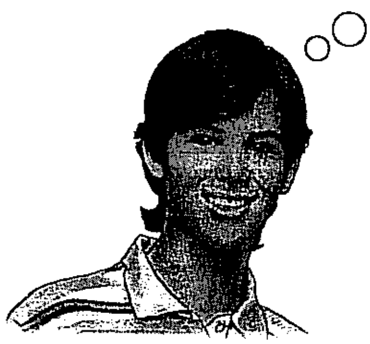
Solution

Let the distance of the mirror from the floor be x inches.

So, the distance of the mirror from the ceiling is $\frac{1}{2}x$ inches.

$x + 28\frac{1}{4} + \frac{1}{2}x = 91\frac{1}{4}$	Write an equation.
$\frac{3}{2}x + 28\frac{1}{4} = 91\frac{1}{4}$	Add like terms.
$\frac{3}{2}x + 28\frac{1}{4} - 28\frac{1}{4} = 91\frac{1}{4} - 28\frac{1}{4}$	Subtract $28\frac{1}{4}$ from both sides.
$\frac{3}{2}x = 63$	Simplify.
$\frac{3}{2}x \cdot \frac{2}{3} = 63 \cdot \frac{2}{3}$	Multiply both sides by $\frac{2}{3}$.
$x = 42$	Simplify.

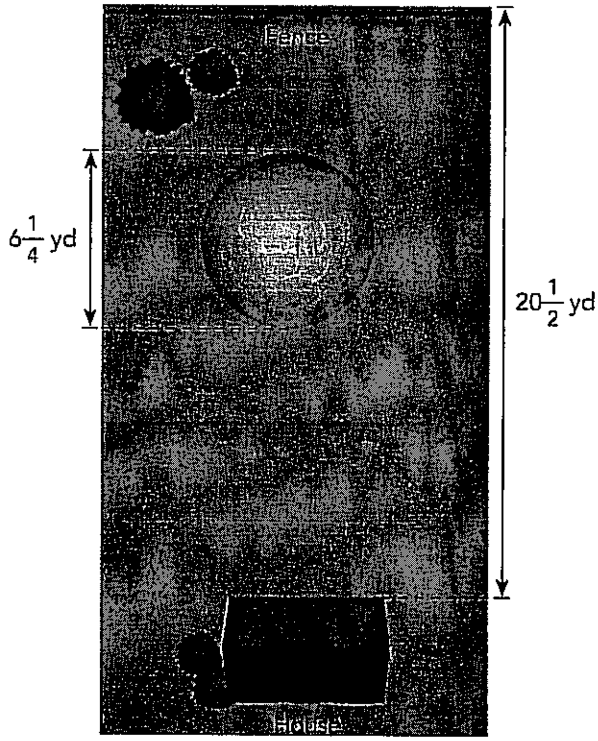
The distance of the mirror from the floor is 42 inches.



Guided Practice

Solve. Show your work.

7 Mr. Johnson wants to add a circular pond to his backyard. The backyard is $20\frac{1}{2}$ yards long, and the pond will be $6\frac{1}{4}$ yards across. He wants the pond set back from the house, so that the distance from the pond to the back fence is half the distance from the pond to the back of the house. How far should the pond be from the back of the house?

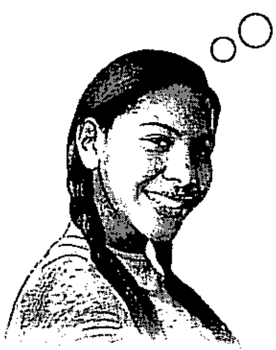


Let the distance from the pond to the house be x yards.

So, the distance from the pond to the fence is $\frac{1}{2}x$ yards.

$\underline{\ ?\ } = 20\frac{1}{2}$	Write an equation.
$\underline{\ ?\ } = 20\frac{1}{2}$	Add like terms.
$\underline{\ ?\ } = 20\frac{1}{2} - \underline{\ ?\ }$	Subtract $\underline{\ ?\ }$ from both sides.
$\underline{\ ?\ } = \underline{\ ?\ }$	Simplify.
$\underline{\ ?\ } \cdot \underline{\ ?\ } = \underline{\ ?\ } \cdot \underline{\ ?\ }$	Multiply both sides by $\underline{\ ?\ }$.
$x = \underline{\ ?\ }$	Simplify.

The distance from the pond to the house is $\underline{\ ?\ }$ yards.



The length of the backyard is about $\underline{\ ?\ }$ yards and the width of the pond is about $\underline{\ ?\ }$ yards. So the total distance of the pond to the house and of the pond to the gate is around $\underline{\ ?\ }$ yards.

$\underline{\ ?\ }$ of $\underline{\ ?\ }$ yards is about $\underline{\ ?\ }$ yards. So, the answer is reasonable.

8 A packager of tea leaves blends 3.5 pounds of tea leaf A with 1.5 pounds of tea leaf B to make a special blend. One pound of tea leaf B costs $2 less than one pound of tea leaf A. The packager finds that the cost of making the blend is $3 per pound. Find the cost of one pound of tea leaf B.

Practice 3.1

Solve each equation. Show your work.

1. $4x - (10 - x) = \frac{15}{2}$
2. $0.5(x + 1) - 1 = 0.2$
3. $2(x - 1) - 6 = 10(1 - x) + 6$
4. $8(x - 3) - (x - 3) = 0.7$
5. $2(x - 4) + 0.5(2 + 8x) = 0$
6. $5 - 3(x - 7) = 2(2 - x) - 8$
7. $3x - 0.4(5 - 2x) = 5.6$
8. $6 + \frac{1}{3}(x - 9) = \frac{1}{2}(2 - x)$
9. $\frac{3x - 2}{8} + \frac{2 - x}{4} = -\frac{1}{2}$
10. $-\frac{x + 1}{6} - \frac{5 - 3x}{4} = \frac{1}{3}$
11. $\frac{5(x + 2)}{3} - \frac{x - 1}{3} = 1$
12. $\frac{4(2x + 3)}{5} - \frac{x + 1}{4} = \frac{31}{5}$

Express each decimal as a fraction. Show your work.

13. $0.8\overline{3}$
14. $0.0\overline{8}$
15. $0.\overline{1}$
16. $0.08\overline{3}$
17. $0.0\overline{5}$
18. $0.0\overline{45}$

Solve each problem algebraically. Show your work.

19. Logan saves \$5.50 in dimes and quarters over a week. He has 20 more dimes than quarters. Find the number of dimes and quarters he saves.

20. Maggie makes some fruit punch. She mixes $2\frac{1}{2}$ quarts of grape juice with $1\frac{1}{2}$ quarts of orange juice. One quart of grape juice costs \$1 less than one quart of orange juice. She finds that the total cost of making the fruit punch is \$12.50. Calculate the cost of each quart of grape juice and each quart of orange juice.

21. Ms. Handler walks to work at an average speed of 5 kilometers per hour. If she increases her speed to 6 kilometers per hour, she will save 10 minutes.

    a) Complete the table.

Speed (km/h)	Distance (km)	Time (h)	Time (min)
5	d	?	?
6	d	?	?

    b) Find the distance she walks.

22 Jane is x years old today. Her brother Kenny is 4 years older. After seven years, their total combined age will be 24 years.

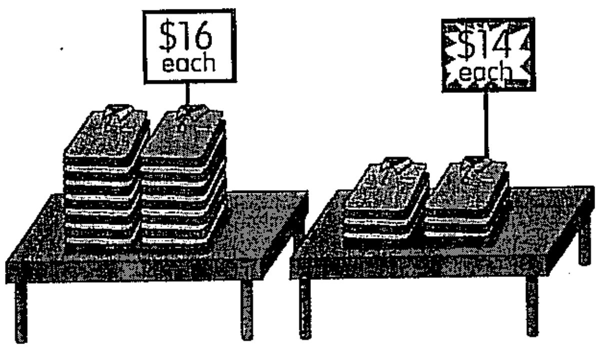
a) Write a linear equation for their total combined age after 7 years.

b) Find Jane's age today.

23 Casper bought some pencils at 50¢ each. He had \$3 left after the purchase. If he wanted to buy the same number of note pads at 80¢ each, he would be short \$1.50. Write a linear equation for the number of pencils he purchased. Then solve it.

24 Alexis earns $2\frac{1}{2}$ times as much as Gary in a day. James earns \$18 more than Gary in a day. If the total combined salary of all three people is \$306, find Alexis's salary.

25 A store bought y shirts at \$12 each. It sold most of them for \$16 each, and the last dozen were sold on sale for \$14 each. It sold all the shirts for \$616. Find the number of shirts sold.



26 There are 40 questions on a class test. Six points are given for each correct answer and three points are deducted for each wrong answer. Find the number of correct answers for a test score of 105.

27 *Math Journal* Georgina was given that the length of a rectangle was 2.5 inches longer than its width, and that the perimeter of the rectangle was 75.4 inches. She found the length and width algebraically. How could she use estimation to check if her answers were reasonable?

28 *Math Journal* Consider the decimal $0.\overline{9}$.

a) Find the fraction equivalent of $0.\overline{9}$.

b) The decimal $0.\overline{9}$ can be thought of as being equal to the following sum, in which the pattern shown continues forever.

$0.9 + 0.09 + 0.009 + 0.0009 + \ldots$

How can thinking about this sum help you explain the result you saw in **a)**?