

## Enrichment



### Lesson: Order of Operations

**Sixth Grade Objective:** 5.01 Simplify algebraic expressions and verify the results using the basic properties of rational numbers.

- a) Identity
- b) Commutative
- c) Associative
- d) Distributive
- e) Order of operations

### Review:

The **Order of Operations** is used to find the value of an expression with more than one operation. In other words, if you have an equation with a combination of addition, subtraction, multiplication, division, exponents and/parenthesis Order of Operations tells you in what order to solve the problem.

Order of Operations can be your friend. They help make your mathematical life easier and your answers correct. When a student uses the Order of Operations correctly, they get the right answer. The Order of Operations goes in this order:

- P - parenthesis
- E - exponents
- M - multiplication
- D - division
- A - addition
- S - subtraction

The best way to remember these six Ops is to address like it is one word. "PEMDAS". Or, you could use acronyms. A common one is "Please Excuse My Dear Aunt Sally."

Let's start with something simple...

$$2(5 + 4) =$$

Ok, so we've got some parenthesis in here. Work them out FIRST!

$$2(9) =$$

Now we still have the parenthesis, but there's not an expression inside, just an answer. Still, parenthesis are just another way of saying "multiply me!" It looks a lot better than a little dot or an X that can be easily confused with the variable "x" in Algebra.

So, because we don't have any exponents to deal with, what we're doing now is multiplying the 2 by the 9.

$$2(9) = 18$$

Let's take it a step further.

$$5 + 2^3 + 5^2(8 + 10) =$$

PEMDAS. Get rid of the parenthesis expression first.

$$5 + 2^3 + 5^2(18) =$$

Now, the exponents.

$$5 + 8 + 25(18) =$$

Ok, I know you're tempted to go ahead and work the whole problem left to right, but DON'T! You MUST follow the Order of Operations! You will use the next Operation in line...Multiplication. Multiply 25 by 18 and plug that answer into the equation.

$$5 + 8 + 450 =$$

NOW you can work the problem left to right because Addition and Subtraction come last.

$$5 + 8 + 450 = 463$$

Lesson:

Now that you are getting the hang of Order of Operations let's take it a step further. Use these rules to solve equations where something is missing.

$$(19 + 23)7 - 5^2 + \underline{\hspace{1cm}} = 277$$

First, the Parenthesis

$$(42)7 - 5^2 + \underline{\hspace{1cm}} = 277$$

Next, the exponents

$$(42)7 - 25 + \underline{\hspace{1cm}} = 277$$

Next, multiply

$$294 - 25 + \underline{\hspace{1cm}} = 277$$

Finally, subtract to solve the equation

$$269 + \underline{\hspace{1cm}} = 277$$

269 plus 8 would be 277. The missing number would be 8!

**Try these on your own!**

Using Order of Operations, find the missing number.

1.  $9^2 + (20 - 4) - \underline{\hspace{2cm}} = 85$

2.  $(52 - 48)^2 + 60 + \underline{\hspace{2cm}} = 136$

3.  $500 - (4^3 + 80) - \underline{\hspace{2cm}} = 350$

**Check your answers**

1.  $9^2 + (20 - 4) - \underline{\hspace{2cm}} = 85$

First, the parenthesis

$$9^2 + (16) - \underline{\hspace{2cm}} = 85$$

Next, the exponents

$$81 + (16) - \underline{\hspace{2cm}} = 85$$

Next, add

$$97 - \underline{\hspace{2cm}} = 85$$

The unknown number is 12

2.  $(52 - 48)^2 + 60 + \underline{\hspace{2cm}} = 136$

First, the parenthesis

$$(4)^2 + 60 + \underline{\hspace{2cm}} = 136$$

Next, the exponent

$$16 + 60 + \underline{\hspace{2cm}} = 136$$

Finally, addition and subtraction, moving left to right

$$76 + \underline{\hspace{2cm}} = 136$$

The unknown number is 69

3.  $500 - (4^3 + 80) - \underline{\hspace{2cm}} = 350$

First, the parenthesis...within the parenthesis is an exponent, solve that, then add.

$$500 - (64 + 80) - \underline{\hspace{2cm}} = 350$$

$$500 - (144) - \underline{\hspace{2cm}} = 350$$

Subtract

$$356 - \underline{\hspace{2cm}} = 350$$

The unknown number is 6.

### Quiz Yourself

Using Order of Operations, find the missing number.

1.  $385 + 3^3 - (22 - 7) + \underline{\hspace{2cm}} = 410$

2.  $5^3 + 125/5 + (180 - 178) - \underline{\hspace{2cm}} = 150$

3.  $2(83 - 62) - 2^3 + \underline{\hspace{2cm}} = 42$

### Check Your Answers

1.  $385 + 3^3 - (22 - 7) + \underline{\hspace{2cm}} = 410$

First, the parenthesis

$$385 + 3^3 - (15) + \underline{\hspace{2cm}} = 410$$

Next, the exponent

$$385 + 27 - (15) + \underline{\hspace{2cm}} = 410$$

Finally, addition and subtraction, moving left to right

$$397 + \underline{\hspace{2cm}} = 410$$

The unknown number is 13.

2.  $5^3 + 125/5 + (180 - 178) - \underline{\hspace{2cm}} = 150$

First, the parenthesis

$$5^3 + 125/5 + (2) - \underline{\hspace{2cm}} = 150$$

Next, the exponent

$$125 + 125/5 + (2) - \underline{\hspace{2cm}} = 150$$

Next, divide. Note that  $125/5$  is the same as  $225 \div 5$

$$125 + 25 + (2) - \underline{\hspace{2cm}} = 150$$

Add from left to right

$$152 - \underline{\hspace{2cm}} = 150$$

The unknown number is 2.

3.  $2(83 - 62) - 2^3 + \underline{\hspace{2cm}} = 42$

First, the parenthesis

$$2(21) - 2^3 + \underline{\hspace{2cm}} = 42$$

Next, the exponent

$$2(21) - 8 + \underline{\hspace{2cm}} = 42$$

Next, multiply

$$42 - 8 + \underline{\hspace{2cm}} = 42$$

Finally, subtract

$$34 + \underline{\hspace{2cm}} = 42$$

The unknown number is 8