Operators and Operations

Operations transform numbers, and **operators** tells us the operation to perform. For instance, the addition <u>operator</u>, +, tells us to perform the <u>operation</u> of addition. When we see 5 + 15 we know to transform the 5 to the left of the operator and the 15 to the right into the single number, 20.

The addition operator, +, tells us to add **terms** to get a **sum**. In the expression 2 + 3, 2 is a term, 3 is a term and the sum would be 5. 2 + 3 is also a sum but the word "sum" usually refers to the 5.

We multiply **factors** to get a **product**. Three common ways to represent multiplication are $\times$ or $\bullet$ or ( ), so 2×5 or $2 \bullet 5$ or $2(5)$ all simplify to the product 10.

When we subtract a **subtrahend** from a **minuend** (minuend $-$ subtrahend) we have a **difference**. For example, with $5 - 3$, 5 is the minuend, 3 is the subtrahend and the difference would be 2. We use a "dash" symbol, $-$, to show the operation of subtraction.

We divide a **dividend** by a **divisor** to get a **quotient** and a **remainder**. To show the operation of division the $\div$ symbol (dividend $\div$ divisor), or a bar ($\dfrac{\text{dividend}}{\text{divisor}}$) are usually used. When we take the point of view that the quotient is a fraction we usually call the dividend the numerator and the divisor the denominator.

A **base** together with an **exponent**, $\text{Base}^{\text{exponent}}$, gives a **power**. In the expression 3^2 the base is 3, the exponent is 2 and the second power of three is 9.

A **radical symbol**, $\sqrt{\ }$, along with an **index** and a **radicand**, $\sqrt[\text{index}]{\text{radicand}}$ gives a **root**. For instance, $\sqrt[3]{8}$, which has an index of 3 and a radicand of 8, gives the "cube" root, 2.

***Procedure* – Order of Operations**

Begin with the innermost grouping idea and work out;

    Explicit grouping ( ), [ ], { }

    Implicit grouping   Operations;
                in the dividend or divisor.
                inside absolute value bars.
                in radicands or exponents.

1. Start to the left and work right simplifying each operation, different from the basic four, as you come to them.

2. Start again to the left and work right simplifying each multiplication or division as you come to them.

3. Start again to the left and work right simplifying each addition or subtraction as you come to them.