Are You Ready?
Simplify Radical Expressions

Teaching Skill 53
Objective Simplify radical expressions.

Review with students the definition of simplest form. Ask: **Is $\sqrt{4}$ written in simplest form?** (No) **Why or why not?** (4 is a perfect square factor.) **Is $\sqrt{\frac{1}{7}}$ written in simplest form?** (No, because there is a fraction under the radical sign.) **Is $\sqrt{\frac{5}{9}}$ written in simplest form?** (Yes, even though there is a fraction, the denominator does not have a radical in it.)

Next, review with students how to simplify radical expressions. Work through each example. Point out that when the expression involves a product or a fraction, it may be more convenient to multiply or divide first, then simplify. Provide the following example: $\sqrt{20}\sqrt{5}$. Ask: **Is 20 or 5 a perfect square?** (No) **If you multiply first, do you get a perfect square inside the radical?** (Yes, 100) Provide a similar example using a fraction (e.g. $\sqrt{\frac{45}{5}}$).

Have students complete the exercises.

PRACTICE ON YOUR OWN
In exercises 1–8, students simplify radical expressions.

CHECK
Determine that students know how to simplify radical expressions.

Students who successfully complete the **Practice on Your Own** and **Check** are ready to move on to the next skill.

COMMON ERRORS
Students may leave a radical expression in the denominator of a fraction.

Students who made more than 2 errors in the **Practice on Your Own,** or who were not successful in the **Check** section, may benefit from the **Alternative Teaching Strategy.**

Alternative Teaching Strategy
Objective Simplify radical expressions.

Some students may benefit from seeing the connection between square roots and squares more directly.

Remind students that the first step in simplifying a radical is to check for perfect squares. If the number inside the radical is the square of an integer, it can be simplified. Write the following problem on the board:
$\sqrt{49} = \sqrt{7 \cdot 7} = \sqrt{7^2}$

Ask: **Since taking the square root of a number is the inverse of squaring the number, what can be said about the square root of a number squared?** (It is equal to the number.)

Have students complete the following table.

n	n^2
1	1
2	4
3	9
4	
5	
6	
7	
8	
9	
10	

$\sqrt{\ }$	$\sqrt{n^2} = n$
$\sqrt{1}$	$\sqrt{1^2} = 1$
$\sqrt{4}$	$\sqrt{2^2} = 2$
$\sqrt{9}$	$\sqrt{3^2} = 3$
$\sqrt{\ }$	$\sqrt{\ } =$
$\sqrt{\ }$	$\sqrt{\ } =$
$\sqrt{\ }$	$\sqrt{\ } =$
$\sqrt{\ }$	$\sqrt{\ } =$
$\sqrt{\ }$	$\sqrt{\ } =$
$\sqrt{\ }$	$\sqrt{\ } =$
$\sqrt{\ }$	$\sqrt{\ } =$

Write the problems below on the board. Have students rewrite the problems as n^2 and then simplify. Remind students that if the expression is a product, they can simplify each term separately and then multiply. Likewise, if the expression is a fraction, they can simplify the numerator and the denominator one at a time.

$\sqrt{16}\ \left(\sqrt{4^2} = 4\right)$; $\sqrt{81}\ \left(\sqrt{9^2} = 9\right)$;

$\sqrt{36}\sqrt{100}\ \left(\sqrt{6^2} = 6, \sqrt{10^2} = 10, 6 \cdot 10 = 60\right)$

$\sqrt{\frac{9}{25}}\ \left(\frac{\sqrt{9}}{\sqrt{25}} = \frac{\sqrt{3^2}}{\sqrt{5^2}} = \frac{3}{5}\right)$

Name ________________________________ Date __________ Class __________

SKILL 53

Are You Ready?

Simplify Radical Expressions

Definition: A radical expression is in *simplest form* when all of the following conditions are met.

1. The number, or expression, under the radical sign contains no perfect square factors (other than 1).
2. The expression under the radical sign does not contain a fraction.
3. If the expression is a fraction, the denominator does not contain a radical expression.

How to Simplify Radical Expressions		
Look for perfect square factors and simplify these first. If the radical expression is preceded by a negative sign, then the answer is negative.	If the expression is a product, simplify then multiply, or multiply then simplify, whichever is most convenient.	If the expression is (or contains) a fraction, simplify then divide, or divide then simplify, whichever is most convenient.
Example 1: Simplify $\sqrt{81}$. Since 81 is a perfect square factor, simplify the expression to 9. $\sqrt{81} = \sqrt{9 \cdot 9} = 9$ $-\sqrt{81} = -\sqrt{9 \cdot 9} = -9$	Example 2: Simplify $\sqrt{25}\sqrt{16}$. Since both numbers are perfect squares, simplify then multiply: $\sqrt{5 \cdot 5}\sqrt{4 \cdot 4} =$ $5 \cdot 4 = 20$	Example 3: Simplify $-\sqrt{\frac{4}{49}}$. $-\sqrt{\frac{4}{49}} = -\frac{\sqrt{2 \cdot 2}}{\sqrt{7 \cdot 7}} = -\frac{2}{7}$

Practice on Your Own

Simplify each expression.

1. $\sqrt{25}$ ____________

2. $\sqrt{9}\sqrt{36}$ ____________

3. $\sqrt{\frac{81}{121}}$ ____________

4. $-\sqrt{81}$ ____________

5. $\sqrt{100}\sqrt{4}$ ____________

6. $\sqrt{2(32)}$ ____________

7. $\sqrt{169}$ ____________

8. $-\sqrt{\frac{1}{625}}$ ____________

Check

Simplify each expression.

9. $\sqrt{16}$ ____________

10. $\sqrt{81}\sqrt{64}$ ____________

11. $-\sqrt{49}$ ____________

12. $\sqrt{\frac{4}{25}}$ ____________

13. $\sqrt{2}\sqrt{50}$ ____________

14. $-\sqrt{144}$ ____________

15. $-\sqrt{9}\sqrt{4}$ ____________

16. $\sqrt{\frac{9}{36}}$ ____________

SKILL 8

Are You Ready?

Evaluate Powers

Teaching Skill 8

Objective Evaluate powers of a number.

Review the definition of a power. Ask: **What does 3 raised to the fourth power mean?** ($3 \cdot 3 \cdot 3 \cdot 3$) Stress to students that raising a number to a power is NOT the same as multiplying the number by that power.

Review the example. Emphasize that it is a good idea to multiply the expression out one product at a time, rather than trying to calculate the entire product mentally.

Explain how to evaluate a number raised to the first power, and to the zero power.

Ask: **When you are evaluating powers of negative numbers, when will the result be negative and when will it be positive?** (The result will be negative when the exponent is an odd number and it will be positive when the exponent is an even number.) Give a few examples to demonstrate why this is true.

Review the example explaining how to add expressions that contain powers.

PRACTICE ON YOUR OWN

In exercises 1–9, students evaluate powers of numbers and perform operations that include powers of numbers.

CHECK

Determine that students know how to evaluate powers of numbers.

Students who successfully complete the **Practice on Your Own** and **Check** are ready to move on to the next skill.

COMMON ERRORS

Students may multiply the base by the exponent instead of raising it to a power.

Students who made more than 2 errors in the **Practice on Your Own**, or who were not successful in the **Check** section, may benefit from the **Alternative Teaching Strategy**.

Alternative Teaching Strategy

Objective Evaluate powers of a number.

Materials needed: number cards shown below. Index cards work nicely.

1^4	5^2	2^3
3^2	6^1	4^3
1	25	8
9	6	64

Tell students that they are going to play a memory game.

Before the game begins, remind students that an exponent tells how many times a base number is used as a factor. To evaluate an expression that contains an exponent, multiply the factors out to arrive at the product. For example,

$5^3 = 5 \cdot 5 \cdot 5 = 125$

Shuffle the cards and place them in rows, face down. Each student will flip over two cards. If the values of the expressions on the two cards are the same, the student keeps the cards. If the values are different, the student flips the cards back over and another student takes a turn. The winner is the student who has the most cards at the end of the game.

As an extension of this exercise, have the students make their own number cards and play again. Instruct them to create 12 new cards. The cards should be created in pairs – one with an expression that contains an exponent and one that has an equivalent number value.

Name ______________________________ Date __________ Class __________

SKILL 8

Are You Ready?

Evaluate Powers

The product of a repeated factor is called a power. To evaluate the power of a number, multiply the factor the correct number of times to arrive at the product.

Example: the 4th power of 3, or 3^4:

$$\underbrace{3 \cdot 3} \cdot 3 \cdot 3 =$$
$$\underbrace{9 \cdot 3} \cdot 3 =$$
$$\underbrace{27 \cdot 3} = 81$$

Special powers:

- Any nonzero number raised to a power of one is the number itself: $5^1 = 5$.
- Any nonzero number raised to a power of zero is 1: $13^0 = 1$.

To add, subtract, multiply, or divide powers of numbers, evaluate each expression and then perform the indicated operation:
$(-4)^3 + 6^2 = (-4 \cdot -4 \cdot -4) + (6 \cdot 6) = -64 + 36 = -28$

Practice on Your Own

Find the value of each expression.

1. 2^5 ____________

2. 4^2 ____________

3. 113^0 ____________

4. 15 raised to the second power ____________

5. –10 cubed ____________

6. $5^0 + 8^0$ ____________

7. $(-2)^4 + 3^2$ ____________

8. $6^2 \cdot 2^2$ ____________

9. $8^2 \div 2^4$ ____________

Check

Find the value of each expression.

10. 4^3 ____________

11. $(-1)^8$ ____________

12. 9 squared ____________

13. $10^2 - 20^0$ ____________

14. $(-2)^3 + 3^3$ ____________

15. $(-1)^3 \cdot 2^5$ ____________

16. $5^2 \cdot 10$ ____________

17. $10^3 \div 5^3$ ____________

18. $\dfrac{3^4}{6^0}$ ____________

SKILL 72

Are You Ready?

Solve for a Variable

Teaching Skill 72

Objective Solve an equation for a given variable.

Explain that there are equations that involve multiple variables and it is helpful to write the equation in terms of a particular variable. To do this, you solve for that variable.

Point out that solving for a variable works exactly the same as solving any equation. Once you have identified the variable that you are solving for, you isolate that variable using inverse operations.

Write the example provided on the board. Ask: **If you are solving for *y*, what should your final answer look like on one side of the equation?** ($y =$ something) **If you were solving for *x* instead, what should one side of your equation look like?** ($x =$ something)

Work through the solution. Remind students that they should be following the order of operations in reverse when solving equations. Emphasize that the coefficient of the variable they are solving for should be 1 when they are done.

Have students complete the practice exercises.

PRACTICE ON YOUR OWN
In exercises 1–9, students solve an equation for a given variable.

CHECK
Determine that students know how to solve an equation for a given variable.

Students who successfully complete the **Practice on Your Own** and **Check** are ready to move on to the next skill.

COMMON ERRORS
Students may try to multiply or divide before they add and subtract.

Students who made more than 2 errors in the **Practice on Your Own,** or who were not successful in the **Check** section, may benefit from the **Alternative Teaching Strategy.**

Alternative Teaching Strategy

Objective Solve an equation for a given variable.

Some students may have difficulty determining in which order to take certain steps.

Write the equation $4x - 5 = 2y - 11$ on the board and tell students you are going to guide them in choosing the correct steps to solve this equation for the variable *y*. Write the following on the board:

$$4x - 5 + \square = 2y - 11 + \square$$

$$4x + \square = 2y$$

$$\frac{4x}{\square} + \frac{6}{\square} = \frac{2y}{\square}$$

$$\square x + \square = y$$

Have students fill in each box based on the operation that is being undone. Ask: **In the first step, if you want to isolate *y*, should you add 5 to both sides or 11?** (11) Point out that the second step is merely simplifying the addition from the first step. Ask: **In the third step, if you are solving for *y*, should you divide by 4 or by 2?** (2) Again, point out that the final step is merely simplifying the division from the third step.

When you get to the final step, ask: Have you solved for *y*? (Yes) **How do you know?** (because *y* is completely by itself)

Set up and have students solve the additional problems provided below for the variable *y* in the first problem and for *x* in the second problem.

$3x + 4y = 7y - 12$ and $\frac{3x}{2} - 12 = y + 3$

Answers: $y = x + 4$ and $x = \frac{2}{3}y + 10$

When you are comfortable that students know in which order the inverse operations should be performed, have them solve other equations without providing the steps.

Name ____________________ Date __________ Class __________

SKILL 72

Are You Ready?

Solve for a Variable

Solving for a variable is the same thing as transforming an equation to represent one quantity in terms of another.

To solve for a variable, identify the variable in the equation that you wish to isolate and then use inverse operations on each side of the equation to isolate the desired variable.

Example: Solve the equation $8x + 3 = 2y + 15$ for y.

You want to isolate y, so you need to move everything else to the other side of the equation.

$8x + 3 = 2y + 15$	
$8x + 3 - 15 = 2y + 15 - 15$	Subtract 15 from both sides.
$8x - 12 = 2y$	Simplify.
$\frac{8x}{2} - \frac{12}{2} = \frac{2y}{2}$	Divide both sides by 2.
$4x - 6 = y$	Simplify.

Practice on Your Own

Solve each equation for the indicated variable.

1. $3x + y = 15$; y ____________

2. $y - 5 = 3x$; y ____________

3. $I = prt$; t ____________

4. $3x + 3y = 12$; y ____________

5. $V = \pi r^2 h$; h ____________

6. $7y - 21x = 14$; y ____________

7. $A = \frac{1}{2}bh$; h ____________

8. $2x + 4 = 9 - y$; y ____________

9. $2x + 5 = 6y - 9$; x ____________

Check

Solve each equation for the indicated variable.

10. $y - 6x = 11$; y ____________

11. $V = \ell wh$; h ____________

12. $7x + 7y = 42$; x ____________

13. $8x + 2y = 22$; y ____________

14. $3x - 4 = y + 8$; y ____________

15. $5 - 2y = 8x - 1$; y ____________

SKILL 60

Are You Ready?

Evaluate Expressions

Teaching Skill 60

Objective Evaluate expressions.

Explain to students that evaluating an expression simply means replacing the variable with a given value and simplifying.

Review with students the order of operations and point out that they will need to follow them to correctly simplify expressions. Also review integer operations as some expressions, and some given values, may involve negative numbers.

Have students consider Example 1. Ask: **What two operations will be used to simplify this expression?** (multiplication then addition) **What number replaces *y*?** (6) Work through the example.

Next have students consider Example 2. Ask: **What two operations will be used to simplify this expression?** (multiplication then subtraction) **What number replaces *p*?** (−4) Stress that students must be careful when working with negatives since it is easy to overlook them when simplifying. Work through the example.

Have students complete the practice exercises.

PRACTICE ON YOUR OWN

In exercises 1–9, students evaluate expressions.

CHECK

Determine that students know how to evaluate expressions.

Students who successfully complete the **Practice on Your Own** and **Check** are ready to move on to the next skill.

COMMON ERRORS

Students may not follow the correct order of operations and may arrive at an incorrect result.

Students who made more than 2 errors in the **Practice on Your Own,** or who were not successful in the **Check** section, may benefit from the **Alternative Teaching Strategy.**

Alternative Teaching Strategy

Objective Evaluate expressions.

Explain to students that most expressions can be evaluated for any given number. Create the table below on the board and have students duplicate it. Tell students they are going to evaluate an expression for several different values.

Value	Substitution	Simplification
−2	6( ) + 3	___ + 3 = ___
−1	6( ) + 3	___ + 3 = ___
0	6( ) + 3	___ + 3 = ___
1	6( ) + 3	___ + 3 = ___
2	6( ) + 3	___ + 3 = ___

Ask: **Based on the center column, what expression are you evaluating?** ($6y + 3$) **For what values are you evaluating the expression?** (−2, −1, 0, 1, and 2)

Have students complete the table and check their answers. (−2, −1, 0, 1, 2; −12, −6, 0, 6, 12; −9, −3, 3, 9, 15)

Have students duplicate the two tables below, identify the expression, and complete the last two columns.

Value	Substitution	Simplification
−3	4( ) − 5	___ − 5 = ___
−1	4( ) − 5	___ − 5 = ___
2	4( ) − 5	___ − 5 = ___
4	4( ) − 5	___ − 5 = ___

Value	Substitution	Simplification
−3	−3( ) + 2	___ + 2 = ___
−2	−3( ) + 2	___ + 2 = ___
1	−3( ) + 2	___ + 2 = ___
2	−3( ) + 2	___ + 2 = ___

When students are comfortable completing tables, give them several expressions and have them create their own tables using the given values −3, −2, −1, 0, 1, 2, and 3.

Name ____ Date ___________ Class ____________

SKILL 60

Are You Ready?

Evaluate Expressions

To evaluate a variable expression, replace the variable(s) with the given value(s) and use the order of operations to simplify.

Example 1: Evaluate $10y + 3$ for $y = 6$.	
$10y + 3 = 10(6) + 3$	Replace y with 6 since 6 is the given value.
$= 60 + 3$	Order of operations says to multiply first.
$= 63$	Add.

Example 2: Evaluate $-6p - 15$ for $p = -4$.	
$-6p - 15 = -6(-4) - 15$	Replace p with -4 since -4 is the given value.
$= 24 - 15$	Order of operations says to multiply first.
$= 9$	Subtract.

Practice on Your Own

Evaluate each expression for the given value of the variable.

1. $7x + 1$ for $x = 5$ ________

2. $8m - 12$ for $m = 5$ ________

3. $2y + 9$ for $y = -6$ ________

4. $6p - 3$ for $p = -4$ ________

5. $27 - 9x$ for $x = 2$ ________

6. $10 + 4q$ for $q = -3$ ________

7. $-7c + 11$ for $c = 3$ ________

8. $\frac{1}{3}t + 5$ for $t = 9$ ________

9. $\frac{1}{2}m - 16$ for $m = 20$ ________

Check

Evaluate each expression for the given value of the variable.

10. $2n - 3$ for $n = 9$ ________

11. $x + 7$ for $x = -5$ ________

12. $15 - 3h$ for $h = 5$ ________

13. $15 - 7m$ for $m = 3$ ________

14. $-5a - 9$ for $a = -1$ ________

15. $\frac{1}{2}y + (-4)$ for $y = 12$ ________

SKILL 89 Are You Ready?
Counterexamples

Teaching Skill 89

Objective Find counterexamples to prove that a given statement is false.

Explain to students that when you determine whether a mathematical statement is true or false, you determines its truth value.

In order to determine that a mathematical statement is true, the statement must be true for all real numbers. However, to determine that a statement is false, you need to find only one counterexample.

Review with students the definition of a counterexample. Emphasize that if you can find a single number for which a statement is not true, then the statement is false.

Have students consider the example. Remind students that real numbers consist of whole numbers, integers (positive and negative), fractions, decimals, and irrational numbers.

Work through the example with students, reviewing the strategy as you go. Then, have students complete the practice exercises.

PRACTICE ON YOUR OWN

In exercises 1–6, students find counterexamples to prove that given statements are false.

CHECK

Determine that students know how to find counterexamples.

Students who successfully complete the **Practice on Your Own** and **Check** are ready to move on to the next skill.

COMMON ERRORS

Students may forget to try fractions or negative numbers when searching for counterexamples.

Students who made more than 2 errors in the **Practice on Your Own,** or who were not successful in the **Check** section, may benefit from the **Alternative Teaching Strategy.**

Alternative Teaching Strategy

Objective Determine which given values are counterexamples for false statements.

Some students may benefit from working problems where there are several types of counterexamples.

Write the following numbers on the board:

$5, 1, \frac{1}{2}, 0, -\frac{1}{2}, -1$, and -5.

Remind students that a counterexample to a statement is a particular example or instance of the statement that is NOT true. If you can find a single counterexample, then the given statement is false.

Tell students they are going to test several statements to try to determine if they are false.

Work through the first statement with students. Write the following on the board: $n \geq -n$. Instruct students to try each of the numbers you wrote on the board and identify each number that is a counterexample.

$5 \geq -5$ True $\quad -5 \geq -(-5) \rightarrow -5 \geq 5$ False

$1 \geq -1$ True $\quad -1 \geq -(-1) \rightarrow -1 \geq 1$ False

$\frac{1}{2} \geq -\frac{1}{2}$ True $\quad -\frac{1}{2} \geq -(-\frac{1}{2}) \rightarrow -\frac{1}{2} \geq \frac{1}{2}$ False

$0 \geq 0$ True

Review students' findings with them. Based on the results of the test, all negative numbers are counterexamples for the given statement.

Have students repeat this exercise for the statement below.

$\frac{1}{n} \geq \frac{1}{n^2}$ (counterexamples: $\frac{1}{2}, -\frac{1}{2}, -1, -5$)

$5n \neq -5n$ (only 0 is a counterexample)

$\frac{1}{n} < n$ (counterexamples: $1, \frac{1}{2}, -1, -5$)

Name ______________________________ Date __________ Class __________

SKILL 89

Are You Ready?

Counterexamples

Definition: A counterexample to a statement is a particular example or instance of the statement that is NOT true.

Example: Find a counterexample to show that the statement below is false.

Statement: $1 + n \geq 1 - n$, where n is a real number.

Strategy to find a counterexample:

Step 1: Always try $n = 0$ first. $1 + 0 \geq 1 - 0 \rightarrow 1 \geq 1$ **True**

Step 2: Try $n = 1$ next. $1 + 1 \geq 1 - 1 \rightarrow 2 \geq 0$ **True**

Step 3: Try $n = -1$ next. $1 + (-1) \geq 1 - (-1) \rightarrow 0 \geq 2$ **False**

STOP: $n = -1$ is your counterexample.

If $n = -1$ had produced another true statement, then you would try a positive and negative fraction, such as $\frac{1}{2}$ and $-\frac{1}{2}$. Then larger numbers, both positive and negative, until you found a number that produced a false statement.

Practice on Your Own

Find a counterexample to show that each statement is false.

1. $n^3 + 2n = 3n^2$, where n is a real number

$n =$

2. $-\frac{1}{n} \leq \frac{1}{n}$, where n is a real number

$n =$

3. $\frac{n}{3} \neq \frac{3}{n}$, where n is a real number

$n =$

4. $\frac{n}{2} < 2n$, where n is a real number

$n =$

5. $-(n + 1) \neq n + 1$, where n is a real number

$n =$

6. $n^2 \geq n$, where n is a real number

$n =$

Check

Find a counterexample to show that each statement is false.

7. $\frac{1}{n} \neq \frac{1}{n^2}$, where n is a real number $\neq 0$

$n =$

8. $n^3 \geq n^2$, where n is a real number

$n =$

9. $\frac{n}{5} < 5n$, where n is a real number

$n =$

10. $-3n \neq 3n$, where n is a real number

$n =$

SKILL 53 ANSWERS:

Practice on Your Own

1. 5
2. 18
3. $\frac{9}{11}$
4. -9
5. 20
6. 8
7. 13
8. $-\frac{1}{25}$

Check

9. 4
10. 72
11. -7
12. $\frac{2}{5}$
13. 10
14. -12
15. -6
16. $\frac{1}{2}$

SKILL 54 ANSWERS:

Practice on Your Own

1. 15
2. 8
3. 0.4
4. 1.19
5. 10
6. 4
7. 0.75
8. 0.7
9. 6
10. 7
11. 0
12. 12

Check

13. 11
14. 2.3
15. 10
16. 25
17. 13
18. 0
19. 1.1
20. 1

SKILL 55 ANSWERS:

Practice on Your Own

1. 3
2. 4
3. 31
4. 3
5. 6
6. 14
7. 50
8. 9
9. 26
10. 43
11. 0
12. 4

Check

13. 4
14. 0
15. 25
16. 22
17. 2
18. 58

Check

17. 49

18. 5

19. 144

20. 10

21. Yes, 6

22. No

23. Yes, 11

24. No

SKILL 7 ANSWERS:

Practice on Your Own

1. $9 \cdot 9 \cdot 9 \cdot 9$

2. $1 \cdot 1 \cdot 1 \cdot 1 \cdot 1$

3. $x \cdot x \cdot x$

4. $8 \cdot 8$

5. $(-2) \cdot (-2) \cdot (-2)$

6. $p \cdot p \cdot p \cdot p \cdot p \cdot p$

7. 10^6

8. 12^4

9. m^5

10. 5^6

11. 9^2

12. p^3

Check

13. $2 \cdot 2 \cdot 2 \cdot 2$

14. $(-4) \cdot (-4)$

15. $h \cdot h \cdot h \cdot h \cdot h$

16. 25^3

17. s^4

18. 8^3

19. 4^1 or 4

SKILL 8 ANSWERS:

1. 32

2. 16

3. 1

4. $15^2 = 225$

5. $(-10)^3 = -1000$

6. $1 + 1 = 2$

7. $16 + 9 = 25$

8. $36 \cdot 4 = 144$

9. $64 \div 16 = 4$

Check

10. 64

11. 1

12. $9^2 = 81$

13. $100 - 1 = 99$

14. $-8 + 27 = 19$

15. $-1 \cdot 32 = -32$

16. $25 \cdot 10 = 250$

17. $1000 \div 125 = 8$

18. $81 \div 1 = 81$

SKILL 9 ANSWERS:

Practice on Your Own

1. 146.39

2. 236

3. 50

4. 15.3

5. 0.005

6. 4.0

7. 230; $(80 + 150)$

8. 180; (9×20)

9. 5; $(10 \div 2)$

10. 1200; $(400 + 700 + 100)$

4. $x = -1$
5. $y = -\frac{1}{4}$
6. $x = \frac{8}{9}$
7. $y = -\frac{4}{7}$
8. $x = \frac{3}{25}$
9. $y = \frac{1}{2}$

Check

10. $x = 4$
11. $y = \frac{4}{3}$
12. $x = \frac{2}{5}$
13. $y = -\frac{5}{11}$
14. $x = \frac{10}{7}$
15. $x = -\frac{1}{8}$

SKILL 72 ANSWERS:

Practice on Your Own

1. $y = 15 - 3x$
2. $y = 3x + 5$
3. $t = \frac{I}{pr}$
4. $y = 4 - x$
5. $h = \frac{V}{\pi r^2}$
6. $y = 2 + 3x$
7. $h = \frac{2A}{b}$
8. $y = 5 - 2x$
9. $x = 3y - 7$

Check

10. $y = 11 + 6x$
11. $h = \frac{V}{\ell w}$
12. $x = 6 - y$
13. $y = 11 - 4x$
14. $y = 3x - 12$
15. $y = -4x + 3$

SKILL 73 ANSWERS:

Practice on Your Own

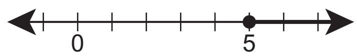
1. $M = (\frac{7}{2}, 5)$; $d = 5$
2. $M = (2, \frac{1}{2})$; $d = \sqrt{13}$
3. $M = (-\frac{5}{2}, \frac{9}{2})$; $d = 5\sqrt{2}$
4. $M = (0, 1)$; $d = 4\sqrt{5}$
5. $M = (-3, -\frac{3}{2})$; $d = \sqrt{29}$
6. $M = (-2, -\frac{3}{2})$; $d = 5$

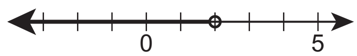
Check

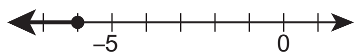
7. $M = (5, 3)$; $d = 10$
8. $M = (\frac{5}{2}, \frac{1}{2})$; $d = \sqrt{34}$
9. $M = (-\frac{1}{2}, -\frac{7}{2})$; $d = 3\sqrt{2}$
10. $M = (2, -4)$; $d = 2\sqrt{5}$

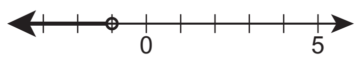
SKILL 74 ANSWERS:

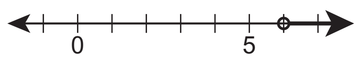
Practice on Your Own

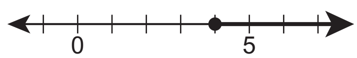
1. $x \geq 5$ 

2. $n < 2$ 

3. $y \leq -6$ 

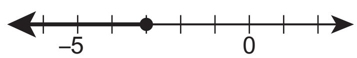
4. $b < -1$ 

5. $y > 6$ 

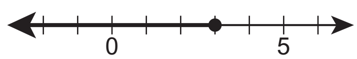
6. $t \geq 4$ 

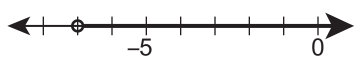
7. $p > -4$ 

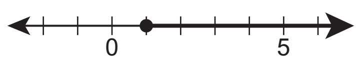
8. $x < -2$ 

9. $m \leq -3$ 

Check

10. $x \leq 3$ 

11. $n > -7$ 

12. $d \geq 1$ 

4. $45p^3q$
5. $25b^5c^4$
6. $6x^2y^2$
7. $16z^5$
8. $8d^3e^2$
9. $-18t^2$
10. w^8
11. $22r^7$
12. $50x^2y^2$

Check

13. $30f^2$
14. $-27x^2y$
15. $60h^4$
16. $49a^2b^2$
17. $4p^4q^2$
18. $-21u^3v$
19. g^8
20. $-16y^2z^2$

SKILL 60 ANSWERS:

Practice on Your Own

1. 36
2. 28
3. -3
4. -27
5. 9
6. -2
7. -10
8. 8
9. -6

Check

10. 15
11. 2
12. 0
13. -6
14. -4
15. 2

SKILL 61 ANSWERS:

Practice on Your Own

1. $10m^4n^2$
2. $4x^2y$
3. $-20a^4b$
4. $\frac{5}{2t^3}$
5. $-\frac{f^2}{3}$
6. $-3p^3q^2r^3$
7. u^4v
8. $\frac{4c^2}{d^5}$
9. $144h^2k^2$
10. -1
11. $10xy^3z^2$
12. $-\frac{wz}{9}$

Check

13. $35s^4t$
14. $-\frac{x}{5y}$
15. $-8b^4c^4$
16. $5pq^3$
17. $-\frac{5mn}{3}$
18. $36u^3w^4$
19. $-10x^8y^2$
20. $\frac{7}{f}$

5. 2
6. 12

Check

7. 16
8. 8
9. 11
10. 5

SKILL 87 ANSWERS:

Practice on Your Own

1. Figure *ABCD* has 4 sides.
2. Angle *ABC* and angle *CBD* share a common vertex.
3. $\angle A$ and $\angle B$ are supplementary.
4. The third side of $\triangle DEF$ has length 8 or 13.
5. Point *P* lies in the third quadrant.

Check

6. The other two angles of triangle *MNP* have measures of 60 degrees.
7. The measure of $\angle HJK$ is greater than 90 degrees.
8. Lines *p* and *q* are perpendicular.

SKILL 88 ANSWERS:

Practice on Your Own

1. Hypothesis: a triangle is a right triangle; Conclusion: the sum of its acute angles is 90 degrees.
2. Hypothesis: two lines are parallel to a third line; Conclusion: the lines are parallel to each other
3. True
   Converse: If the sum of the measures of a polygon's angles is 180 degrees, then the polygon is a triangle.
   True
4. True
   Converse: If two angles are congruent, then they are right angles.
   False

Check

5. Hypothesis: two planes intersect; Conclusion: they intersect in a line.
6. True
   Converse: If two angles are congruent, then they are vertical.
   False
7. True
   Converse: If a parallelogram is a rhombus, then the diagonals of the parallelogram are perpendicular.
   True

SKILL 89 ANSWERS:

Practice on Your Own

1. any real number other than 0, 1, or 2 are all counterexamples
2. any negative number
3. $n = 3$
4. any negative number or 0
5. $n = -1$
6. any fraction such that $-1 < n < 1$, e.g. $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots \frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \ldots$

Check

7. $n = 1$
8. any negative number of any positive fraction such that $0 < n < 1$
9. any negative number or 0
10. $n = 0$

5. 2

6. 12

Check

7. 16

8. 8

9. 11

10. 5

SKILL 87 ANSWERS:

Practice on Your Own

1. Figure *ABCD* has 4 sides.

2. Angle *ABC* and angle *CBD* share a common vertex.

3. $\angle A$ and $\angle B$ are supplementary.

4. The third side of $\triangle DEF$ has length 8 or 13.

5. Point *P* lies in the third quadrant.

Check

6. The other two angles of triangle *MNP* have measures of 60 degrees.

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8. Lines *p* and *q* are perpendicular.

SKILL 88 ANSWERS:

Practice on Your Own

1. Hypothesis: a triangle is a right triangle; Conclusion: the sum of its acute angles is 90 degrees.

2. Hypothesis: two lines are parallel to a third line; Conclusion: the lines are parallel to each other

3. True
Converse: If the sum of the measures of a polygon's angles is 180 degrees, then the polygon is a triangle.
True

4. True
Converse: If two angles are congruent, then they are right angles.
False

Check

5. Hypothesis: two planes intersect; Conclusion: they intersect in a line.

6. True
Converse: If two angles are congruent, then they are vertical.
False

7. True
Converse: If a parallelogram is a rhombus, then the diagonals of the parallelogram are perpendicular.
True

SKILL 89 ANSWERS:

Practice on Your Own

1. any real number other than 0, 1, or 2 are all counterexamples

2. any negative number

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Check

7. $n = 1$

8. any negative number of any positive fraction such that $0 < n < 1$

9. any negative number or 0

10. $n = 0$