

Chapter 1 Section 5

The Order of Operations Agreement

More than one operation may occur in a numerical expression. For example, the expression

$$4 + 3(5)$$

includes two arithmetic operations, addition and multiplication, The operations could be performed in different orders.

If we multiply first
and then add, we have: $4 + 3(5)$
 $4 + 15$
 19

If we add first and
then multiply, we have: $4 + 3(5)$
 $7(5)$
 35

To prevent more than one answer to the same problem, an Order of Operations Agreement is followed. By this agreement, 19 is the only correct answer.

The Order of Operations Agreement:

Step 1: Do all operations in parentheses

Step 2: Simplify any numerical expressions containing exponents

Step 3: Do all multiplication or division as they occur from left to right.

Step 4: Do addition and subtraction as they occur from left to right.

Or, you could just remember the following acronym:

PEMDAS

Which stands for:

P lease	P = parentheses
E xcuse	E = exponents
M y	M = Multiplication <i>or</i>
D ear	D = division
A unt	A = addition <i>or</i>
S ally	S = subtraction

(This makes it much easier to remember...)

Here are some examples:

Simplify: $2(4+1)-2^3+6\div 2$

Perform operations in parentheses: $2(4+1) - 2^3 + 6 \div 2$

Simplify expressions with exponents: $= 2(5) - 2^3 + 6 \div 2$

Do multiplication or division L \rightarrow R: $= 2(5) - 8 + 6 \div 2$

Do addition or subtraction L \rightarrow R: $= 10 - 8 + 6 \div 2$

$= 2 + 3$

$= 5$

Examples:

Simplify: $18 \div (6+3) * 9 - 4^2$

$18 \div (6+3) * 9 - 4^2$

$= 18 \div 9 * 9 - 4^2$

$= 18 \div 9 * 9 - 16$

$= 2 * 9 - 16$

$= 18 - 16$

$= 2$

Simplify: $20 + 24(8-5) \div 2^2$

$= 20 + 24(3) \div 2^2$

$= 20 + 72 \div 4$

$= 20 + 18$

$= 38$