Expressions

To perform calculations, you write expressions to calculate the answer in a form similar to that used in mathematics. Consider the quadratic equation:

$$ax^2 + bx + c = 0$$

This equation has two solutions given by the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

To solve this in C++, you write an **expression** which uses **+** in place of the **±** symbol, to calculate one of the roots, like this:

```
(-b + sqrt(b * b - 4 * a * c)) / (2 * a)
```

An Expression Vocabulary

An **expression** is any combination of **operators** and **operands** which, when evaluated, yields a value.

1. An **operand** indicates a **value**. Operands include:
    - **Literals:** which represent a value
    - **Variables:** a storage location containing a value
    - **Function calls:** which can produce a value
    - **Sub-expressions:** which yeild a value
2. An **operator** is a symbol which performs an operation on one or more operands and, subsequently, produces a value. Operators have three characteristics:
    - **Arity**: the number of operands required. **Unary** operators require a single operand, while **binary** operators require two.
    - **Precedence**: determines which operands "bind to" the operator. Those with **higher precedence** "stick to" their adjacent operands more closely.
    - **Associativity**: determines whether operations, **at the same level of precedence**, should proceed from right-to-left, (called **right-associative**), or from left-to-right, (called **left-associative**).

This linked table shows the precedence and associativity for all of the C++ operators.