Order of Operations without Parentheses

Order of Operations

Similar to the word **order**, is the word "arrangement". **Operations** on the other hand would mean to **add**, **subtract**, **divide** and **multiply**. So "**Order of Operations**" means the correct arrangement of the operations involved in a numerical expression.

For instance, James and Sally were asked to give the value of $5 + 2 \times 10$.

Who do you think did it right?

James	**Sally**
$5 + 2 \times 10 - 3$	$5 + 2 \times 10 - 3$
$7 \times 10 - 3$	$5 + 20 - 3$
$70 - 3$	$25 - 3$
67	**22**

It's very clear that Sally and James came up with different answers. Both steps may look **OK,** but only **ONE** is correct, and the other one is just deceiving you!

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Order of Operations without Parentheses

Questions like "**What should go first?**" and "**What must be done next?**" are just some of the many questions when asked to **EVALUATE** numerical expressions.

Evaluating Numerical Expressions (without Parentheses)

The word **EVALUATE** means to "calculate" or to "get" the value of a given expression. Going back to the answers of James and Sally, they were asked to evaluate $5 + 2 \times 10 - 3$.

James

$$5 + 2 \times 10 - 3$$

$$7 \times 10 - 3$$

$$70 - 3$$

$$67$$

Sally

$$5 + 2 \times 10 - 3$$

$$5 + 20 - 3$$

$$25 - 3$$

$$22$$

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Order of Operations without Parentheses

As mentioned earlier, there could only be **ONE** correct answer. Below is the comparison of the order of operations each of them used.

James

$5 + 2 \times 10 - 3$

Addition

$7 \times 10 - 3$

Multiplication

$70 - 3$

Subtraction

67

Sally

$5 + 2 \times 10 - 3$

Multiplication

$5 + 20 - 3$

Addition

$25 - 3$

Subtraction

22

So who got it right??? **Sally** got it right!!!

In Mathematics, we need to make sure that answers are **accurate** and **valid**. How do we make sure that they are "accurate" and "valid"? Why is James incorrect?

To get the "accurate" and "valid" answer, there are certain **rules** to be followed. You can't just do anything whichever you like and however you would want to. **What are those RULES?**

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Order of Operations without Parentheses

Guide Notes

Math 5

Multiplication – Division – Addition – Subtraction (MDAS)

Following a **pattern**, **arrangement**, or **order** in evaluating numerical expressions will definitely lead you to the correct answer. Let's first evaluate numerical expressions **without parentheses** using the **MDAS** rule.
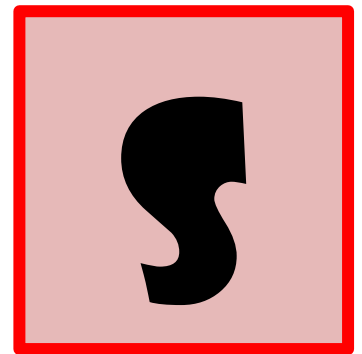
M	**D**	**A**	**S**
Multiplication	Division	Addition	Subtraction

Step #1
Always work from left to right, like the arrows below.

⟶ ⟶ ⟶ ⟶ ⟶ ⟶

Step #2
Work on with MULTIPLICATION or DIVISION, whichever comes first, from LEFT to RIGHT.

Step #3
Work on with ADDITION or SUBTRACTION, whichever comes first, from LEFT to RIGHT.

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Order of Operations without Parentheses

Guide Notes

Math 5

Let's find out why Sally got it right and James didn't!

James's Solution

$5 + 2 \times 10 - 3$

$7 \times 10 - 3$

$70 - 3$

67

$5 + 2 \times 10 - 3$

Addition

$7 \times 10 - 3$

Multiplication

$70 - 3$

Subtraction

67

Here, James went from **left** to **right**, but failed to follow the steps. He first **ADDED**, **MULTIPLIED**, then **SUBTRCATED**... which is terribly **incorrect**!

Sally's Solution

$5 + 2 \times 10 - 3$

$5 + 20 - 3$

$25 - 3$

22

$5 + 2 \times 10 - 3$

Multiplication

$5 + 20 - 3$

Addition

$25 - 3$

Subtraction

22

Sally got it right because she followed the **MDAS** rule. **MULTIPLY** or **DIVIDE** (whichever comes first), then **ADD** or **SUBTRACT** (whichever comes first), from left to right!

WARNING!!!... one wrong move and you'll get it all WRONG ☹!

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Order of Operations without Parentheses

Example:

Sam and Paul were asked to evaluate $15 + 4 \times 5 - 10 \div 2$. Each of their solution is shown below. Who among the two followed the MDAS rule? Explain your answer.

Sam	Paul
$15 + 4 \times 5 - 10 \div 2$	$15 + 4 \times 5 - 10 \div 2$
$15 + 20 - 10 \div 2$	$19 \times 5 - 10 \div 2$
$15 + 20 - 5$	$95 - 10 \div 2$
$35 - 5$	$85 \div 2$
30	**42.5**

Solution:

The one who did it right is Sam. He followed the MDAS rule. First he multiplied 4 and 5 to get 20, and then got the quotient of 10 and 2 which is 5. Next, he got the sum of 15 and 20 which is 35. Lastly, he got the difference of 35 and 5. They were all done from left to right.

Paul on the other hand is incorrect because even though he worked form left to right, he failed to follow the MDAS rule.

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Order of Operations without Parentheses

Guide Notes

Math 5

Sample Problem 1:

The numerical expression $20 + 28 \div 4 \times 7 - 39$ is solved in two different ways with different answers.

a. Which among the two solutions is correct and why?

b. What makes the other one incorrect?

Solution A	Solution B
$20 + 28 \div 4 \times 7 - 39$	$20 + 28 \div 4 \times 7 - 39$
$48 \div 4 \times 7 - 39$	$20 + 7 \times 7 - 39$
$12 \times 7 - 39$	$20 + 49 - 39$
$84 - 39$	$69 - 39$
45	**30**

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Order of Operations without Parentheses

The Funnel Method

To make sure that you get the **CORRECT** answer, the use of the **FUNNEL METHOD** can help. Why is it called **FUNNEL METHOD**? Because it looks like a funnel! ☺

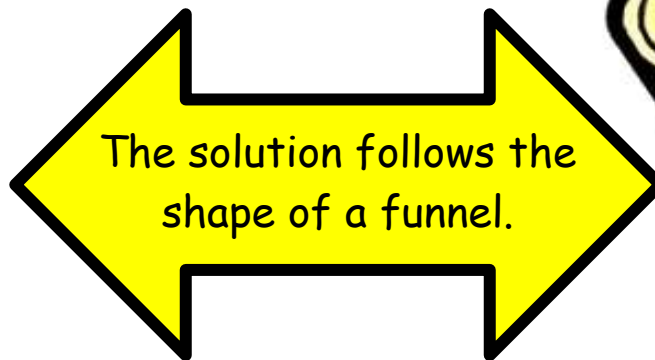The examples we did earlier made use of the funnel method.

Sally's Solution

$$5 + 2 \times 10 - 3$$
$$5 + 20 - 3$$
$$25 - 3$$
$$22$$

The solution follows the shape of a funnel.

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Order of Operations without Parentheses

THE FUNNEL METHOD

1. Write the expression horizontally.

2. Determine the operation that should be done first, following the MDAS rule and underline it.

3. Perform the said operation and rewrite the expression the way it appeared in the original expression.

4. Underline the next operation following the MDAS rule.

5. Continue performing the operations one at a time, rewrite the expression after each step until you've completed all the operations… and you have one value left.

Order of Operations without Parentheses

Example:

Evaluate the numerical expression $3 + 12 \div 4 \times 2 - 8$ using the funnel method.

Solution:

$$3 + \underline{12 \div 4} \times 2 - 8$$

$$3 + \underline{3 \times 2} - 8$$

$$\underline{3 + 6} - 8$$

$$\underline{9 - 8}$$

$$1$$

Sample Problem 2:

Evaluate the following numerical expressions.

a. $10 + 5 \times 6 \div 10 - 13$

b. $45 \div 15 \times 3 + 2 - 4 + 3$

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Order of Operations without Parentheses

Order of Operations in Real World

The MDAS rule is also used to solve real-life problems. These problems happen on a daily basis, without us realizing that we are using such rule. Below is an example:

Example:

Martha bought 5 pairs of pants for $30 each. She paid the cashier $200.

a. Write a numerical expression that represents the problem.

==Solution:== $200 - 5 \times 30$

b. How much money does Martha have left?

==Solution:== $200 - 5 \times 30$

$200 - 150$

==50==

==Martha has $50 left.==

Order of Operations without Parentheses

Sample Problem 3:

Read the situation below and answer the questions that follow.

Paul bought 4 burgers for $2.50 each and 4 medium fries for $1.25.

a. Write a numerical expression that represents the problem.

b. How much money did Paul spend?