

Lesson: Order of Operations

Title: Order of Operations

Objectives: Students will be able to apply the order of operations when performing calculations

Materials:

Teacher notes and script (*This page and next*)

Student note sheet and practice problems (*1 copy per student*)

Student worksheet (*1 copy per student. Option A requires scissors, glue sticks and construction paper.*)

Overheads (*Make transparencies*)

Previous Knowledge Needed:

Integer operations

Important Concepts/Methods:

Order of operations:

Parenthesis – Exponents – Multiplication and Division (In order, left to right) – Addition and Subtraction (In order, left to right)

Two ways to remember:

Please excuse my dear Aunt Sally or PEMDAS

Script:

The order of operations tells you what order you need to do the arithmetic in problems. You need to do every problem in this order. Let's look at the example. (*Put overhead up and read through the problem.*)

$$2 \cdot 4^2 - (12 + 6)$$

- a) 58
- b) 14
- c) 10
- d) -2

The order of operations states that we need to do parenthesis first. Do we have parenthesis in this problem? (*Get students to state the $12 + 6$ is in parenthesis. Underline it in the problem, and have student do the same.*) $12 + 6$ is 18 so our problem is now $2 \cdot 4^2 - 18$ (*Write new problem on the overhead, and have students write it on their papers.*)

The next step in order of operations is exponents. Do we have exponents in the problem? (*Have students respond that 4^2 is an exponent. Underline it in the problem. Have students do the same.*) What is 4 squared? (*Get students to answer 16. If any of the answer 8, take a minute to review the difference between multiplying and exponents.*)

So our problem is now $2 \cdot 16 - 18$. (*Write new problem on the overhead, and have students write it on their paper.*)

The next step is to multiply and divide. 2 times 16 equals 32. (*Underline $2 \cdot 16$ and rewrite problem $32 - 18$.*) So the problem is now 32 minus 18.

The last step is to add and subtract. So 32 minus 18 is 14. (*Write answer on overhead.*) Any questions? (*Answer any questions the students have before going on.*)

Let's look at another problem. Many times order of operations is used in formulas. You work out the problems in the same way, but you need to rewrite the problem using numbers first. So let's read the second problem. (*Put up overhead and read.*)

Lesson: Order of Operations

If $c = 5$, $d = 3$, and $g = 2$ evaluate $c^2 - d + g$.

- a) 5
- b) 9
- c) 20
- d) 24

Before we start working it out we need to rewrite the problem putting numbers in for the variables. We know c is 5, d is 3 and g is 2, so we'll write it out. (*Rewrite problem $5^2 - 3 + 2$ and have students do the same.*)

Now we do the problem in the same way we did it last time. First is parenthesis, but we don't have any so next we do exponents. (*Underline 5^2 and rewrite problem $25 - 3 + 2$. Have students do the same.*)

Now we do multiplying and dividing, but we don't have any, so we move on to adding and subtracting. Remember that we do these in order left to right. Adding does not come before subtracting. $25 - 3$ equals 22, and 22 plus 2 equals 24. (*Write down answer.*) Any questions? (*Answer any questions that come up.*)

Common Mistakes:

Now let's look at the wrong answers. In the first problem the answer was b) 14.

They got a) 58 by just doing the problem in the order that it was written. 2 times 4 is 8. 8 squared is 64. 64 minus 12 is 52, and 52 plus 6 is 58.

c) 10 was wrong because they thought 4 squared was 8 instead of 16 and, and they didn't do their parenthesis first.

The last one d) -2 was wrong because they wrote 4 squared as 8, even though they did the rest of the problem in the correct order.

Let's look at the second problem. The answer was d) 24.

a) 5 was wrong because they wrote 5 squared as 10.

b) 9 was wrong because they wrote 5 squared as 10 and then added before subtracting, and last c) 20 was wrong because they added before subtracting.

Student Problems:

Try the next two problems on your own. (*Give students time to try the problems.*)

(*Put overhead up and either work out problems or give students the opportunity to come up and explain them. Make sure they do all steps.*)

Assignment:

(*Hand out assignment sheet. Either give students time to do and then discuss their problems, or give as homework and collect the next day.*)

Order of Operations

1) $4^2 - (12 + 6)$

a) 58

b) 14

c) 10

d) -2

2) If $c = 5$, $d = 3$, and $g = 2$ evaluate $c^2 - d + g$.

a) 5

b) 9

c) 20

d) 24

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

a) 4

b) 6

c) -0.6

d) 0.2

4) If $a = 4$ and $b = 5$ evaluate $3a - 2b$

a) 50

b) 7

c) 2

d) 52

Ideas that I'm going to study and learn.

Order of operations

ORDER	First	Second	Third	Fourth
STEPS	P arenthesis	E xponents	M ultiply/ D ivide (In order-left to right)	A dd/ S ubtract (In order – left to right)
WAY TO REMEMBER	P lease	E xcuse	M y D ear	A unt S ally
WAY TO REMEMBER	P	E	MD	AS

Problems

Solutions

1) $2 \cdot 4^2 - (12 + 6)$

- a) 58
- b) 14
- c) 10
- d) -2

2) If $c = 5$, $d = 3$, and $g = 2$ evaluate $c^2 - d + g$

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Problems

Solutions

1) $2 \cdot 4^2 - (12 + 6)$

- a) 58
- b) 14
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- d) -2

$$\begin{array}{r}
 2 \cdot 4^2 - (12 + 6) \quad P \\
 \downarrow \quad \downarrow \quad \downarrow \\
 2 \cdot 4^2 - 18 \\
 \downarrow \quad \downarrow \quad \downarrow \\
 2 \cdot 16 - 18 \\
 \hline
 32 - 18 \\
 14 \quad \quad \quad A
 \end{array}$$

2) If $c = 5$, $d = 3$, and $g = 2$ evaluate $c^2 - d + g$

- a) 5
- b) 9
- c) 20
- d) 24

$$\begin{array}{r}
 5^2 - 3 + 2 \quad E \\
 \hline
 \downarrow \quad \downarrow \\
 25 - 3 + 2 \quad S \text{ (Remember left to right)} \\
 \downarrow \\
 22 + 2 \\
 \hline
 24
 \end{array}$$

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

- a) 4
- b) 6
- c) -0.6
- d) 0.2

$$\begin{array}{r}
 2(8 - 4) \div (5 - 3) \quad P \\
 \downarrow \quad \downarrow \\
 2 \cdot 4 \div 2 \quad M \\
 \hline
 8 \div 2 \quad D \\
 \hline
 4
 \end{array}$$

4) If $a = 4$ and $b = 5$ evaluate $3a - 2b$

- a) 50
- b) 7
- c) 2
- d) 52

$$\begin{array}{r}
 3 \cdot 4 - 2 \cdot 5 \quad M \\
 \hline
 12 - 10 \quad S \\
 \hline
 2
 \end{array}$$

Let me show what I know!

Option A: Cut out the following 20 pieces. Put a puzzle together that shows the correct way to solve $2(10 - 8) + 5^2 - 14 \div 2 + 6$. Glue them down in the correct order. You won't use all the pieces, but use as many as you can.

$2(10 - 8) + 5^2 - 14 \div 2 + 6$	$22 + 6$
1	$20 - 8 + 25 - 7 + 6$
$20 - 8 + 5^2 - 14 \div 2 + 6$	$2(2) + 5^2 - 14 \div 2 + 6$
$2(2) + 10 - 14 \div 2 + 6$	$37 - 7 + 6$
36	$12 + 25 - 7 + 6$
$2(2) + 25 - 14 \div 2 + 6$	28
$20 - 33 - 13$	$4 + 10 - 7 + 6$
$29 - 7 + 6$	- 26
$30 + 6$	$4 + 25 - 7 + 6$
$14 - 13$	$20 - 8 + 25 - 14 \div 2 + 6$

Option B: Rewrite the problem in the correct order using the table below. Cross out the pieces as you use them.

Let me show what I know!

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$2(2) + 10 - 14 \div 2 + 6$	$37 - 7 + 6$
36	$12 + 25 - 7 + 6$
$2(2) + 25 - 14 \div 2 + 6$	28
$20 - 33 - 13$	$4 + 10 - 7 + 6$
$29 - 7 + 6$	- 26
$30 + 6$	$4 + 25 - 7 + 6$
$14 - 13$	$20 - 8 + 25 - 14 \div 2 + 6$

Option B: Rewrite the problem in the correct order using the table below. Cross out the pieces as you use them.

$2(10 - 8) + 5^2 - 14 \div 2 + 6$
S _____
A <u>$22 + 6$</u>
28