

# Programming fundamentals

## Section 3

Example on float/double to solve quadratic equation:  $x^2 + 4x - 21$

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

```
#include <iostream>
#include <math.h>
using namespace std;

int main()
{
    float a,b,c;
    cout<< "Enter a:"<< endl;
    cin>> a;
    cout<< "Enter b:"<< endl;
    cin>> b;
    cout<< "Enter c:"<< endl;
    cin>> c;

    double x,temp;
    temp= b*b - 4*a*c;
    temp = sqrt(temp);
    x= (-1*b + temp) / (2*a);
    cout<< "x1 = " << x << endl;
    x= (-1*b - temp) / (2*a);
    cout<< "x2 = " << x << endl;
    return 0;
}
```

The output

```
Enter a:
1
Enter b:
4
Enter c:
-21
x1 = 3
x2 = -7
```

The sizeof operator can be used to determine to the number of bytes occupied in memory by a variable of a certain type.

```
#include<iostream>
using namespace std;
void main()
{
cout << "sizeof(integer)is:" << sizeof(int) << "byte" <<
endl;
cout << "sizeof(float)is:" << sizeof(float) << "byte" <<
endl;
cout << "sizeof(character)is:" << sizeof(char) << "byte" <<
endl;
system("Pause");
}
```

# float and double (IEEE 754)

- Float

- 32 bit

Sign (1 bit)	Exponent (8 bit) الأس	Mantissa ( 23 bit) الجزء العشري
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- Double

- 64 bit

Sign (1 bit)	Exponent (11 bit)	Mantissa ( 52 bit)
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## float and double(Example)

- Represent the Float number 95.145 using (IEEE 754):

1- Convert 95 to binary  $\rightarrow$  01011111

2- Convert .145 to binary  $\rightarrow$  00100101000111101

The number is  $\rightarrow$  1011111.00100101000111101

3- Write the number in this form  $\rightarrow$  1.01111100100101000111101  $\times 2^6$

4- Number is positive so, first bit is 0.

5- For Float  $\rightarrow$  Add 127 to exponent (in this example, 6+127= 133)

For Double  $\rightarrow$  Add 1023 to exponent.

0	10000101	01111100100101000111101
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# Example:

```
#include <iostream>
using namespace std;

int main()
{
    union{
        float x;
        int z;} data;

    data.x= 95.145;
    cout<< hex << data.z;
    return 0;
}
```

- The result >> 42be4a3d
- take the result in hexa and Convert it to binary.
- Binary >> 0 10000101 01111100100101000111101.

# Operators

**There are four main classes of operators:**

- Arithmetic
- Relational
- Logical
- Bitwise.

# Arithmetic Operators

Operator	Action
-	Subtraction, also unary minus
+	Addition
*	Multiplication
/	Division
%	Modulus
--	Decrement
++	Increment



# Increment and Decrement

- The operator ++ adds 1 to its operand, and - - subtracts 1.
- Both the increment and decrement operators may either **prefix** or **postfix** the operand.

$x = x + 1$    $x++$  or  $++x$

$x = x - 1$    $x--$  or  $--x$

- When an increment or decrement operator precedes its operand, the increment or decrement operation is performed before obtaining the value of the operand for use in the expression. If the operator follows its operand, the value of the operand is obtained before incrementing or decrementing it

# Increment and Decrement

<b>x = 10; y = ++x;</b>	<b>x = 10; y = x++;</b>	<b>x=10; y=--x;</b>	<b>x=10; y=x--;</b>
<b>sets y to 11</b>	<b>sets y to 10</b>	<b>Set y to 9</b>	<b>Set y to 10;</b>

The precedence of the arithmetic operators:

<b>highest</b>	<b>++ --</b>
	<b>- (unary minus)</b>
	<b>* / %</b>
<b>lowest</b>	<b>+ -</b>

# Example

```
#include<iostream>
using namespace std;
void main()
{
int x = 5;
int y = 10;
int z = ++x * y-- + 10;
cout << "z= " << z << endl;
cout << "x= " << x << endl;
cout << "y= " << y << endl;
system("Pause");
}
```

```
#include<iostream>
using namespace std;
void main()
{
int x = 5;
int y = 10;
int z = ++x * --y + 10;
cout << "z= " << z << endl;
cout << "x= " << x << endl;
cout << "y= " << y << endl;
system("Pause");
}
```

# Exercise :Show Output

```
#include<iostream>
using namespace std;
void main()
{
    int x = 4;
    int y = 3;
    cout<< y++ * x-- <<endl;
    cout<< ++y * x-- << endl;
    cout<< ++y * --x << endl;
    system("Pause");
}
```

# Example

```
#include<iostream>
using namespace std;
void main()
{
    int x = 30;
    int y = 40;
    int z = ++x * --y + x++ - y-- * 10;
    cout << "z= " << z << endl;
    cout << "x= " << x << endl;
    cout << "y= " << y << endl;
    system("Pause");
}
```