Unit 1: Lesson 01 Order of operations (PEMDAS)

In arithmetic expressions it is important to know the **order** in which to do the operations. The correct order is given by **PEMDAS**:

- PEMDAS is a memory aid for the correct order: **parentheses, exponents, multiplication, division, addition, and subtraction**.

- Even though multiplication is listed before division, they are actually of the **same** priority.

- Even though addition is listed before subtraction, they are actually of the **same** priority.

- When deciding which of two operations of the same priority to do first, do them in a **left-to-right order**.

In the following examples, perform the arithmetic operations in the correct order to produce a final value for the expression.

Example 1: $2 \cdot 8 + 5 - 6 + 1 \cdot 3$

$$= 16 + 5 - 6 + 1 \cdot 3$$
$$= 16 + 5 - 6 + 3$$
$$= 21 - 6 + 3$$
$$= 15 + 3 = \boxed{18}$$

Example 2: $17 + 6 \cdot 3 \div 2$

$$= 17 + 18 \div 2$$
$$= 17 + 9$$
$$= \boxed{26}$$

Example 3: $2 \cdot (7 + 2) + 1 - 8/2$

$$= 2(9) + 1 - 8/2$$
$$= 18 + 1 - 8/2$$
$$= 18 + 1 - 4$$
$$= 19 - 4 = \boxed{15}$$

Example 4: $2 \cdot 3^2 - 15/3$

$$= 2 \cdot 9 - 15/3$$
$$= 18 - 15/3$$
$$= 18 - 5 = \boxed{13}$$

Example 5: $24 \div 2^2 \cdot 10 - 2(3 \cdot 5)$

$$= 24 \div 2^2 \cdot 10 - 2(15)$$
$$= 24 \div 4 \cdot 10 - 30$$
$$= 6 \cdot 10 - 30$$
$$= 60 - 30$$
$$= \boxed{30}$$

Example 6: $(18 - (12/2) + 3)/(4 + 1)$

$$= (18 - 6 + 3)/(4 + 1)$$
$$= (12 + 3)/(5)$$
$$= 15/5$$
$$= \boxed{3}$$

As a special case of parentheses, consider a fraction written in this form:

$$\frac{a + b}{c + d}$$

Rewrite with parentheses in this form $(a + b)/(c + d)$ and simplify in the parentheses first.

Example 7: $\dfrac{3 \cdot 2 + 6 \cdot 5}{28 - 25}$

$$= (3 \cdot 2 + 6 \cdot 5)/(28 - 25)$$
$$= (6 + 6 \cdot 5)/3$$
$$= (6 + 30)/3$$
$$= 36/3 = \boxed{12}$$

Assignment: In the following examples, perform the arithmetic operations in the correct order to produce a final value for the expression.

1. $8 + 4(7 - 2)$

2. $3(4 + 1) - 12 \div 2^2$

3. $11 - 22/11 + 2^3 \cdot 6$

4. $40 - 25 \div 5$

5. $(6 \cdot 5)/(11 - 8)$

6. $\dfrac{4 \cdot 3^2}{18 - 2 \cdot 3}$

7. $11 + 1 \cdot 2 - 4 \cdot 1 + 36 \div 3$

8. $200/2/2 \cdot 3 + 1$

9. $\dfrac{10 \cdot 2 + 1 \cdot 12}{1 + 2 \cdot 3 - 3}$

10. $8 \cdot 5 - 2(22 \div 2) + 3(5 - 2)$

11. $3(36 \div 9) + 2(80 - 60) - 3 \cdot 4$

12. $\dfrac{5 \cdot 2 + 48 \div 12}{9 - 2 - 5}$

*13. $\{\,72 - 4[11 - 3(12/4)]\,\}/2$

*14. $\dfrac{15[\,5 + 3(8 \div 4 + 2)\,] + 15}{7 - 45 \div [5 + 2(6 \div 3)]}$