ORDER OF OPERATIONS

The **ORDER OF OPERATIONS** is an order agreed upon by all mathematicians (and math students!) that should be closely followed. Follow this order:

1ST Any calculations inside parentheses or brackets should be done first. (This includes all grouping symbols, such as ( ), { }, and [ ].)

2ND Exponents, roots, and absolute value are calculated left to right.

3RD Multiplication and division—whichever comes first when you calculate left to right.

4TH Addition and subtraction—whichever comes first when you calculate left to right.

Lots of people use the mnemonic "Please Excuse My Dear Aunt Sally" for **PEMDAS** (Parentheses, Exponents, Multiplication, Division, Addition, and Subtraction) to remember the order of operations, but it can be VERY misleading. You can do division before multiplication as long as you are calculating from left to right—the same thing goes for addition and subtraction. Also, because other calculations like roots and absolute value aren't included, PEMDAS isn't totally foolproof.

EXAMPLE: $4 + 3 \cdot 2$ First, multiply the 3 and 2 together.

$= 4 + 6$ Then add.
$= 10$

EXAMPLE: $6 + (12 \div 4) - 2$ Start with the calculation inside the parentheses first.

$= 6 + (3) \cdot 2$ Next, multiply the 3 and 2 together.

$= 6 + 6$ Then add.
$= 12$

EXAMPLE: $3^2 - 4(6 + 1) - 2$ Start with the exponent and the calculations inside the parentheses.

$= 9 - 4(7) - 2$ Next, multiply.

$= 9 - 28 - 2$ Last, subtract from left to right.

$= -21$

Whenever you have two sets of parentheses or brackets nested inside one another, CALCULATE THE INNERMOST SET OF PARENTHESES OR BRACKETS FIRST, then work outward.

EXAMPLE: $[14 \div (9 - 2) + 1] \cdot 6$ Start with the calculations inside the innermost parentheses: $9 - 2 = 7$.

$= [14 \div 7 + 1] \cdot 6$ Next, divide inside the brackets: $14 \div 7 = 2$.

$= [2 + 1] \cdot 6$ Then, add inside the brackets: $2 + 1 = 3$.

$= 3 \cdot 6$

$= 18$

For **1**, fill in the blanks:

According to the order of operations, follow this order: First, do any calculations inside parentheses or _____ . (This includes all grouping symbols, such as ( ), { }, and [ ].) Then, calculate exponents, roots, and _____ . Next, do multiplication and division (it doesn't matter whether you do _____ or multiplication first, as long as you calculate from _____ to _____). Then, do addition and subtraction (it doesn't matter whether you do subtraction or _____ first as long as you calculate from _____ to _____).

For **2** through **10**, simplify the following expressions:

2. $4 + 8 \cdot 2$

3. $2 + 6 + 8^2$

4. $9 + (9 - 4 \cdot 2)$

5. $4^2 + (19 - 15) \cdot 3$

6. $(-4)(-2) + 2(6+5)$

7. $(6-3)^2 - (4+-3)^3$

8. $|6-8| + [(2+5) \cdot 3]^2$

9. $\dfrac{27}{-3} + (12 \div 4)^3$

10. $[6 \cdot 4(15 \div 5)] + [2^2 + (1 \cdot -5)]$

CHECK YOUR ANSWERS

1. brackets; absolute value; division; left; right; addition; left; right

2. 20

3. 72

4. 10

5. 28

6. 30

7. 8

8. 443

9. 18

10. 71