

## Exponents, Complex Fractions, and the Order of Operations Agreement

**Exponents:** Recall that an exponent indicates the repeated multiplication of the same factor. For example:

$$3^5 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$$

The exponent, 5, indicates how many times the base, 3, occurs as a factor in the multiplication.

The base of an exponential expression can be a fraction, for example:

$$\left(\frac{2}{3}\right)^4 = \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} = \frac{16}{81}$$

**Evaluate:**  $\left(\frac{-3}{5}\right)^2 \cdot \left(\frac{5}{6}\right)^3$

Write each factor as many times as indicated by the exponent.

$$\left(\frac{-3}{5}\right)^2 \cdot \left(\frac{5}{6}\right)^3 = \frac{-3}{5} \cdot \frac{-3}{5} \cdot \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6}$$

Multiply. The product of two negative numbers is positive.

$$= \frac{3}{5} \cdot \frac{3}{5} \cdot \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6}$$

Write the product in simplest form.

$$= \frac{5}{24}$$

**Evaluate:**  $x^3$  when  $x = 2.5$

Replace  $x$  with 2.5

$$= (2.5)^3$$

Multiply.

$$= 7.25$$

### **COMPLEX FRACTIONS:**

A complex fraction is a fraction whose numerator or denominator contains one or more fractions.

**Examples:**  $\frac{\frac{3}{4}}{\frac{7}{8}}$ ,  $\frac{4}{3 - \frac{1}{2}}$

$\frac{\frac{3}{4}}{\frac{7}{8}}$  is a division problem and may be rewritten as :

$$\frac{3}{4} \div \frac{7}{8} = \frac{3}{4} \times \frac{8}{7} = \frac{24}{28} = \frac{6}{7}$$

### **ORDER OF OPERATIONS AGREEMENT:**

Recall the following steps in the order of operations:

- 1.) Do all operations in groupings (*note: fraction bars act as a grouping*).
- 2.) Simplify exponents.
- 3.) Perform multiplication and division operations, as they occur, from left to right.
- 4.) Perform addition and subtraction operations, as they occur, from left to right.

$$\begin{aligned}
 \text{Example 1: } & \left(\frac{1}{2}\right)^2 + \left(\frac{2}{3} \div \frac{5}{9}\right) \cdot \frac{5}{6} \\
 & = \left(\frac{1}{2}\right)^2 + \left(\frac{2}{3} \cdot \frac{9}{5}\right) \cdot \frac{5}{6} \\
 & = \left(\frac{1}{2}\right)^2 + \left(\frac{6}{5}\right) \cdot \frac{5}{6} \\
 & = \left(\frac{1}{2}\right)^2 + 1 \\
 & = \frac{1}{4} + 1 = 1\frac{1}{4}
 \end{aligned}$$

$$\begin{aligned}
 \text{Example 2: } & 6 - \frac{2+2}{15-8} \div \frac{3}{14} \\
 & = 6 - \frac{3}{7} \div \frac{3}{14} \\
 & = 6 - \left(\frac{3}{7} \times \frac{14}{3}\right) \\
 & = 6 - 2 = 4
 \end{aligned}$$