Number Sense and Numeration and Algebra

Order of Operations with Exponents and Integers

Listen & Learn

PRESENTED BY MARSHALL

Mathematics, Grade 8

Order of Operations with Exponents and Integers

Introduction

- Welcome to today's topic
- Parts of Listen & Learn
  - Presentation, Q&A
- Housekeeping
  - Your questions
  - Satisfaction meter
  - Downloading slides

Order of Operations with Exponents and Integers

What you will learn

After viewing this presentation, you will be able to

- apply the Order of Operations rules (BEDMAS) to correctly simplify an expression that contains exponents and integers

Order of Operations with Exponents and Integers

Agenda

- The importance of Order of Operations
- Review of concepts
- Order of Operations
  - Evaluating expressions with exponents
  - Evaluating expressions with integers
  - Evaluating expressions with exponents and integers
- Recap
- Putting it all together

Order of Operations with Exponents and Integers

Importance

Figure 1

BEDMAS is used in all math calculations involving more than one operation

Mathematicians agreed on a specific way to simplify expressions so that everyone gets the same answer. Math problems with 2 or more different operations must be solved with BEDMAS. The Order of Operations with BEDMAS rules have many real-life applications such as:

- building a fence, a house or almost any other object
- a manager ordering food for a restaurant based on the number of visitors expected for the day
- balancing your bank account

Order of Operations with Exponents and Integers

Importance

Real-life Application

John works for a company that pays him once every 2 weeks. His paycheque always equals $1003. Within that 2-week time period, John has many expenses to cover.

Order of Operations with Exponents and Integers

Importance

Expenses over 2 weeks

Clothing $234
Gas $56 for each fill **(he fills up 3 times)**
Groceries $170
Savings 10% **of paycheque put into savings account**
Rent $400 (for 2 weeks)
Cellphone $35 (for 2 weeks)

How much does John have left over?

Order of Operations with Exponents and Integers

Importance

Real-life Application

Developing the equation:

$1,003 **John's income**
– $234 **Subtract clothing expenses**
– ($56 x 3) **Subtract gas (must be multiplied by 3)**
($56 x 3 = $168)
– $170 **Subtract groceries**
– ($1003 x 0.10) **Subtract how much goes into savings**
($1003 x 0.10 = $103)
– $400 **Subtract rent**
– $35 **Subtract cellphone bill**

Order of Operations with Exponents and Integers

Importance

What this equation looks like:

$1003 - $234 – ($56 x 3) – $170 – ($1003 x .10) – $400 – $35

BEDMAS: $1003 – $234 – ($168) – $170 – ($103) – $400 – $35
BEDMAS: No exponents
BEDMAS: No further division or multiplication
BEDMAS: $1003 – $234 – $168 – $170 – $103 – $400 – $35

BEDMAS: – $107

John does not have enough money to cover his expenses.

Order of Operations with Exponents and Integers

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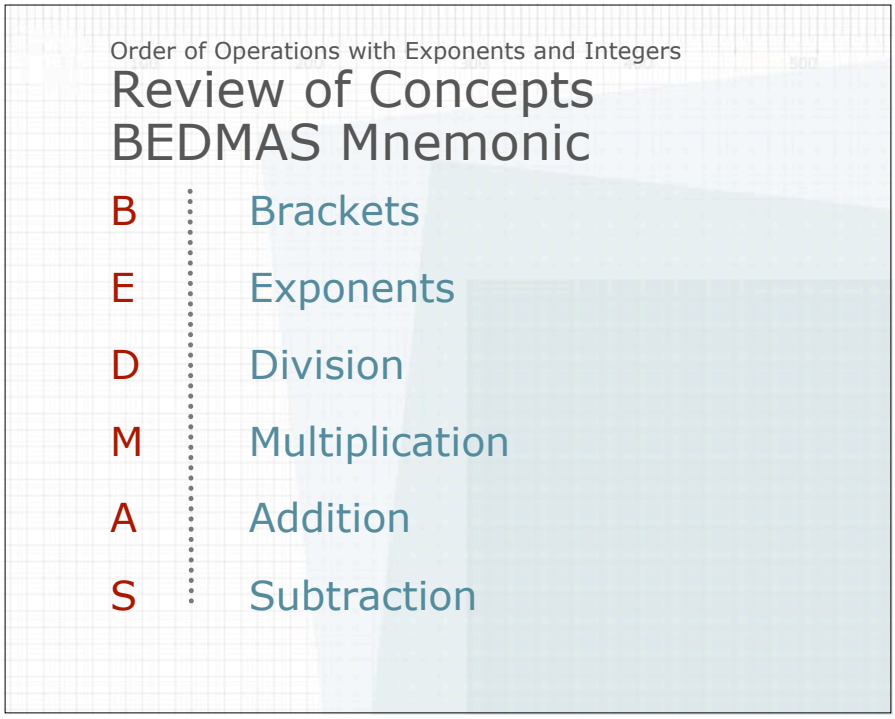
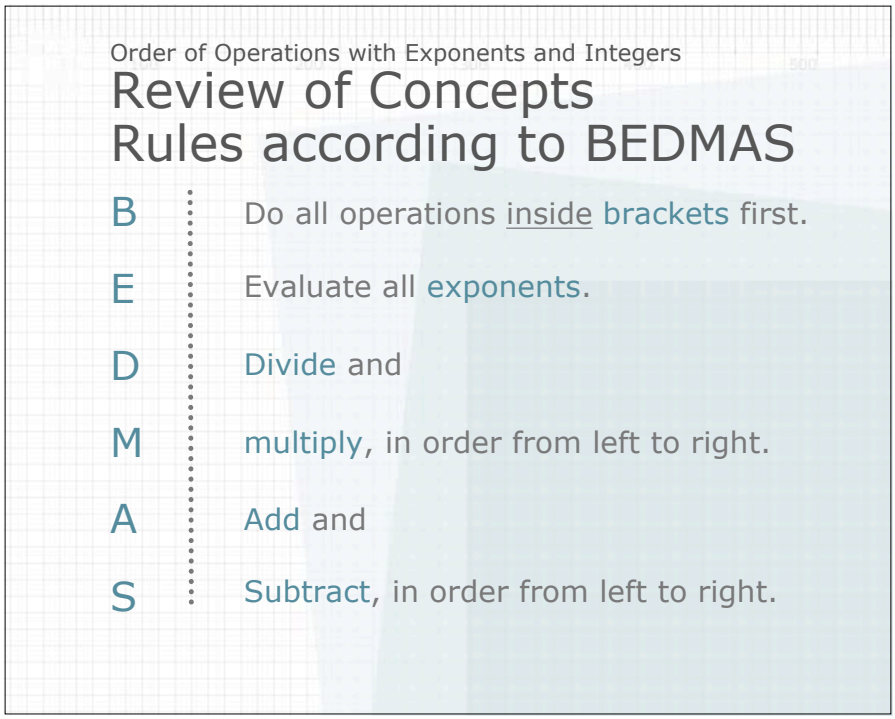

Order of Operations with Exponents and Integers
Review of Concepts
BEDMAS Mnemonic
B
Brackets
E
Exponents
D
Division
M
Multiplication
A
Addition
S
Subtraction


Order of Operations with Exponents and Integers
Review of Concepts
Rules according to BEDMAS
B
Do all operations inside brackets first.
E
Evaluate all exponents.
D
Divide and
M
multiply, in order from left to right.
A
Add and
S
Subtract, in order from left to right.

Order of Operations with Exponents and Integers

Review of Concepts Working with Exponents

Let's review how to solve an exponent.

Example:

$$6^2$$

Order of Operations with Exponents and Integers

Review of Concepts Exponents

The parts of a power are the base and the exponent.

Order of Operations with Exponents and Integers

Review of Concepts Solving the Exponent

Simplify the power:

$$6^2$$

The base is multiplied by ITSELF the number of times noted in the exponent.

Therefore to simplify this power you need to multiply 6 x 6

NOT 6 x 2

Therefore $6^2 = 36$

Order of Operations with Exponents and Integers

Review of Concepts Solving Integers

When simplifying expressions you may encounter integers within the expression.

You are encouraged to have a calculator with a +/− button on it to assist you with integers if necessary.

Order of Operations with Exponents and Integers

Review of Concepts Integers

Positive Integers are whole numbers such as +17, +2, +1. They are numbers that are greater than 0.

Negative Integers are whole numbers such as -5, –28, –1. They are numbers that are less than 0.

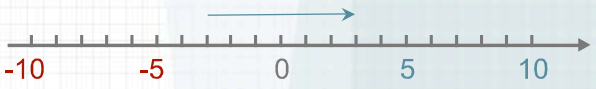
Any positive integer is greater than any negative integer. For example, +20 is greater than –700.

Order of Operations with Exponents and Integers

Review of Concepts Adding Integers

To add a positive integer, move right on a number line. (–3) + (+6)

Start at –3 on a number line and move 6 units to the right.



To add a negative integer, move left on the number line. (–1) + (–2)

Start at –1 on the number line and move 2 units to the left.

Order of Operations with Exponents and Integers

Review of Concepts Subtracting Integers

There is a trick for subtracting integers.

Think about subtracting one whole number from another (such as 3 from 9). Instead of just subtracting the numbers from each other, ask yourself "What can I add to get from 3 to 9?" The answer is 6. Therefore 9 – 3 = 6.

To subtract an integer from another (such as (–3) – (+9)), ask "What can I add to +9 to get to –3?"

Order of Operations with Exponents and Integers

Review of Concepts Subtracting Integers

Subtracting an integer is the same as adding the opposite integer.

(–6) – (+7) = –13

Or

(–6) + (–7) = –13

Order of Operations with Exponents and Integers

Review of Concepts Multiplying Integers

Positive x Positive = Positive

(+3) x (+3) = +9

Negative x Negative = Positive

(–4) x (–4) = +16

Positive x Negative = Negative

(+5) x (–3) = –15

Negative x Positive = Negative

(–6) x (+3) = –18

Order of Operations with Exponents and Integers

Review of Concepts Dividing Integers

Positive / Positive = Positive

(+15) / (+3) = +5

Negative / Negative = Positive

(–16) / (–4) = +4

Positive / Negative = Negative

(+15) / (–3) = –5

Negative / Positive = Negative

(–20) / (+5) = –4

Order of Operations with Exponents and Integers

Review of Concepts
The Understood Operation

In mathematics, we sometimes use brackets instead of a multiplication sign.

45 + 21 (36) – 17

Multiplication is the understood operation here.

Order of Operations with Exponents and Integers

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Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents

Let's first look at an expression that contains an exponent.

Exponent

$(6 + 10.8) + 10.4 \times 10^2$

Recall: BEDMAS

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents

$(6 + 10.8) + 10.4 \times 10^2$

Simplify: BEDMAS – Brackets

$= 16.8 + 10.4 \times 10^2$

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents

$(6 + 10.8) + 10.4 \times 10^2$

Simplify: BEDMAS – Brackets
$= 16.8 + 10.4 \times 10^2$

Simplify: BEDMAS – Exponents
$= 16.8 + 10.4 \times \underline{10^2}$
$= 16.8 + 10.4 \times 100$

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents

$(6 + 10.8) + 10.4 \times 10^2$

Simplify: BEDMAS – Brackets
$= 16.8 + 10.4 \times 10^2$

Simplify: BEDMAS – Exponents
$= 16.8 + 10.4 \times \underline{10^2}$
$= 16.8 + 10.4 \times 100$

Simplify: BEDMAS – Division & Multiplication
$= 16.8 + \underline{10.4 \times 100}$
$= 16.8 + 1040$

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents

$(6 + 10.8) + 10.4 \times 10^2$

Simplify: BEDMAS – Brackets
$= 16.8 + 10.4 \times 10^2$

Simplify: BEDMAS – Exponents
$= 16.8 + 10.4 \times \underline{10^2}$
$= 16.8 + 10.4 \times 100$

Simplify: BEDMAS – Division & Multiplication
$= 16.8 + \underline{10.4 \times 100}$
$= 16.8 + 1040$

Simplify: BEDMAS – Addition & Subtraction
$= \underline{16.8 + 1040}$
$= 1056.8$

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents

$(6 + 10.8) + 10.4 \times 10^2$

$= 16.8 + 10.4 \times 10^2$
$= 16.8 + 10.4 \times 100$
$= 16.8 + 1040$
$= 1056.8$

Order of Operations with Exponents and Integers

Evaluating Expressions with Integers

Let's look at an expression that contains an integer.

$$200 + 6\,[40/(-4)]$$

Since we use curved brackets for integers, for example (–4), we will use square brackets to group terms together.

To keep our expressions "clean" we do not add the (+) positive sign in front of positive numbers. We write them as whole numbers.

Order of Operations with Exponents and Integers

Evaluating Expressions with Integers

$200 + 6[40/(-4)]$

Simplify: BEDMAS – Brackets

$= 200 + 6[40/(-4)]$

$= 200 + 6(-10)$

Note: The BEDMAS bracket is signified by square brackets. The curved bracket used to indicate a negative integer does not have an operation to perform inside the bracket. Integer operation is solved just like any question involving an integer.

Order of Operations with Exponents and Integers

Evaluating Expressions with Integers

200 + 6 [40 / (–4)]

Simplify: BEDMAS – Brackets (with integer)
= 200 + 6 [40 / (–4)] ← Integer division
= 200 + 6 (–10)

Simplify: BEDMAS – Exponents
There are no exponents to solve.

Simplify: BEDMAS – Division & Multiplication
= 200 + 6 (–10)
= 200 + (–60) ← Integer multiplication

Simplify: BEDMAS – Addition & Subtraction
= 200 + (–60)
= 140 ← Integer addition

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents and Integers

Evaluate an expression that contains exponents and integers.

$$\frac{(4) \times (-10) - 10}{(-5)^2}$$

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents and Integers

Evaluate an expression that contains integers and exponents.

$$\frac{(4) \times (-10) - 10}{(-5)^2}$$

This expression is the same as

$$[(4) \times (-10) - 10] \div (-5)^2$$

So you would work on the expression in the brackets first (numerator, then denominator).

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents and Integers

Evaluate:

$$\frac{(4) \times (-10) - 10}{(-5)^2}$$

Work through the numerator (the top section of the fraction) first!

$(4) \times (-10) - 10$

$= (-40) - 10$

$= -50$

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents and Integers

Evaluate:

$$\frac{-50}{(-5)^2}$$

Now that we have solved the numerator, let's solve the denominator.

$(-5)^2$

Remember this is (–5) x (–5)

= 25

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents and Integers

Our expression simplified:

$$\frac{-50}{25}$$

The last part is finally completing the division:

–50/25

= –2

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents and Integers

Write an expression for the following statements and then evaluate each expression:

a) Multiply 5 and 2, then subtract 3^2

b) Multiply the sum of –8 and –16 by –2.

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents and Integers

a) Multiply 5 and 2, then subtract 3^2

Order of Operations with Exponents and Integers

Evaluating Expressions with Exponents and Integers

b) Multiply the sum of –8 and –16 by –2

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Order of Operations with Exponents and Integers

Recap

When there is no operation symbol between numbers and one number is in brackets, it is understood that you perform:

a) addition

b) division

c) multiplication

d) subtraction

Order of Operations with Exponents and Integers

Recap

When there is no operation symbol between numbers and one number is in brackets, it is understood that you perform:

a) addition

b) division

c) multiplication

d) subtraction

Order of Operations with Exponents and Integers

Recap

Multiplication is always used when there is no symbol between the numbers in an expression and one number is in brackets.

Order of Operations with Exponents and Integers

Recap

$$\frac{(3 \times 2)^2 - 10 + 9}{-7}$$

a) 5

b) –5

c) 35

d) –245

Order of Operations with Exponents and Integers

Recap

$$\frac{(3 \times 2)^2 - 10 + 9}{-7}$$

a) 5

b) –5

c) 35

d) –245

Order of Operations with Exponents and Integers

Recap

$\frac{(3 \times 2)^2 - 10 + 9}{-7}$	Numerator first BEDMAS (Bracket)
$= \frac{(6)^2 - 10 + 9}{-7}$	BEDMAS (Exponent)
$= \frac{36 - 10 + 9}{-7}$	BEDMAS (No multiplication/division in numerator)
$= \frac{26 + 9}{-7}$	BEDMAS (Addition/Subtraction)
$= \frac{35}{-7}$	BEDMAS (Addition/Subtraction)
= –5 (Solution)	Denominator – divide numerator by denominator

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Order of Operations with Exponents and Integers

Let's Put It All Together!

$(5 - 3)^2 \times (-4) - 10 + 18 / 6 = ?$

a) –23

b) 0

c) 9

d) –5

Order of Operations with Exponents and Integers

Let's Put It All Together!

$(5 - 3)^2 \times (-4) - 10 + 18 / 6 = ?$

a) –23

b) 0

c) 9

d) –5

Order of Operations with Exponents and Integers

Let's Put It All Together!

$(5 - 3)^2 \times (-4) - 10 + 18 / 6$

$= (2)^2 \times (-4) - 10 + 18 / 6$ BEDMAS

$= 4 \times (-4) - 10 + 18 / 6$ BEDMAS

$= (-16) - 10 + 3$ BEDMAS

$= (-26) + 3$ BEDMAS

$= -23$

Order of Operations with Exponents and Integers

Resources

OERB: Ontario Educational Resource Bank

http://resources.elearningontario.ca

- Order of Operations 1: Grade 6, 7,8 Math
  Resource Bank ID: ELO1020530
- Exponents Grade 8 Math
  Resource Bank ID: ELO1033350
- Integers…Positive or Negative? Grade 8 Tutorial
  Resource Bank ID: ELO1033460

Math Goodies

http://www.mathgoodies.com/lessons/vol7/order_operations.html

(Note: this website uses PEDMAS, the US version of BEDMAS. "P" stands for "parentheses," which means the same as brackets.)