

Teacher Notes.

Lesson 6: The Order of Operations

Classwork

Example 1: Expressions with Only Addition, Subtraction, Multiplication, and Division

What operations are evaluated first?

Multiplication and division are evaluated first, from left to right.

What operations are always evaluated last?

Addition and subtraction are always evaluated last, from left to right.

Exercises 1–3

1. $4 + 2 \times 7$

$$4 + 14$$

$$= 18$$

2. $36 \div 3 \times 4$

$$12 \times 4$$

$$= 48$$

3. $20 - 5 \times 2$

$$20 - 10$$

$$= 10$$

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Example 2: Expressions with Four Operations and Exponents

$$4 + \overset{\textcircled{1}}{9^2} \div 3 \times 2 - 2$$

$$4 + \overset{\textcircled{2}}{81} \div 3 \times 2 - 2$$

$$4 + \overset{\textcircled{3}}{27} \times 2 - 2$$

$$4 + \overset{\textcircled{4}}{54} - 2$$

$$\overset{\textcircled{5}}{58} - 2 = \textcircled{56}$$

What operation is evaluated first?

Exponents ($9 \times 9 = 81$)

What operations are evaluated next?

Multiplication and division, from left to right

What operations are always evaluated last?

Addition and subtraction, from left to right.

What is the final answer?

56

Exercises 4–5

$$4. \quad \overset{\textcircled{1}}{90} - \overset{\textcircled{2}}{5^2} \times 3$$

$$\underline{90 - 25 \times 3}$$

$$90 - 75$$

$$15$$

$$5^2 = 5 \cdot 5 = 25$$

$$5. \quad \underline{4^3} + 2 \times 8$$

$$\underline{64 + 2 \times 8}$$

$$64 + 16$$

$$80$$

$$4^3 = 4 \cdot 4 \cdot 4$$

Example 3: Expressions with Parentheses

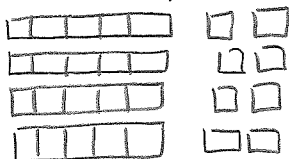
Consider a family of 4 that goes to a soccer game. Tickets are \$5.00 each. The mom also buys a soft drink for \$2.00. How would you write this expression?

$$\begin{array}{r} 4 \times 5 + 2 \\ \hline 20 + 2 \end{array}$$

How much will this outing cost?

\$ 22

Consider a different scenario: The same family goes to the game as before, but each of the family members wants a drink. How would you write this expression?



$$4 \times (5 + 2)$$

Why would you add the 5 and 2 first?

We need to determine how much each person spends. Each person spends \$7. Then, we multiply by 4 people to figure out total cost.

How much will this outing cost?

$$\begin{array}{r} 4 \times 7 \\ 28 \end{array}$$

How many groups are there?

4

What does each group comprise?

$$\cancel{\$}5 + \cancel{2} \text{ or } \cancel{\$}7$$

Exercises 6-7

6. $2 + (9^2 - 4)$

$$2 + (81 - 4)$$

$$2 + 77$$

$$79$$

7. $2 \cdot (13 + 5 - 14 \div (3 + 4))$

$$2 \cdot (13 + 5 - 14 \div 7)$$

$$2 \cdot (13 + 5 - 2)$$

$$2 \cdot (18 - 2)$$

$$2 \cdot 16$$

$$32$$

Example 4: Expressions with Parentheses and Exponents

$$2 \times (3 + 4^2)$$

$$2 \times (3 + 16)$$

$$2 \times (19)$$

$$38$$

Which value will we evaluate first within the parentheses? Evaluate.

Evaluate $4^2 = 4 \cdot 4 = 16$ Then add 3

Evaluate the rest of the expression.

$$= 38$$

What do you think will happen when the exponent in this expression is outside of the parentheses?

$$2 \times (3 + 4)^2$$

$$2 \times (7)^2$$

$$2 \times 49$$

$$98$$

Will the answer be the same?

No

Which should we evaluate first? Evaluate.

$$\text{Add } 3 + 4$$

What happens differently here than in our last example?

The 4 was not raised to the second power because it did not have an exponent. We added numbers inside ().

What should our next step be?

$$7^2 = 7 \times 7 = 49$$

Evaluate to find the final answer.

$$2 \times 49$$

$$98$$

What do you notice about the two answers?

The final answer was not the same.

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Skip: What was different between the two expressions?

Skip: What conclusions can you draw about evaluating expressions with parentheses and exponents?

Exercises 8–9

8. $7 + (12 - 3^2)$ $3^2 = 3 \cdot 3$

$$7 + (12 - 9)$$

$$7 + (3)$$

$$10$$

9. $7 + (12 - 3)^2$ $9^2 = 9 \cdot 9$

$$7 + 9^2$$

$$7 + 81$$

$$88$$