

**Notes: 1.2: Order of Operations** Name: \_\_\_\_\_

**Avoiding Mass Confusion:** 14, 84, 4225,  $8\frac{2}{3}$ , 49

You can probably think of several ways to evaluate the following expression:

$$13 - 6 \div 2 \cdot (7 - 5)^2$$

Handwritten annotations show three different ways to evaluate the expression:

- $13 - 3 \cdot 4 = 13 - 12 = 1$  (green)
- $13 - 6 \div 2 \cdot 2^2$  (purple)
- $13 - 6 \div 2 \cdot 4$  (orange)

A green arrow points from the purple expression to the green expression.

And each of the ways probably has a different answer.

In order to avoid the confusion of everybody doing a problem correctly, but getting different answers an Order of Operations was established.

P

E

MD - left to right

AS - left to right

**The Order of Operations:**

- Parentheses (do any operations inside parentheses/absolute value first)
- Exponents (evaluate any powers or (square) roots)
- Multiplication and Division (do multiplications and divisions from left to right)
- Addition and Subtraction (add and subtract in order from left to right)

People remember the order by using PEMDAS, or Please Excuse My Dear Aunt Sally.

Some calculators know the order of operations and others don't. Some can't even do more than one operation at a time. Experiment with yours and try to always use the same calculator - so you know what it can do.

a)  $7 - 2 \cdot 3$

b)  $6 + 9 \div 3$

$6 + 3 = 9$

c)  $8 - 1 \cdot 4 + 2$

$8 - 4 + 2$   
 $4 + 2 = 6$

d)  $7 + 8 \div 2 - 5$

$7 + 4 - 5$   
 $11 - 5 = 6$

e)  $9 \div 3 + 5 \cdot 4$

f)  $6 \cdot 2 - 12 \div 3$

$12 - 4 = 8$

g)  $8 - (9 + 5) \div 2$

h)  $4 + (11 - 7) \cdot 2 - 9$

$4 + 4 \cdot 2 - 9$   
 $4 + 8 - 9 = 3$

i)  $-(2)^2$

$-2^2 = -4$

$-1 \cdot 2^2$

$-1 \cdot 4 = -4$

j)  $(-2)^2$

$-2 \cdot -2 = 4$

$2(5)^2$

$4(3)^2$

$2(25)$

$50$