



### Using Skill 69

**OBJECTIVE** Evaluate expressions using the order of operations

Read the order of operations at the top of the page. Discuss why it is important to have a set of rules for deciding the order of computation. Demonstrate by doing the first example left to right instead of with order of operations.

Refer to the first problem.

Ask: **What operations are in the problem?** (addition and multiplication) **Which operation do you perform first?** (multiplication) **Which operation do you perform second?** (addition)

Focus on the second problem. Have students state the order in which they will do the operations. Make sure that they see the exponent. (Help students to understand that the parentheses do not affect the answer because even without parentheses they would divide before adding.)

Ask: **What is the first thing you do in this problem?** (divide) **What is the second thing you do?** (simplify the exponent) **What is  $3^2$ ?** (9) **What is the last thing you do?** (add) **What is the value of the expression?** (11)

Lead students through the third problem. Stress that the fraction bar is actually a grouping symbol that requires them to simplify the numerator, then simplify the denominator before dividing the numerator by the denominator.

**TRY THESE** In Exercises 1–4 students use the order of operations to evaluate expressions.

- **Exercise 1** Divide then add
- **Exercise 2** Simplify within parentheses, then multiply
- **Exercise 3** Subtract, divide, then multiply
- **Exercise 4** Simplify within parentheses, simplify exponent, then subtract

**PRACTICE ON YOUR OWN** Review the example at the top of the page. As they work through the exercise, have the students focus on the fraction bar as a division symbol.

**CHECK** Determine if the students know the order of operations.

Success is indicated by 3 out of 3 correct responses.

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

### COMMON ERRORS

- Students may not recall how to compute with exponents.
- Students may always work from left to right and forget to consider parentheses.

Students who made more than 1 error in the **Practice on Your Own**, or who were not successful in the **Check** section, may benefit from the **Alternative Teaching Strategy** on the next page.

## Optional

# Alternative Teaching Strategy

## Model Order of Operations



**OBJECTIVE** Model evaluating an expression using the order of operations

Say: **We're going to solve this problem. If I have 5 cubes and then John, Maria, and Remy each give me 2 cubes, how many cubes will I have?** (11)

Ask: **What is an expression that describes this problem? ( $5 + 3 \times 2$ ) If we work this problem left to right, what value do we get?** (16)

Now, demonstrate with cubes. Ask students to take on the roles from the problem and follow it exactly. Discuss why you only have 11 cubes. Lead students to conclude that multiplication must come before addition, unless parentheses tell you otherwise.

Act out and solve the following problems. In each case, discuss whether parentheses are needed.

- I have 2 cubes. Pedro has 25 cubes that he will share equally with Anne, Tara, Kim, and me. When I get my share, how many cubes will I have? ( $2 + 25 \div 5 = 7$ ; note that if Pedro is sharing, he gets a share too; parentheses are not needed.)

- I had 25 cubes, but I gave 9 of them to Junior before I shared the ones I had left with Jan, Rita, and Omar. How many do I have now? ( $(25 - 9) \div 4 = 4$ ; Parentheses are necessary.)

- I had 25 cubes and I gave 3 of them to each of 4 students. How many do I have now? ( $25 - 3 \times 4 = 13$ ; Parentheses are not needed.)

# Order of Operations

## Skill 69

Evaluate an expression by using the order of operations.

### Order of Operations

1. Do the operation in parentheses.
2. Simplify exponents.
3. Multiply and divide from left to right.
4. Add and subtract from left to right.

Evaluate  $7 + 2 \times 3$ .

$$2 \times 3 = 6$$

$7 + 2 \times 3$  Multiply first.  
 $7 + 6$  Then add.

13

The value of the expression is 13.

Evaluate  $3^2 + (4 \div 2)$ .

$$2 \overline{)4}$$

$3^2 + (4 \div 2)$  Operate within parentheses.  
 $3^2 + 2$  Simplify the exponent.

$$3 \times 3 = 9$$

$$9 + 2$$

11

The value of the expression is 11.

Evaluate  $\frac{(4+2)}{3} + 4^2$ .

$$\frac{(4+2)}{3} + 4^2$$

$\frac{6}{3} + 4^2$  Operate within parentheses.

$\frac{6}{3} + 16$  Simplify the exponent.

$2 + 16$  Divide.

18 Add.

The value of the expression is 18.

### Try These

Evaluate each expression. Write what you do.

1  $3 + 8 \div 2$

First do: \_\_\_\_\_

Then do: \_\_\_\_\_

The value is \_\_\_\_\_.

2  $(5 + 3) \times 7$

First do: \_\_\_\_\_

Then do: \_\_\_\_\_

The value is \_\_\_\_\_.

3  $\frac{(12-3)}{3} \times 8$

First do: \_\_\_\_\_

Next do: \_\_\_\_\_

Then do: \_\_\_\_\_

The value is \_\_\_\_\_.

4  $5^2 - (10 - 6)$

First do: \_\_\_\_\_

Next do: \_\_\_\_\_

Then do: \_\_\_\_\_

The value is \_\_\_\_\_.

Go to the next side. 

# Practice on Your Own

# Skill

# 69

**Think:**

Order of operations:

1. Operate within parentheses.
2. Simplify exponents.
3. Multiply and divide from left to right.
4. Add and subtract from left to right.

Evaluate  $\frac{(29 - 5)}{4} + 2^3$ .

$\frac{(29 - 5)}{4} + 2^3$	Operate within parentheses. $29 - 5 = 24$
$\frac{24}{4} + 2^3$	Simplify the exponent. $2 \times 2 \times 2 = 8$
$\frac{24}{4} + 8$	Divide. $24 \div 4 = 6$
$6 + 8$	Add.
14	
The value of the expression is 14.	

Evaluate each expression.

**1**  $7 + 10 \div 5$

First do: \_\_\_\_\_  
 Then do: \_\_\_\_\_  
 The value is \_\_\_\_\_.

**2**  $\frac{(18 - 6)}{4} \times 2$

First do: \_\_\_\_\_  
 Next do: \_\_\_\_\_  
 Then do: \_\_\_\_\_  
 The value is \_\_\_\_\_.

**3**  $\frac{(15 - 6)}{3} + 4^2$

First do: \_\_\_\_\_  
 Next do: \_\_\_\_\_  
 Then do: \_\_\_\_\_  
 Then do: \_\_\_\_\_  
 The value is \_\_\_\_\_.

Evaluate each expression. Write the steps you use to evaluate.

**4**  $5^2 \div (8 - 3)$

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**5**  $(18 + 18) \div 3^2$

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**6**  $\frac{(12 - 3)}{3} \times 8$

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



## Check

Evaluate each expression. Write the steps you use to evaluate.

**7**  $(5 \times 2) + (8 - 3)$

\_\_\_\_\_  
 \_\_\_\_\_

**8**  $4^2 - (13 - 5)$

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**9**  $\frac{(16 - 7)}{9} + 6^2$

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Answer Key continued

### SKILL 66 ANSWERS:

#### Practice on Your Own

1.  $\angle ABC$  or  $\angle CBA$ ; right
2.  $\angle XYZ$  or  $\angle ZYX$ ; obtuse
3.  $\angle EDF$  or  $\angle FDE$ ; acute
4.  $\angle PQR$  or  $\angle RQP$ ; obtuse
5.  $\angle ABC$  or  $\angle CBA$ ; straight
6.  $\angle PQR$  or  $\angle RQP$ ; acute
7.  $\angle XYZ$  or  $\angle ZYX$ ; straight
8.  $\angle EDF$  or  $\angle FDE$ ; right
9.  $\angle ACB$  or  $\angle BCA$ ; acute

#### Check

10.  $\angle QPR$  or  $\angle RPQ$ ; acute
11.  $\angle ABC$  or  $\angle CBA$ ; straight
12.  $\angle SQP$  or  $\angle PQS$ ; acute
13.  $\angle DEF$  or  $\angle FED$ ; right
14.  $\angle YXZ$  or  $\angle ZXY$ ; acute
15.  $\angle ABC$  or  $\angle CBA$ ; obtuse

### SKILL 67 ANSWERS:

#### Try These

1.  $GHK$ ;  $KHG$ ;  $H$
2.  $d$
3.  $BGD$ ;  $DGB$

#### Practice

1.  $GCN$ ;  $NCG$ ;  $C$
2.  $a$
3.  $RQE$ ;  $EQR$
4.  $DEW$ ;  $WED$ ;  $E$
5.  $g$
6.  $SOP$ ;  $POS$
7. 3
8.  $OPL$ ;  $LPO$
9.  $TAP$ ;  $PAT$

#### Check

10.  $CDA$ ;  $ADC$
11.  $R$
12.  $PDQ$ ;  $QDP$

### SKILL 68 ANSWERS:

#### Try These

1.  $\frac{9}{10}$
2.  $\frac{1}{2}$
3.  $\frac{1}{9}$
4. 4

#### Practice

1.  $\frac{2}{8}$ ,  $\frac{3}{8}$ ,  $\frac{5}{8}$
2.  $\frac{15}{36}$ ,  $\frac{28}{36}$ ,  $\frac{43}{36}$  or  $1\frac{7}{36}$
3.  $\frac{12}{15}$ ,  $\frac{10}{15}$ ,  $\frac{2}{15}$
4.  $\frac{22}{30}$ ,  $\frac{18}{30}$ ,  $\frac{2}{15}$
5.  $\frac{3 \times 1}{5 \times 6} = \frac{3}{30}$ ,  $\frac{1}{10}$
6.  $\frac{5 \times 3}{8 \times 10} = \frac{15}{80}$ ,  $\frac{3}{16}$
7.  $\frac{4 \times 3}{9 \times 1} = \frac{12}{9}$ ,  $1\frac{1}{3}$
8.  $\frac{9 \times 6}{10 \times 3} = \frac{54}{30}$ ,  $1\frac{4}{5}$

#### Check

9.  $1\frac{2}{9}$
10.  $\frac{5}{16}$
11.  $\frac{1}{7}$
12.  $\frac{9}{20}$

### SKILL 69 ANSWERS:

#### Try These

1.  $8 \div 2 = 4$ ;  $3 + 4 = 7$ ; 7
2.  $5 + 3 = 8$ ;  $8 \times 7 = 56$ ; 56
3.  $12 - 3 = 9$ ;  $\frac{9}{3} = 3$ ;  $3 \times 8 = 24$ ; 24

## Answer Key continued

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4.  $10 - 6 = 4$ ;  $5 \times 5 = 25$ ;  
 $25 - 4 = 21$ ; 21

### Practice

- $10 \div 5 = 2$ ;  $7 + 2 = 9$ ; 9
- $18 - 6 = 12$ ;  $\frac{12}{4} = 3$ ;  $3 \times 2 = 6$ ; 6
- $15 - 6 = 9$ ;  $4 \times 4 = 16$ ;  $\frac{9}{3} = 3$ ;  
 $3 + 16 = 19$ ; 19
- $5^2 \div 5$   
 $25 \div 5$   
5
- $36 \div 3^2$   
 $36 \div 9$   
4
- $\frac{9}{3} \times 8$   
 $3 \times 8$   
24

### Check

- $10 + 5$   
15
- $4^2 - 8$   
 $16 - 8$   
8
- $\frac{9}{9} + 6^2$   
 $\frac{9}{9} + 36$   
 $1 + 36$   
37

### SKILL 70 ANSWERS:

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#### Try These

- 4; 1; *F*
- 5; 2; *E*
- 6; 5; (6, 5)

#### Practice

- 1; right; 3; up; (1, 3)
- 5; right; 0; up; (5, 0)
- 3; left; 4; down; (-3, -4)
- (-5, 4)
- (-2, -3)

- (0, 1)
- (5, 4)
- (-6, 0)
- (5, -4)

### Check

- (2, -2)
- (0, -6)
- (-3, 5)
- (4, 0)

### SKILL 71 ANSWERS:

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#### Practice on Your Own

- h*
- a, c*
- h*
- e*
- h*
- $65^\circ$
- $115^\circ$
- $65^\circ$
- $115^\circ$
- $65^\circ$
- $65^\circ$
- $115^\circ$

### Check

- k*
- k*
- h*
- g*
- $105^\circ$
- $75^\circ$
- $105^\circ$
- $75^\circ$

### SKILL 72 ANSWERS:

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#### Try These

- 30, 30, 0.3
- 9, 9, 0.09