

Visual C# Program: Basic Math Functions

In this chapter, you will learn how to use the following Visual C# Application functions to World Class standards:

- Opening Visual C# Editor
- Beginning a New Visual C# Project
- Laying Out a User Input Form in Visual C#
- Insert a Label into a Form
- Insert a Textbox into a Form
- Insert a Label into a Form to Post an Output
- Insert Command Buttons into a Form
- Adding a Copyright Statement to a Form
- Insert a Picture into a Form
- Adding Comments in Visual C# to Communicate the Copyright
- Declaring Variables in a Program with the Double Statement
- Setting Variables in a Program
- Adding Numbers in Visual C#
- Subtracting Numbers in Visual C#
- Multiplying Numbers in Visual C#
- Dividing Numbers in Visual C#
- Finding Remainders in Visual C#
- Computing Absolute Values in Visual C#
- Fixing Numbers in Visual C#
- Rounding Numbers in Visual C#
- Computing Exponents in Visual C#
- Computing Square Roots in Visual C#
- Computing Sine's in Visual C#
- Computing Cosines in Visual C#
- Resetting the Data
- Exiting the Program
- Running the Program

Writing Math Equations in Visual C#

There are many arithmetic and geometric functions that we can utilize in programming in Visual C#. Some arithmetic functions include adding, subtracting, multiplying and dividing, which are obvious for everyday work. The absolute value, exponent and square roots are for more serious technicians. Even greater code writers that are computing angles are using sine and cosine. These functions are easy to learn and there are examples in each section to practice every function in this chapter. Figure 3B.1 shows a layout of the form we want to create to see how math functions operate in Visual C#.

Math in Visual Basic		
Number 1	<input type="text" value="3.0"/>	Number 2 <input type="text" value="4.0"/>
Adding	$3.0 + 4.0 =$	7.0
Subtracting	$3.0 - 4.0 =$	-1.0
Multiplying	$3.0 * 4.0 =$	12.0
Dividing	$3.0 / 4.0 =$	0.75
Remainder	$4 / 3$	1.0
Absolute Value	Abs (3)	3.0
Fixing	$3 / 4$	1
Rounding	$3 / 4$	1
Exponents	$3^4 =$	81
Square Root	$\sqrt{3}$	1.732
Sine	Sine (3 / 4)	0.6816
Cosine	Cosine (3 / 4)	0.7317

Figure 3B.1 – A Sketch of Arithmetic Functions

Open the Visual C# Editor

In this lesson, we will step through each procedure in adding labels, textboxes and command buttons and we will integrate into the tutorial the methods such as adding, subtracting, multiplying and dividing numbers. We will also include formatting the answers as they are shown in the answer labels. As in every project, we will create variables, set their values, execute mathematical equations and output data.

To open a new project, we select New Project on the left side of the Start Page.

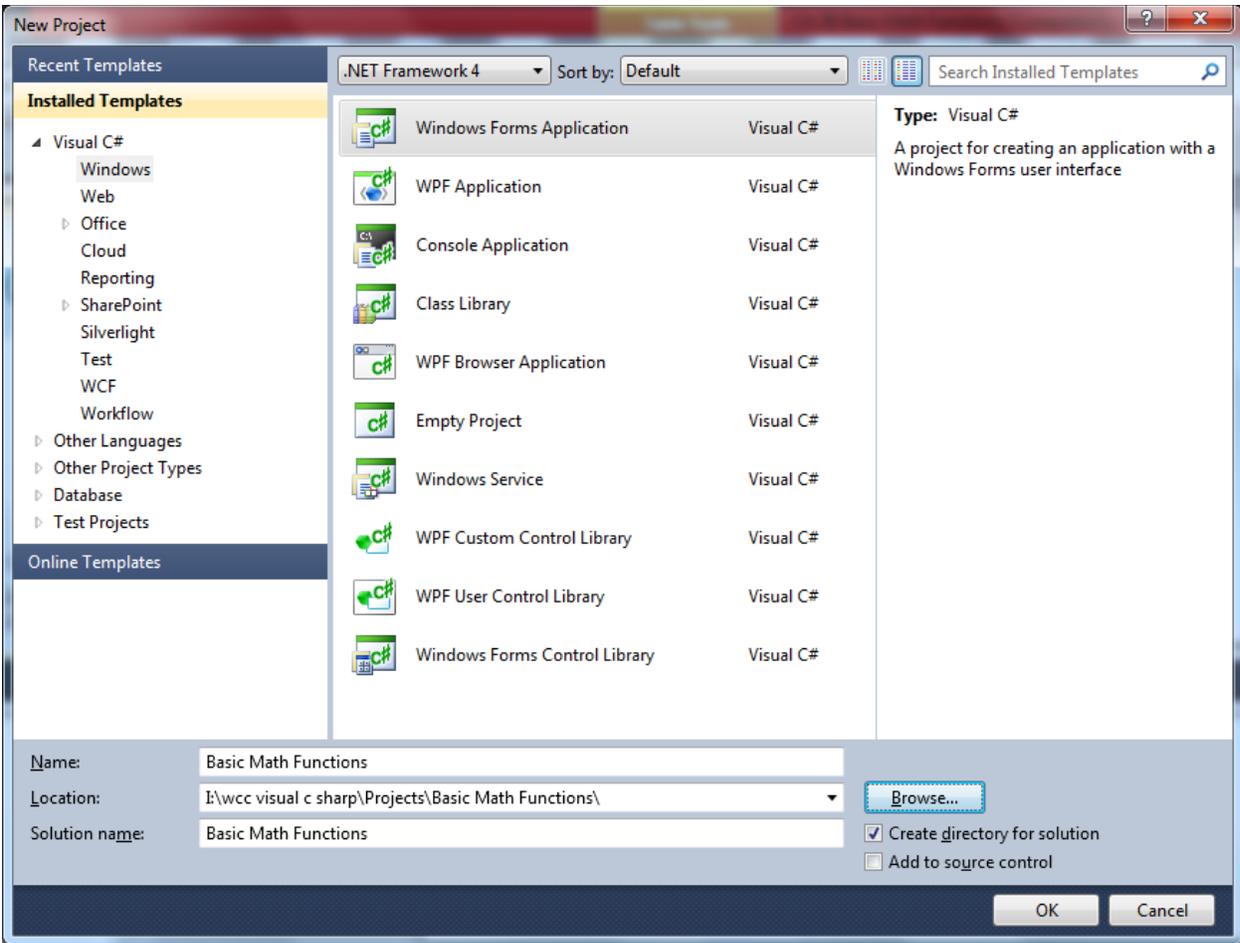


Figure 3B.2 – The Start Page

We start a new Windows Application Project by picking the Windows under Visual C # in the left pan of the New Project window. Then we pick Windows Form Application in the center pane.

At the bottom of the Window, we name the project, Basic Math Functions. We make a folder for our projects called Visual C Sharp on the desktop, on our flash drive or in the Documents folder. We make another folder inside the first called Basic Math Functions. On the New Project window, we browse to the Basic Math Functions location. The solution name is the same as the project name.

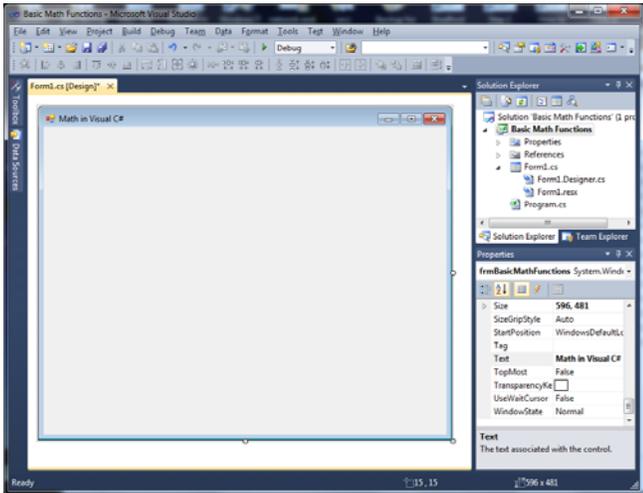


Figure 3B.3 – New Project

Beginning a New Visual C# Application

Remember, that all programming projects begin with one or more sketches. The sketch will show labels, textboxes, and command buttons. In this project, we will name the input form, **Basic Math Functions**. We will have two textboxes to key in number1 and number2. We will have two labels to output each mathematical expression and the answers. In front of the two labels, we will have labels to identify the mathematical process. We will have three command buttons, **Calculate**, **Reset** and **Exit**. On the bottom of the form, we will write the copyright statement using another label. On this presentation, we can help ourselves by being as accurate as possible, by displaying sizes, fonts, colors and any other specific details which will enable us to quickly create the form. On this form, we will use a 12 point Arial font. From the beginning of inserting the form into the project, we need to refer to our sketch.

We should train new programmers initially in the art of form building. When using the editor, we insert and size the form, and selecting the Controls Toolbox, we will place all the various input tools and properly label them. Whenever we place an input tool, the properties window will display a list of every attribute associated with the tool, and we will take every effort to arrange the tool by performing such actions as naming, labeling and sizing the visual input device.

Math in Visual C#		
Number 1	<input type="text" value="3.0"/>	Number 2 <input type="text" value="4.0"/>
Adding	3.0 + 4.0 =	7.0
Subtracting	3.0 - 4.0 =	-1.0
Multiplying	3.0 * 4.0 =	12.0
Dividing	3.0 / 4.0 =	0.75
Remainder	4 / 3	1.0
Absolute Value	Abs (3)	3.0
Fixing	3 / 4	1
Rounding	3 / 4	1
Exponents	3 ⁴ =	81
Square Root	$\sqrt{3}$	1.732
Sine	Sine (3 / 4)	0.6816
Cosine	Cosine (3 / 4)	0.7317

Figure 3B.4 – Sketch of the Resistor Sizing Form

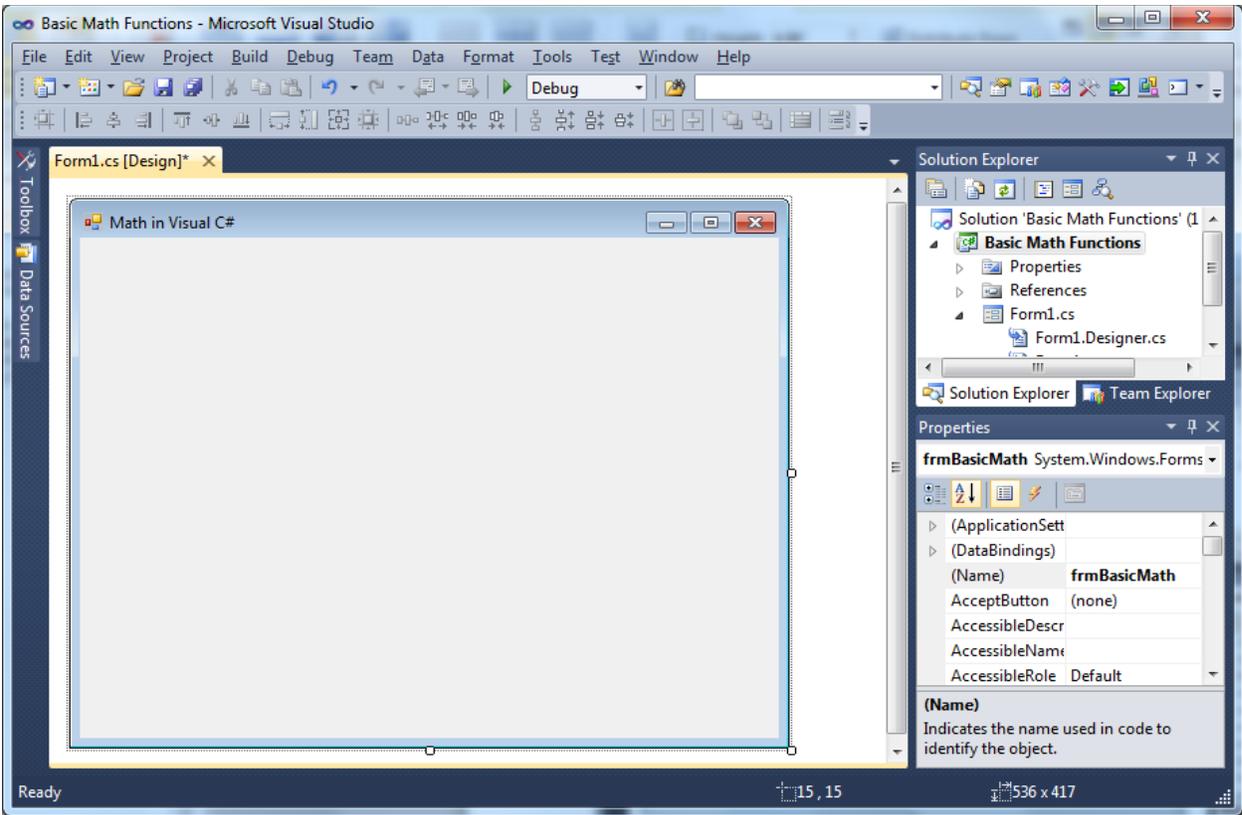


Figure 3B.5 – Designing the Basic Math Functions Form in Visual C#

Laying Out a User Input Form in Visual C#

We will change the **Text** in the Properties pane to **Math in Visual C#**. Go ahead and change the form in two other aspects, **BackColor** and **Size**.

Alphabetic	
(Name)	frmBasicMath
BackColor	White
Font	Arial, 12 pt
Size	424,552
Text	Math in Visual C#

The first number is the width and the second number is the height. The form will change in shape to the size measurement.

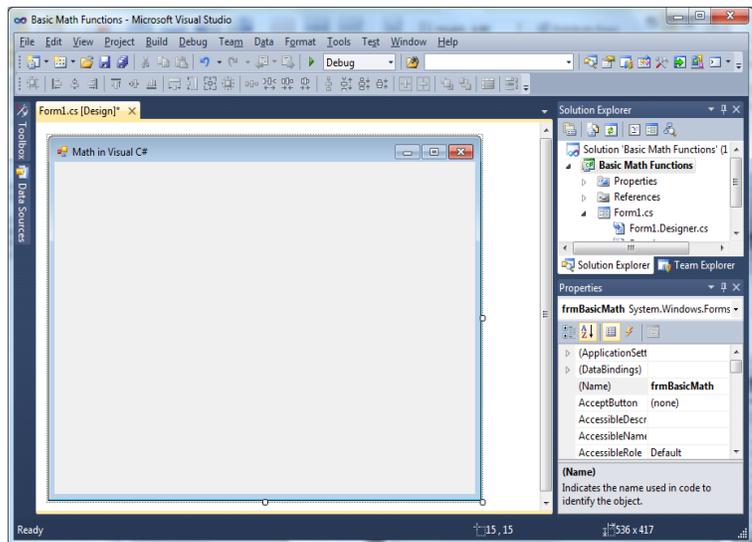


Figure 3B.6 – Setting the Form Properties

The background color will change to a white. There are many more attributes in the Properties pane that we will use on future projects.

In this project, we will select the font in the form. By selecting the font, font style and size for the form, each label, textbox and command button we insert will have these settings for their font.

When highlighting the row for Font, a small command button with three small dots appears to the right of the default font name of Microsoft San Serif. Click on the three dotted button to open the Visual C# Font window.

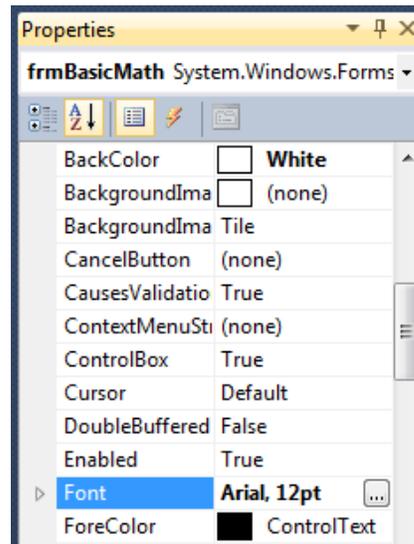


Figure 3B.7 – The Font Window in Visual C#

We will select the Arial font, Regular font style and 12 size for this project to agree with the initial sketch if the user input form. If we wish to underline the text or phrase in the label, add a check to the Underline checkbox in the Effects section of the Font window. When we finish making changes to the font property, select the OK command button to return to the work area.

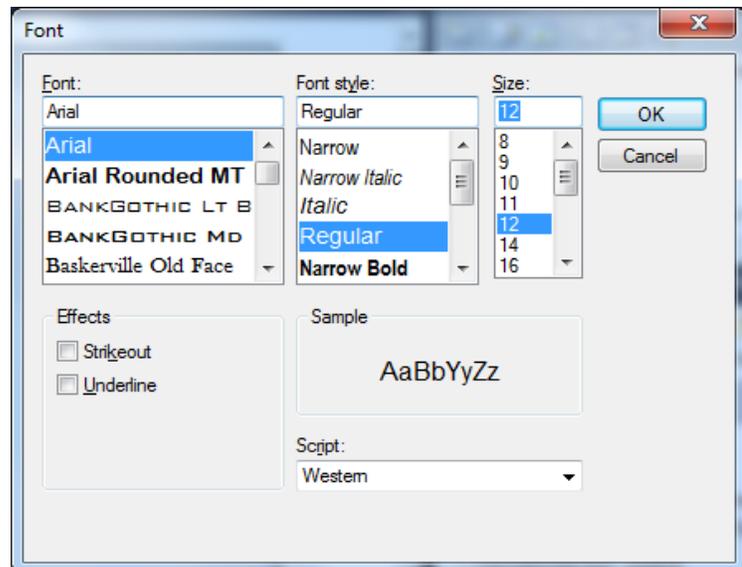


Figure 3B.8 – Changing the Font to Arial

Inserting a Label into a Form

A good form is easy to figure out by the user, so when we are attempting to provide information on the window that will run in Windows; we add labels to textboxes to explain our intent. Press the Label (A) button on the Control Toolbar to add a label. To size the label area, click on the upper left area of the form and hold down on the left mouse button, draw the dotted label box.

When the first label is done, the background color of the label matches the background color of the form. In many cases that effect is visually pleasing to the eye, versus introducing another color. Both color and shape will direct the user in completing the form along with the explanation we place on the window to guide the designer in using the automated programs. Use colors and shape strategically to communicate well.

We will insert our first Label on the upper left corner of the form and call the entity **lblNumber1**.

Alphabetic	
(Name)	lblNumber1
Size	76,18
Text	Number1

Since the bgcolor and font are already set, we just type "Number1" at the text attribute.

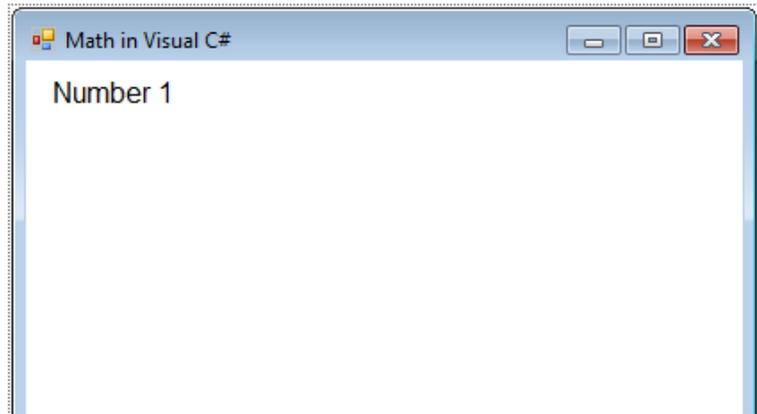


Figure 3B.9 – The Finished Label on the Form

Inserting a Textbox into a Form

A textbox is used so that a user of the computer program can input data in the form of words, numbers or a mixture of both. Press the TextBox (ab) button on the Control Toolbar to add a textbox. To size the label area, click on the upper left area of the form and hold down on the left mouse button, draw the dotted textbox.

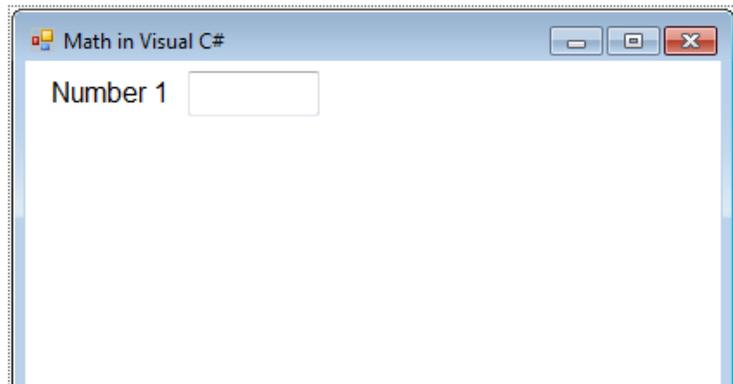


Figure 3B.10 – Placing a TextBox on the Form

We will name the TextBox using the three letter prefix followed by the name or phrase of the tool. For our first textbox, the name is **txtNumber1**.

Alphabetic	
(Name)	txtNumber1
Size	76, 26
TextAlign	Right

The size of the textbox will be 72 wide and 26 tall and the characters inside the textbox will be aligned to the right.

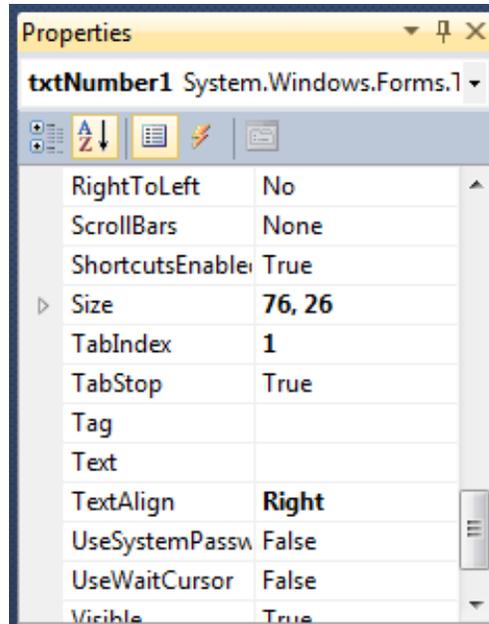


Figure 3B.11 – Setting the Size of the Textbox

We will insert our second Label on the upper right corner of the form and call the entity **lblNumber2**.

Alphabetic	
(Name)	lblNumber2
Size	76,18
Text	Number 1

For our second textbox, the name is **txtNumber2**.

Alphabetic	
(Name)	txtNumber2
Size	76, 26
TextAlign	Right

The size of the textbox will be 72 wide and 26 tall and the characters inside the textbox will be aligned to the right.

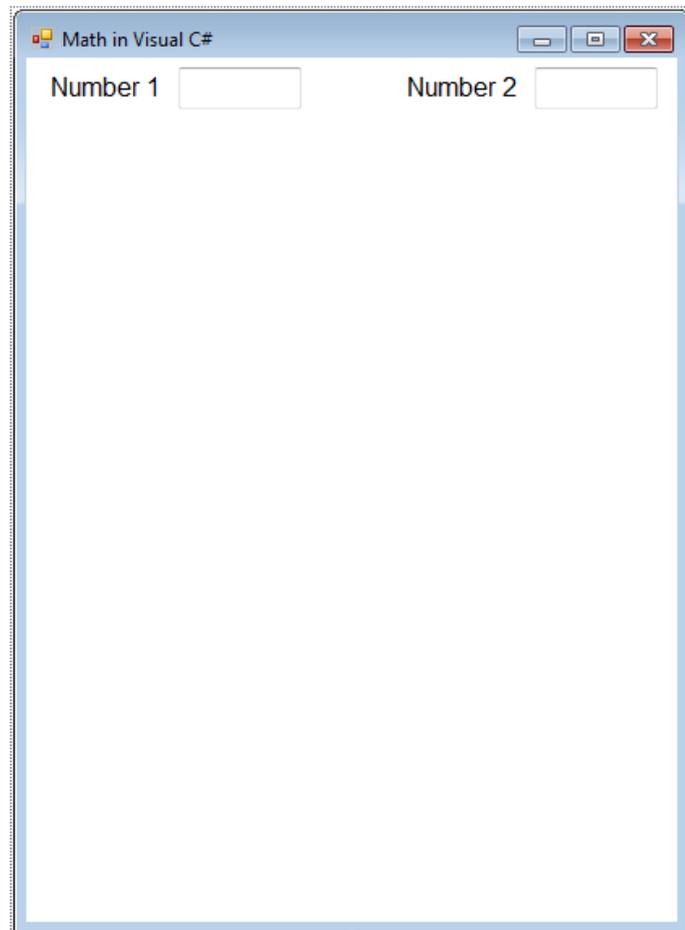


Figure 3B.12 – Adding another Label and Textbox

Inserting a Label into a Form to Post the Output

Some labels on a form are used to show answers. The first row will label and show the adding function and answer. We begin by adding a label called **lblAdding** label. The key attributes for the label are:

Alphabetic	
(Name)	lblAdding
BackColor	White
Size	103,26
Text	Adding
TextAlign	MiddleRight

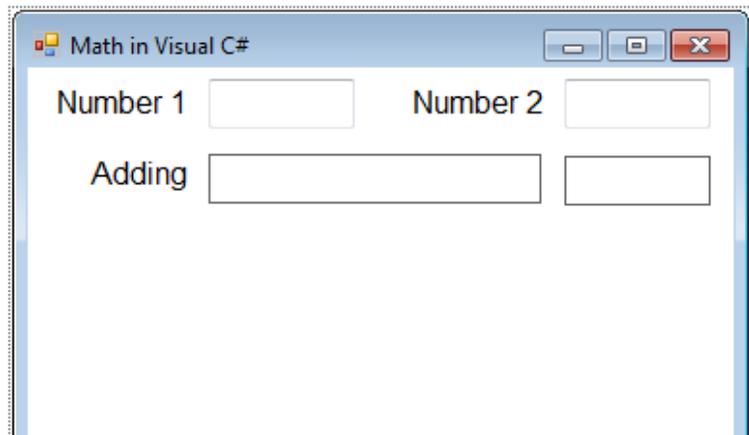


Figure 3B.13 – The Labels for the Adding Row

We will insert the label for the math expression to the right of **lblAdding** and name the label **lblAddingPblm**.

Alphabetic	
(Name)	lblAddingPblm
AutoSize	False
BackColor	White
BorderStyle	FixedSingle
Size	173,26
TextAlign	MiddleRight

We will insert the label for the answer to the right of **lblAddingPblm** and name the label **lblAddingAns**.

Alphabetic	
(Name)	lblAddingAns
AutoSize	False
BackColor	White
BorderStyle	FixedSingle
Size	76,26
TextAlign	MiddleRight

We will make the borderstyle FixedSingle to place a line around the math expression and answer. The text will be in the middle of the label and align to the right

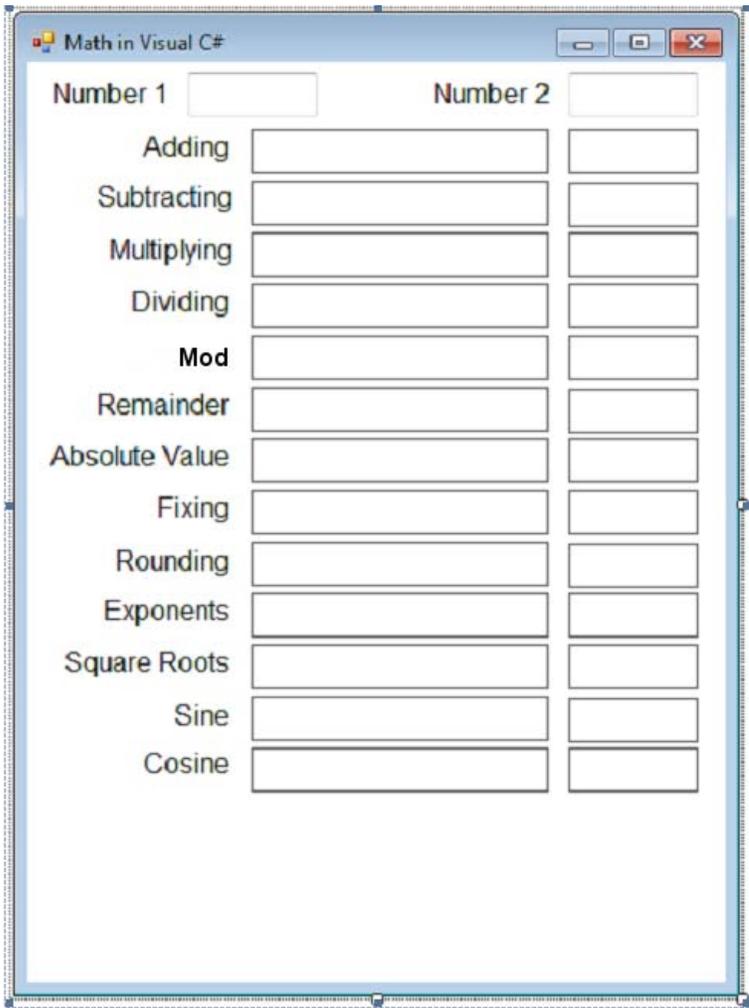


Figure 3B.14 – Labels for the Arithmetic Expressions

We use our mouse to draw a box over each of the three labels for the Adding label, math expression and answer. When we select the three labels, we right click on them and choose copy from the popup menu. Then we right click on an open portion of the form and choose paste. Three labels will appear on the form and we should move them into position under the Adding row. The following table shows the names of each label in the form.

IblAdding	IblAddingPblm	IblAddingAns
IblSubtracting	IblSubtractingPblm	IblSubtractAns
IblMultiplying	IblMultiplyingPblm	IblMultiplyAns
IblDividing	IblDividingPblm	IblDivideAns
IblDividing2	IblDividing2Pblm	IblDivideAns2
IblRemainder	IblRemainderPblm	IblRemainderAns
IblAbsValue	IblAbsValuePblm	IblAbsValueAns
IblFixing	IblFixingPblm	IblFixingAns
IblRounding	IblRoundingPblm	IblRoundingAns
IblExponents	IblExponentsPblm	IblExponentsAns
IblSquRoots	IblSquRootsPblm	IblSquRootsAns
IblSine	IblSinePblm	IblSineAns
IblCosine	IblCosinePblm	IblCosineAns

All of the labels have the same measurement as the labels on the Adding row.

Inserting a Command Buttons into a Form

A command button is used so that a user will execute the application. Press the Command button on the Control Toolbar to add a command button. To size the label area, click on the upper left area of the form and hold down on the left mouse button, draw the command button as shown in Figure 3B.15.

We will name the command button using the name is **cmdCalculate**.

Alphabetic	
(Name)	cmdCalculate
Caption	Calculate
Size	108,34

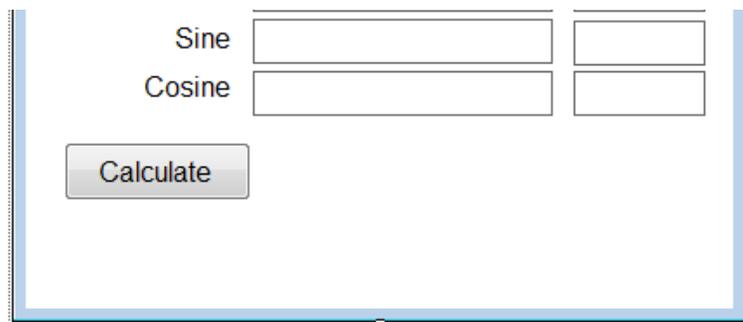


Figure 3B.15 – The Command cmdCalculate Button

Add a second Command button, named cmdReset is for clearing the txtName and lblGreeting objects. The third command button is to exit the program. When the user presses the Exit command button, the application closes. Notice the equal spacing between the command buttons gives a visually friendly appearance.

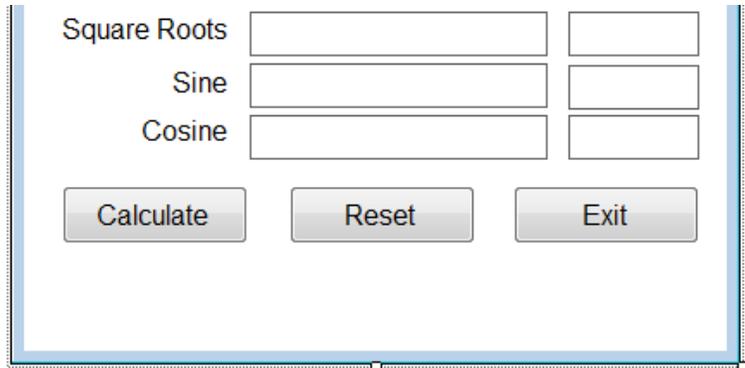


Figure 3B.16 – Insert Two More Command Buttons

Adding a Copyright Statement to a Form

At the beginning of a new program, we will expect to see an explanation or any special instructions in the form of comments such as copyright, permissions or other legal notices to inform programmers what are the rules dealing with running the code. Comments at the opening of the code could help an individual determine whether the program is right for their application or is legal to use. The message box is a great tool when properly utilized to inform someone if they are breaking a copyright law when running the code.

Finish the form with the following copyright information.

Basic Math Functions. Copyright (c) 2011 by Charles Robbins.

If there are special rules or instructions that the user needs to know, place that information on the bottom of the form.

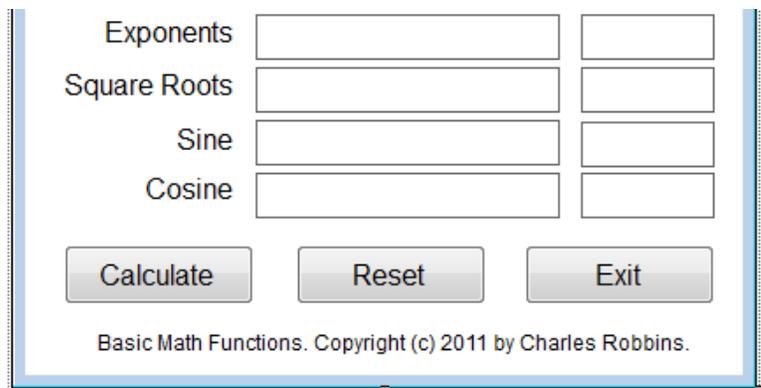


Figure 3B.17 – Adding a Copyright Statement

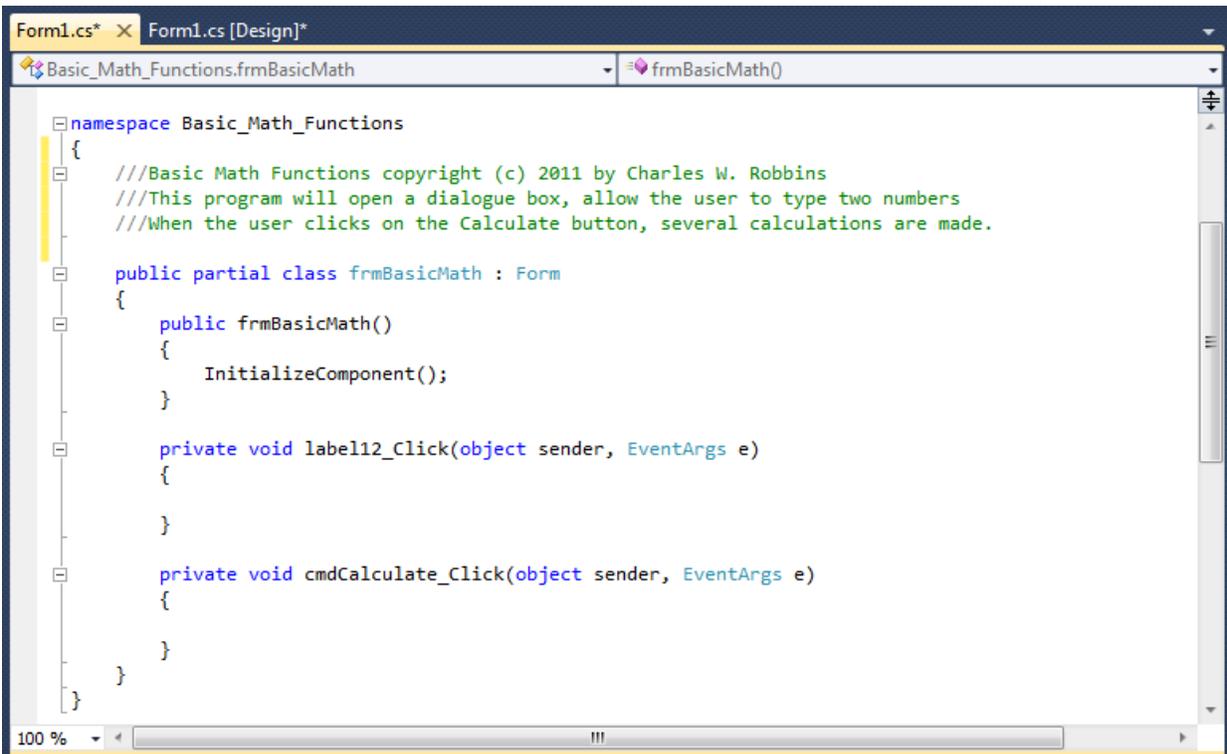
Adding Comments in Visual C# to Communicate the Copyright

The comments we placed in the first three lines of the program will inform the individual opening and reading the code of the ownership. This is for those user that may run the application without checking the label on the bottom of the form with the copyright information. It is a great tool to alert the client to the rules of the program and tell them what the application will do.

To begin the actual coding of the program, double click on the Hello command button. At the top of the program and after the line of code with Namespace Basic_Math_Functions {, place the following comments with two slash (//) characters. Remember, the two slashes (//) will precede a comment and when the code is compiled, comments are ignored.

Type the following line of code:

```
//Basic Math Functions copyright (c) 2011 by Charles W. Robbins  
//This program will open a dialogue box, allow the user to type two numbers  
//When the user clicks on the Calculate button, several calculations are made.
```



```
namespace Basic_Math_Functions  
{  
    ///Basic Math Functions copyright (c) 2011 by Charles W. Robbins  
    ///This program will open a dialogue box, allow the user to type two numbers  
    ///When the user clicks on the Calculate button, several calculations are made.  
  
    public partial class frmBasicMath : Form  
    {  
        public frmBasicMath()  
        {  
            InitializeComponent();  
        }  
  
        private void label12_Click(object sender, EventArgs e)  
        {  
        }  
  
        private void cmdCalculate_Click(object sender, EventArgs e)  
        {  
        }  
    }  
}
```

Figure 3B.18 – Adding a Copyright Statement

Declaring Variables in a Program with the Double Statement

When we are going to use a number, text string or object that may change throughout the life of the code, we create a variable to hold the value of that changing entity. In Visual C#, the Double statement is one of the ways to declare a variable at the procedure level.

In our program, we will retrieve the data from the textboxes and also we will create data from mathematical computations. We will place the values in variables called Number1 and Number2. These variables will hold numbers for calculations so we will declare them as Double Integers. We will also make another 14 variables, 13 which are double integers and one that is a 32 bit integer.

Type the following code under the cmdCalculate subroutine of the program.

```
private void cmdCalculate_Click(object sender, EventArgs e)
{
    //declare variables
    Double Number1;
    Double Number2;
    Double AddingAnswer;
    Double SubtractingAnswer;
    Double MultiplyingAnswer;
    Double Dividing1Answer;
    Double Dividing2Answer;
    Double RemainderAnswer;
    Double AbsoluteAnswer;
    Double FixAnswer;
    Double RoundingAnswer;
    Double ExponentAnswer;
    Double SquareRootAnswer;
    Double SineAnswer;
    Double CosineAnswer;
    Int32 Result;
```

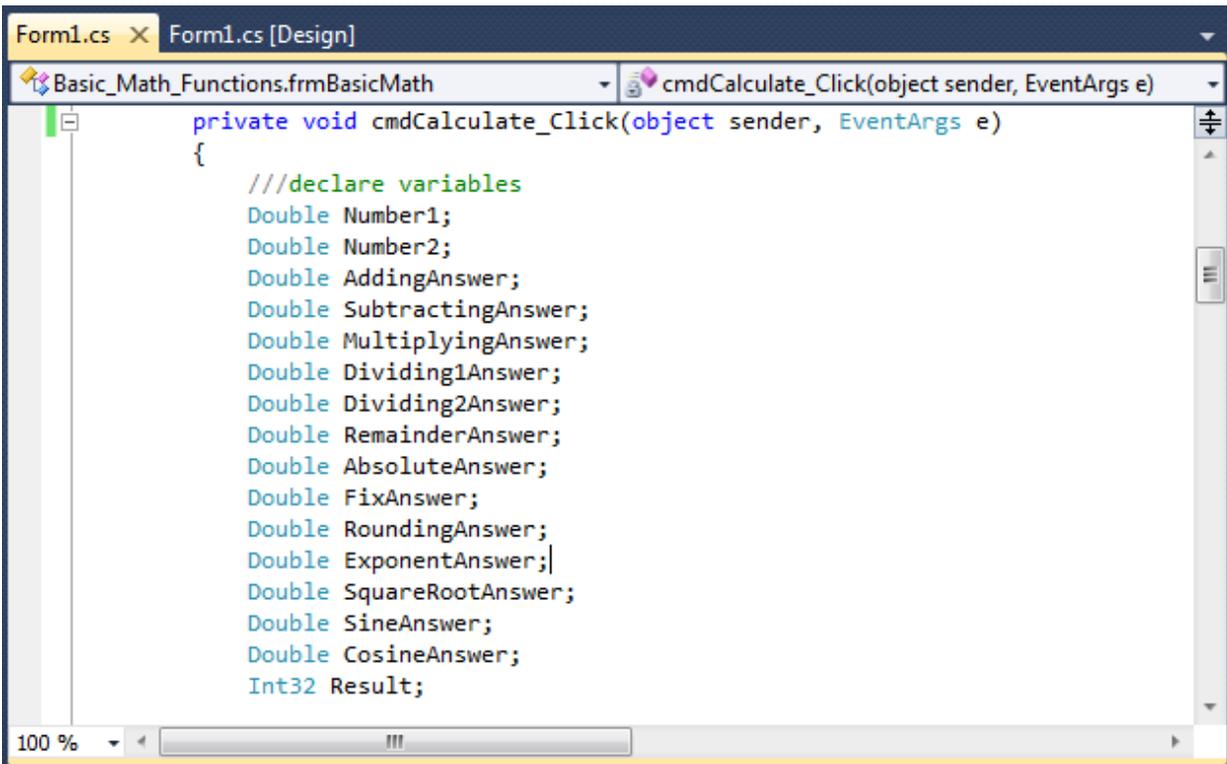


Figure 3B.19 – Declaring Variables with Double Statements

Notice that the variable name should be a word or a phrase without spaces that represents the value that the variable contains. If we want to hold a value of one's date of birth, we can call the

variable, DateofBirth. The keywords Date and Birth are in sentence case with the first letter capitalized. There are no spaces in the name. Some programmers use the underscore character (_) to separate words in phrases. This is acceptable, but a double underscore (__) can cause errors if we do not detect the repeated character.

Adding Two Numbers in a Visual C#

The first arithmetic function we will address is one of the most common, the adding function which is displayed by the icon +. The addition function allows us to add two or more numbers. The values of the numbers can be whole like 1,2,3... or decimals, positive or negative. Remember we can have more than two numbers like $2 + 3 + 7 + 4$.

In this program, we will add the two variables that are holding the numbers, Number1 and Number2. The variable **AddingAnswer** will equal the sum of the value in variable number1 and with the value in variable number2.

Type the following code in the Define Variables Section.

```
//Define Variables
Double AddingAnswer;
```

Then assign the variable AddingAnswer the results of adding Number1 plus Number2.

```
//Assign Variables
AddingAnswer = Number1 + Number2;
```

By writing the addition problem to a label caption, we will display the answer to the problem when adding the numbers together. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

```
//Adding the numbers
lblAddingPblm.Text = Convert.ToString(txtNumber1.Text) + "+" + Convert.ToString (txtNumber2.Text) + "=";
lblAddingAns.Text = Convert.ToString(AddingAnswer);
```

The following is an extract from the Visual C# Quick Reference for the Addition function.

Function	Name	Description
+	Adding	The addition function will add two or more numbers
Examples		
Using integers	answer = 4 + 6	Answers 10
Using decimals	answer = 2.3 + 5.1	Answers 7.4
Using negatives	answer = 3 + -7	Answers -4

Subtracting Numbers in a Visual C#

The subtraction function is similar to the adding function, but the number following the first argument is subtracted from the first number. Again there is not a limit to the number of arguments in the math statement. An easy error to make is mistaking the negative sign attached to the front of a number constructing a negative value with the minus sign in the subtraction function. Be aware of these two symbols are their meaning to prevent a troubleshooting dilemma

In this program, we will subtract the second variable **Number2** from the first variable, **Number1** to equal the variable **SubtractingAnswer**.

Type the following code in the Define Variables Section.

```
//Define Variables  
Double SubtractingAnswer;
```

Then assign the variable **SubtractingAnswer** the results of subtracting Number2 from Number1.

```
//Assign Variables  
SubtractingAnswer = Number1 - Number2;
```

By writing the subtraction problem to a label caption, we will display the answer to the problem when subtracting the numbers. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

```
//Subtracting the numbers  
lblSubtractingPblm.Text = Convert.ToString(txtNumber1.Text) + "-" + Convert.ToString(txtNumber2.Text) + "=";  
lblSubtractAns.Text = Convert.ToString(SubtractingAnswer);
```

The following is an extract from the Visual C# Quick Reference for the Subtraction function.

Function	Name	Description
-	Subtracting	The subtraction function will subtract a number from the preceding number
Examples		
Using integers	answer = 4 - 6	Answers -2
Using decimals	answer = 2.3 - 5.1	Answers -2.8
Using negatives	answer = 3 - -7	Answers 10

Multiplying Numbers in a Visual C#

We can use the multiplying function to multiply two or more numbers together using the asterisk icon. After practicing the simple examples in the multiplying table, we can be experimenting with compound expressions on the AutoCAD Command line like:

```
answer = (4 + 3) * (7 - 3)
```

After computing $4 + 3 = 7$ and $7 - 3 = 4$, the computer calculates $7 * 4 = 28$. Very neat.

Now, we will multiply the first and second numbers.

In this program, we will multiply the two variables that are holding the numbers, **Number1** and **Number2**. The variable **AddingAnswer** will equal the product of the value in variable **number1** and the value in variable **number2**.

Type the following code in the Define Variables Section.

```
//Define Variables  
Double MultiplyingAnswer;
```

Then assign the variable **MultiplyingAnswer** the results of Number1 times Number2.

```
//Assign Variables  
MultiplyingAnswer = Number1 * Number2;
```

By writing the addition problem to a label caption, we will display the answer to the problem when multiplying the numbers together. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

```
//Adding the numbers  
lblMultiplyingPblm.Text = Convert.ToString(txtNumber1.Text) + "*" + Convert.ToString(txtNumber2.Text) + "=";  
lblMultiplyAns.Text = Convert.ToString(MultiplyingAnswer);
```

The following is an extract from the Visual C# Quick Reference for the Multiplication function.

Function	Name	Description
*	Multiplying	The multiplication function will multiply two or more numbers
Examples		
Using integers	answer = 4 * 6	Answers 24
Using decimals	answer = 2.3 * 5.1	Answers 11.73
Using negatives	answer = 3 * -7	Answers -21

Dividing Numbers in a Visual C#

As the first three arithmetic functions were very similar in their handling of integers, decimals and negatives, the division function will cause some problems depending on the direction of the division symbol. Also, we can divide multiple numbers where the first argument is divided by the second and if there is a third, the process will continue until there are no more arguments, but the danger in this function exists when we change the direction of the division symbol. In any Visual C#, type the expression `3 / 2` and the return is `1.5`, and there is no problem, but type in `DivRem(3,2)` and the answer will be `1`. When we only want the whole number in a division problem to determine the number of loops in the program, the integer division function `DivRem` will return an answer with the decimal remainder left off, so the `3 \ 2` is `1` instead of `1.5`. Some programmers make the error thinking the Visual C# code will round the number up if the remainder is `5` or greater, but not so, the decimal component is just removed.

Now, we will divide the first number by the second number.

In this program, we will divide the two variables that are holding the numbers, `Number1` by `Number2`. The variable `Dividing1Answer` will equal the variable `number1` divided by the value in variable `number2`.

Type the following code in the Define Variables Section.

//Define Variables

```
Double Dividing1Answer;
```

Then assign the variable `Dividing1Answer` the results of `Number1` divided by `Number2`.

//Assign Variables

```
Dividing1Answer = Number1 / Number2;
```

By writing the division problem to a label caption, we will display the answer to the problem when dividing the numbers. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

//Dividing the numbers

```
lblDividingPblm.Text = Convert.ToString(txtNumber1.Text) + "/" + Convert.ToString(txtNumber2.Text) + "=";
```

```
lblDivideAns.Text = Convert.ToString(Dividing1Answer);
```

The following is an extract from the Visual C# Quick Reference for the Division function.

Function	Name	Description
/	Division	The division function will divide the first number by the second number
Examples		
Using integers	answer = 4 / 6	Answers 0.666
Using decimals	answer = 2.3 / 5.1	Answers 0.450980
Using negatives	answer = 3 / -7	Answers -0.428571428

Now we divide numbers when we only want the whole number in a division problem.

Now, we will divide the first number by the second number with the integer division symbol, \.

In this program, we will divide the two variables that are holding the numbers, **Number1** by **Number2**. The variable **Dividing2Answer** will equal the variable **number1** divided by the value in variable **number2**.

Type the following code in the Define Variables Section.

```
//Define Variables  
Double Dividing2Answer;
```

Then assign the variable **Dividing2Answer** the results of Number1 divided by Number2.

```
//Assign Variables  
Dividing2Answer = Math.DivRem(Convert.ToInt32(Number1), Convert.ToInt32(Number2), out Result);
```

By writing the division problem to a label caption, we will display the answer to the problem when dividing the numbers. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

```
//Dividing the numbers  
lblDividing2Pblm.Text = Convert.ToString(txtNumber1.Text) + "/" + Convert.ToString(txtNumber2.Text) + "=";  
lblDivideAns2.Text = Convert.ToString(Dividing2Answer);
```

The following is an extract from the Visual C# Quick Reference for the Integer Division function.

Function	Name	Description
DivRem	Integer Division	The division function will divide the first number by the second number
Examples		
Using integers	<code>answer = DivRem(15 ,6)</code>	Answers 2
Using decimals	<code>answer = DivRem (3,2)</code>	Answers 1
Using negatives	<code>answer = DivRem(13 , -7)</code>	Answers -1

Finding Remainders with Visual C#

The Modulus Division function will return a number displaying the remainder after the second number is divided into the first number. This is a useful tool when determining whether a counter number even or odd. If you write the following expression to set the counter.

```
counter = 4
```

And the even and odd checker to determine the state of the counter.

$$\text{EvenOrOdd} = \text{counter} \bmod 2$$

The variable **EvenOrOdd** will be a **0** for even or a **1** for odd.

In this program, we will divide the two variables that are holding the numbers, **Number1** by **Number2** and place the remainder in the variable **RemainderAnswer**.

Type the following code in the Define Variables Section.

//Define Variables

```
Double RemainderAnswer;
```

Then assign the variable **RemainderAnswer** the results of Number1 divided by Number2 using again the **DivRem** function with the out Result added. The variable result will hold the remainder.

//Assign Variables

```
Dividing2Answer = Math.DivRem(Convert.ToInt32(Number1), Convert.ToInt32(Number2), out Result);  
RemainderAnswer = Result;
```

By writing the remainder problem to a label caption, we will display the answer to the problem. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

//Finding the Remainder

```
IblRemainderPblm.Text = "Remainder of " + Convert.ToString(txtNumber1.Text) + "/" + Convert.ToString(txtNumber2.Text) + " is";  
IblRemainderAns.Text = RemainderAnswer.ToString("F4");
```

The following is an extract from the Visual C# Quick Reference for the Integer Division function.

Function	Name	Description
mod	Modulus Division	The Modulus Division function will return a number displaying the remainder after the second number is divided into the first number
Examples		
Using integers	answer = 15 mod 6	Answer 3
Using decimals	answer = 3 mod 2.1	Answer 0.9
Using negatives	answer = 13 mod -7	Answer 0

Computing Absolute Values with Visual C#

The absolute value function, a function that will only allow a single case to follow the syntax **abs** will return with a positive number. This function is useful in formula writing when deciphering positive distances. In our career, we will discover that graphics program uses a starting point and ending point to explain the construction of a line. When subtracting the starting point x-value and ending point x-value depending on how the line is drawn, our answer can be a negative number. Placing the absolute value function in front of any answer will result in a positive number.

Now, we will find the absolute value of a number.

In this program, we will change the figure in variable **Number1** to its absolute value and place the answer in the variable **AbsoluteAnswer**.

Type the following code in the Define Variables Section.

```
//Define Variables  
Double AbsoluteAnswer;
```

Then assign the variable **AbsoluteAnswer** the results of Number1 using the **abs** function.

```
//Assign Variables  
AbsoluteAnswer = Math.Abs(Number1);
```

By writing the absolute value to a label caption, we will display the answer to the problem. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

```
//Finding the absolute value  
lblAbsValuePblm.Text = "Absolute value of " + Convert.ToString(txtNumber1.Text) + " is ";  
lblAbsValueAns.Text = Convert.ToString(AbsoluteAnswer);
```

The variable **AbsoluteAnswer** will equal the positive value of the variable **number1**.

The following is an extract from the Visual C# Quick Reference for the Absolute Value function.

Function	Name	Description
abs	Absolute Value	The absolute value function will return the positive value of a number
Examples		
Using integers	answer = abs (15)	Answers 15
Using decimals	answer = abs (3.1)	Answers 3.1
Using negatives	answer = abs (-7)	Answers 7

Fixing Numbers in Visual C#

The fix function is in our list of number modifiers for arithmetic functions, but we will visit the tool again in the conversion function list. This contrivance will take a real number and remove the decimal places leaving a whole number or integer. There is not any rounding, but the numbers to the right of the decimal place are just removed. This coding method will be useful when computing an array, where we want a whole number response.

In this program, we will fix the variable **Number1**.

Type the following code in the Define Variables Section.

```
//Define Variables  
Double FixAnswer;
```

Then assign the variable **FixAnswer** the results of **Number1** using the **fix** function.

```
//Assign Variables  
FixAnswer = Math.Floor(Number1);
```

By writing the fixing problem to a label caption, we will display the answer to the problem. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

```
//Fixing the number  
lblFixingPblm.Text = "Fixing " + Convert.ToString(txtNumber1.Text) + " to ";  
lblFixingAns.Text = Convert.ToString(FixAnswer);
```

The following is an extract from the Visual C# Quick Reference for the Fix function.

Function	Name	Description
floor	Fix	The fix function will return a whole number of a value by removing the number's decimal places
Examples		
Using integers	answer = fix (15)	Answer 15
Using decimals	answer = fix (3.1)	Answer 3
Using negatives	answer = fix (-7.5)	Answer -7

Rounding Numbers in a Visual C#

The round function will take a single number and round the number to the integer value or if we set the placeholder value will round the decimal places to the placeholder value. Numbers to the right of the rounding placeholder will cause that value to increase by one if the number is 5 or above. If the number to the right of the rounding placeholder is 4 or less, the value at the precise decimal place being requested will remain the same.

Type the following code in the program to set the variables for the rounding function.

In this program, we will round the variable **Number1**.

Type the following code in the Define Variables Section.

//Define Variables

Double RoundingAnswer;

Then assign the variable **RoundingAnswer** the results of **Number1** using the **Round** function.

//Assign Variables

RoundingAnswer = Math.Round(Number1, 2);

By writing the rounding problem to a label caption, we will display the answer to the problem. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

//Rounding Answer

lblRoundingPblm.Text = "Rounding " + Convert.ToString(txtNumber1.Text) + " to 2 places is ";

lblRoundingAns.Text = RoundingAnswer.ToString("F2");

The following is an extract from the Visual C# Quick Reference for the Round function.

Function	Name	Description
Round	Round	The round function will return a number set to the requested decimal place.
Examples		
Using integers	answer = round (15,0)	Answer 15
Using decimals	answer = round (3.125,2)	Answer 3.13
Using negatives	answer = round (-7.523,1)	Answer -7.5

Computing an Exponent in Visual C#

The exponent function is used when applying formulas like the area of a circle, which is

$$A = \pi r^2$$

Setting the radius of the circle to 3 type:

$$r = 3$$

The value of π in AutoLISP is already assigned with syntax, **pi**. Remember we can type **!pi** to check any variable, so try check the value of **pi**. Now to find the area of the radius 3 circle, enter the code shown.

$$a = \text{pi} * r ^ 2$$

Type the following code in the program to set the variables for the exponent function.

In this program, we will take the variable **Number1** to the power of the value in the variable **Number2**.

Type the following code in the Define Variables Section.

```
//Define Variables  
Double ExponentAnswer;
```

Then assign the variable **ExponentAnswer** the results of **Number1** to the **Number2** power.

```
//Assign Variables  
ExponentAnswer = Math.Pow(Number1, Number2);
```

By writing the exponential problem to a label caption, we will display the answer to the problem. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

```
//Finding the Exponent  
lblExponentsPblm.Text = Convert.ToString(Number1.Text) + "to the" + Convert.ToString(Number2.Text) + "power equals";  
lblExponentsAns.Text = ExponentAnswer.ToString("F4");
```

We have added a new feature to the output by using the Format() function with the variable first then a comma and the format of how many decimals we would like to see in the answer. “#.###” will give us 3 decimals in the answer.

The following is an extract from the Visual C# Quick Reference for the Exponent (^) function.

Function	Name	Description
Pow	Exponent	The exponent function will raise the first number to the power of the second number
Examples		
Using integers	answer = Pow(4 , 3)	Answers 64
Using decimals	answer = Pow(5.5 , 0.2)	Answers 1.40628
Using negatives	answer = Pow(-2.0 , 4)	Answers 16.0

Computing a Square Root in Visual C#

The square root function will return a decimal number representing the side of a square area. This function only expects a single argument after the function **sqrt**. Remember no negative numbers are permissible with the square root function. A complex expression that would be common place would be finding the hypotenuse of a triangle using the variables **a** and **b** that are already defined:

$$c = \text{sqrt}((a^2) + (b^2))$$

In this program, we will take the square root of the variable **Number1**.

Type the following code in the Define Variables Section.

//Define Variables

```
Double SquareRootAnswer;
```

Then assign the variable **SquareRootAnswer** the results of the square root of **Number1**.

//Assign Variables

```
SquareRootAnswer = Math.Sqrt(Number1);
```

By writing the square root problem to a label caption, we will display the answer to the problem. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

//Finding the square root

```
lblSquRootsPblm.Text = "Square root of " + Convert.ToString(txtNumber1.Text) + " is ";  
lblSquRootsAns.Text = SquareRootAnswer.ToString("F4");
```

The following is an extract from the Visual C# Quick Reference for the Square Root function.

Function	Name	Description
sqrt	Square Root	The square root function will find the root of the square represented a number
Examples		
Using integers	answer = sqrt (4)	Answers 2.0
Using decimals	answer = sqrt (5.5)	Answers 2.34521
Using negatives	answer = sqrt (-155)	Negatives Not Allowed

The sine, cosine and tangent functions use an angular measurement of radians. We are most familiar with radians when we hear the word pi. Pi radians or 3.14159 is equal to 180 degrees. To convert degrees to radians, divide the angle in degrees by 57.29578.

Computing Sine in a Visual C#

The sin function is a key tool in find the length of the side opposite the angle and in the case of the standard CAD drawing system using the Cartesian coordinate system, the sine of the angle times the hypotenuse of the triangle or length of the line will represent the delta-y of the line being examined.

$$\text{delta_y} = \sin (\text{angle} / 57.29578)$$

Type the following code in the program to set the variables for the sine function.

In this program, we will take the Sine of the variable **Number1**.

Type the following code in the Define Variables Section.

```
//Define Variables  
Double SineAnswer;
```

Then assign the variable **SineAnswer** the results of the sine of **Number1**.

```
//Assign Variables  
SineAnswer = Math.Sin(Number1);
```

By writing the Sine problem to a label caption, we will display the answer to the problem. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

```
//Finding the Sine  
lblSinePblm.Text = "Sine of " + Convert.ToString(txtNumber1.Text) + " radians is ";  
lblSineAns.Text = SineAnswer.ToString("F4");
```

The following is an extract from the Visual C# Quick Reference for the Sine function.

Function	Name	Description
sin	Sine	The sine function will return the length of the side opposite the angle of a right sided triangle when the hypotenuse is 1
Examples		
Using integers	answer = sin (2)	Answer 0.909297
Using decimals	answer = sin (0.5)	Answer 0.479426
Using negatives	answer = sin (-0.2)	Answer -0.198669

Computing Cosine in a Visual C#

The `cos` function is likewise a tool in find the length of the side adjacent to the angle and in the case of the standard CAD drawing system using the Cartesian coordinate system, the cosine of the angle times the hypotenuse of the triangle or length of the line will represent the delta-x of the line being examined.

$$\text{delta_x} = \cos(\text{angle} / 57.29578)$$

In this program, we will take the Cosine of the variable `Number1`.

Type the following code in the Define Variables Section.

//Define Variables

Double CosineAnswer;

Then assign the variable `CosineAnswer` the results of the cosine of `Number1`.

//Assign Variables

CosineAnswer = Math.cos(Number1);

By writing the Cosine problem to a label caption, we will display the answer to the problem. We will use the text concatenation function (+) to connect the text string together so the label can be easily inserted into the caption.

//Cosine

lblCosinePblm.Text = "Cosine of " + Convert.ToString(txtNumber1.Text) + " radians is ";

lblCosineAns.Text = CosineAnswer.ToString("F4");

The following is an extract from the Visual C# Quick Reference for the Cosine function.

Function	Name	Description
COS	Cosine	The cosine function will return the length of the side adjacent to the angle of a right sided triangle when the hypotenuse is 1
Examples		
Using integers	answer = cos (2)	Answer -0.416147
Using decimals	answer = cos (0.5)	Answer 0.877583
Using negatives	answer = cos (-0.2)	Answer 0.980067

We have now added our last label that defines the category and another that holds the answer to the math problem in the caption. The last step in the program is to add the reset and exit code. For each label, we have coded a simple math function using one or both of the numbers at the top of the form to get an answer described to the left of the form.

The following is the entire subroutine to calculate the expressions.

```

private void cmdCalculate_Click(object sender, EventArgs e)
{
    //declare variables
    Double Number1;
    Double Number2;
    Double AddingAnswer;
    Double SubtractingAnswer;
    Double MultiplyingAnswer;
    Double Dividing1Answer;
    Double Dividing2Answer;
    Double RemainderAnswer;
    Double AbsoluteAnswer;
    Double FixAnswer;
    Double RoundingAnswer;
    Double ExponentAnswer;
    Double SquareRootAnswer;
    Double SineAnswer;
    Double CosineAnswer;
    Int32 Result;

    //Assign Variables
    Number1 = Convert.ToDouble(txtNumber1.Text);
    Number2 = Convert.ToDouble(txtNumber2.Text);
    AddingAnswer = Number1 + Number2;
    SubtractingAnswer = Number1 - Number2;
    MultiplyingAnswer = Number1 * Number2;
    Dividing1Answer = Number1 / Number2;
    Dividing2Answer = Math.DivRem(Convert.ToInt32(Number1), Convert.ToInt32(Number2),
    out Result);
    RemainderAnswer = Result;
    AbsoluteAnswer = Math.Abs(Number1);
    FixAnswer = Math.Floor(Number1);
    RoundingAnswer = Math.Round(Number1, 2);
    ExponentAnswer = Math.Pow(Number1, Number2);
    SquareRootAnswer = Math.Sqrt(Number1);
    SineAnswer = Math.Sin(Number1);
    CosineAnswer = Math.Cos(Number1);

    //Adding the numbers
    lblAddingPblm.Text = Convert.ToString(txtNumber1.Text) + " + " +
    Convert.ToString(txtNumber2.Text) + " = ";
    lblAddingAns.Text = Convert.ToString(AddingAnswer);

    //Subtracting the numbers
    lblSubtractingPblm.Text = Convert.ToString(txtNumber1.Text) + " - " +
    Convert.ToString(txtNumber2.Text) + " = ";
    lblSubtractAns.Text = Convert.ToString(SubtractingAnswer);
}

```

//Multiplying the numbers

```
lblMultiplyingPblm.Text = Convert.ToString(txtNumber1.Text) + " * " +  
Convert.ToString(txtNumber2.Text) + " = ";  
lblMultiplyAns.Text = Convert.ToString(MultiplyingAnswer);
```

//Dividing the numbers

```
lblDividingPblm.Text = Convert.ToString(txtNumber1.Text) + " / " +  
Convert.ToString(txtNumber2.Text) + " = ";  
lblDivideAns.Text = Convert.ToString(Dividing1Answer);  
lblDividing2Pblm.Text = Convert.ToString(txtNumber1.Text) + " / " +  
Convert.ToString(txtNumber2.Text) + " = ";  
lblDivideAns2.Text = Convert.ToString(Dividing2Answer);
```

//Finding the remainder

```
lblRemainderPblm.Text = "Remainder of " + Convert.ToString(txtNumber1.Text) + " / " +  
Convert.ToString(txtNumber2.Text) + " is ";  
lblRemainderAns.Text = RemainderAnswer.ToString("F4");
```

//Finding the absolute value

```
lblAbsValuePblm.Text = "Absolute value of " + Convert.ToString(txtNumber1.Text) + " is ";  
lblAbsValueAns.Text = Convert.ToString(AbsoluteAnswer);
```

//Fixing the number

```
lblFixingPblm.Text = "Fixing " + Convert.ToString(txtNumber1.Text) + " to ";  
lblFixingAns.Text = Convert.ToString(FixAnswer);
```

//Rounding the number

```
lblRoundingPblm.Text = "Rounding " + Convert.ToString(txtNumber1.Text) + " to 2 places  
is ";  
lblRoundingAns.Text = RoundingAnswer.ToString("F2");
```

//Exponents

```
lblExponentsPblm.Text = Convert.ToString(txtNumber1.Text) + " to the " +  
Convert.ToString(txtNumber2.Text) + " power equals ";  
lblExponentsAns.Text = ExponentAnswer.ToString("F4");
```

//Square root

```
lblSquRootsPblm.Text = "Square root of " + Convert.ToString(txtNumber1.Text) + " is ";  
lblSquRootsAns.Text = SquareRootAnswer.ToString("F4");
```

//Sine

```
lblSinePblm.Text = "Sine of " + Convert.ToString(txtNumber1.Text) + " radians is ";  
lblSineAns.Text = SineAnswer.ToString("F4");
```

```

//Cosine
lblCosinePblm.Text = "Cosine of " + Convert.ToString(txtNumber1.Text) + " radians is ";
lblCosineAns.Text = CosineAnswer.ToString("F4");
}

```

Resetting the Data

To reset the textboxes or labels containing the data, we will replace the date with blank strings and the date and time with the current day and time setting.

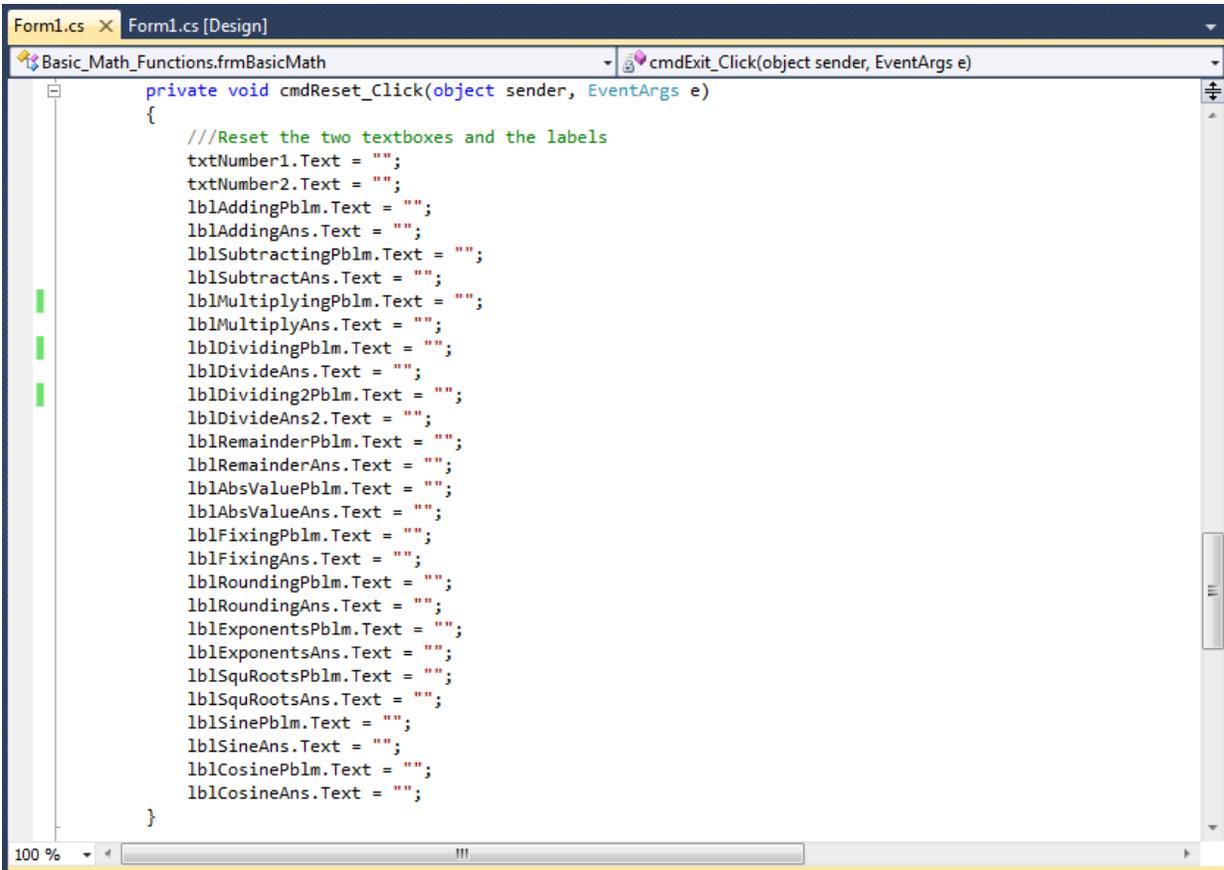
Type the following code under the cmdReset subroutine of the program

//Reset the two textboxes and the labels

```

txtNumber1.Text = "";
txtNumber2.Text = "";
lblAddingPblm.Text = "";
lblAddingAns.Text = "";
lblSubtractingPblm.Text = "";
lblSubtractAns.Text = "";
lblMultiplyingPblm.Text = "";
lblMultiplyAns.Text = "";
lblDividingPblm.Text = "";
lblDivideAns.Text = "";
lblDividing2Pblm.Text = "";
lblDivideAns2.Text = "";
lblRemainderPblm.Text = "";
lblRemainderAns.Text = "";
lblAbsValuePblm.Text = "";
lblAbsValueAns.Text = "";
lblFixingPblm.Text = "";
lblFixingAns.Text = "";
lblRoundingPblm.Text = "";
lblRoundingAns.Text = "";
lblExponentsPblm.Text = "";
lblExponentsAns.Text = "";
lblSquRootsPblm.Text = "";
lblSquRootsAns.Text = "";
lblSinePblm.Text = "";
lblSineAns.Text = "";
lblCosinePblm.Text = "";
lblCosineAns.Text = "";

```

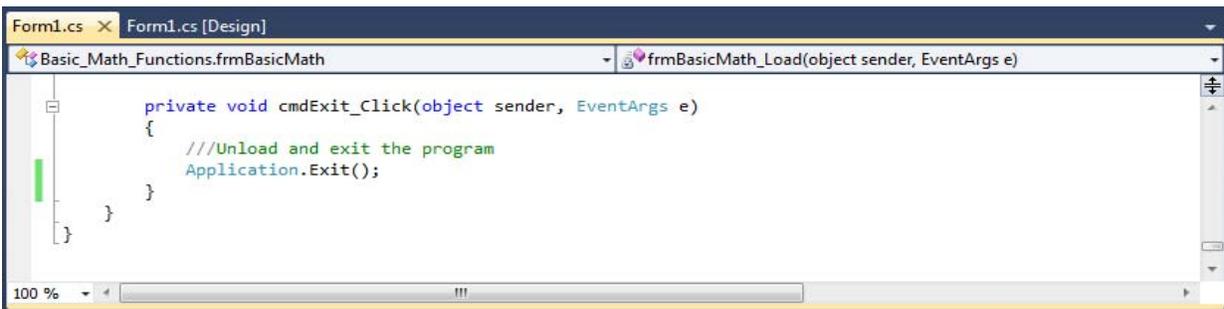


```
Form1.cs x Form1.cs [Design]
Basic_Math_Functions.frmBasicMath cmdExit_Click(object sender, EventArgs e)

private void cmdReset_Click(object sender, EventArgs e)
{
    ///Reset the two textboxes and the labels
    txtNumber1.Text = "";
    txtNumber2.Text = "";
    lblAddingPblm.Text = "";
    lblAddingAns.Text = "";
    lblSubtractingPblm.Text = "";
    lblSubtractAns.Text = "";
    lblMultiplyingPblm.Text = "";
    lblMultiplyAns.Text = "";
    lblDividingPblm.Text = "";
    lblDivideAns.Text = "";
    lblDividing2Pblm.Text = "";
    lblDivideAns2.Text = "";
    lblRemainderPblm.Text = "";
    lblRemainderAns.Text = "";
    lblAbsValuePblm.Text = "";
    lblAbsValueAns.Text = "";
    lblFixingPblm.Text = "";
    lblFixingAns.Text = "";
    lblRoundingPblm.Text = "";
    lblRoundingAns.Text = "";
    lblExponentsPblm.Text = "";
    lblExponentsAns.Text = "";
    lblSquRootsPblm.Text = "";
    lblSquRootsAns.Text = "";
    lblSinePblm.Text = "";
    lblSineAns.Text = "";
    lblCosinePblm.Text = "";
    lblCosineAns.Text = "";
}
100 %
```

Figure 3B.20 – Computing the Reset Button by Clearing a Textbox and Label Caption

Exiting the Program



```
Form1.cs x Form1.cs [Design]
Basic_Math_Functions.frmBasicMath frmBasicMath_Load(object sender, EventArgs e)

private void cmdExit_Click(object sender, EventArgs e)
{
    ///Unload and exit the program
    Application.Exit();
}
100 %
```

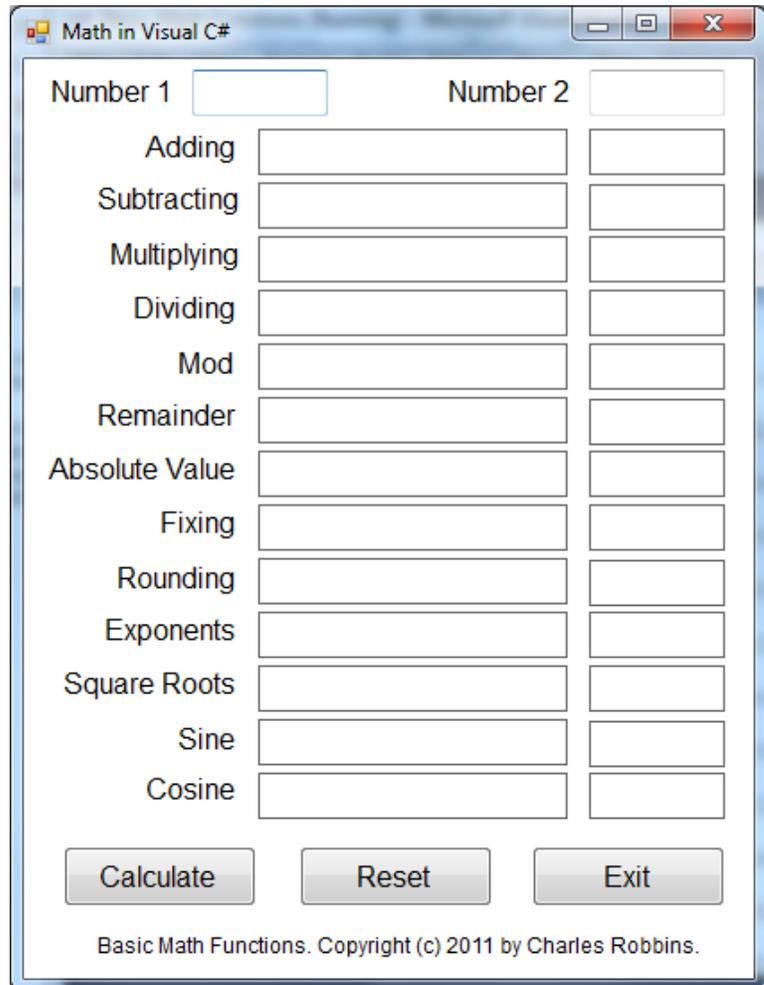
Figure 3B.21 – Exiting the Program

To exit this program, we will unload the application and end the program. Type the following code:

```
///Unload and exit the program
Application.Exit();
```

Running the Program

After noting that the program is saved, press the F5 to run the Basic Math Functions application. The Basic Math Functions window will appear on the graphical display as shown in Figure 3B.22. Notice the professional appearance and presentation of information in a clean dialogue box.



	Number 1	Number 2
Adding		
Subtracting		
Multiplying		
Dividing		
Mod		
Remainder		
Absolute Value		
Fixing		
Rounding		
Exponents		
Square Roots		
Sine		
Cosine		

Calculate Reset Exit

Basic Math Functions. Copyright (c) 2011 by Charles Robbins.

Figure 3B.22 – Launching the Program

Type 3.3 in the Number1 textbox and 2 in the Number2 textbox as shown in Figure 3B.23. If we make a mistake, we can type over the text entry or press the Reset command button to clear the textbox. Press the Calculate command button and the answer labels will show the math expressions and answers. After experimenting with our program, press the Exit command button to exit the application.

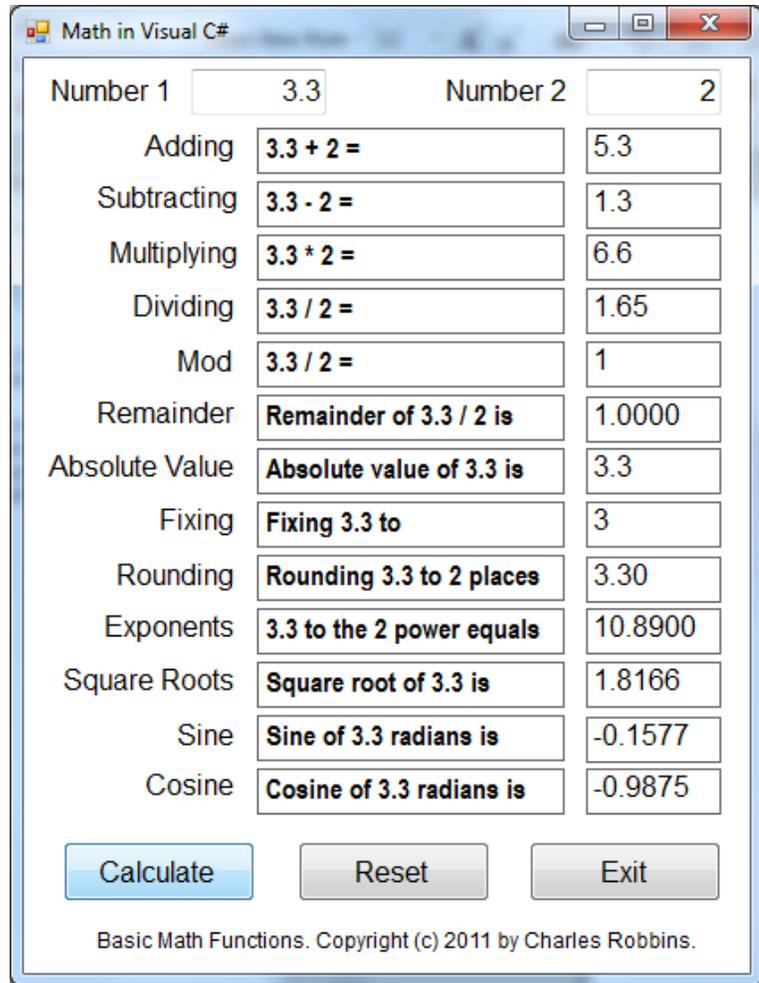


Figure 3B.23 – Running the Program

If our program does not function correctly, go back to the code and check the syntax against the program shown in previous sections. Repeat any processes to check or Beta test the program. When the program is working perfectly, save and close the project.

There are many variations of this Visual C# Application we can practice and obtain information from a personal computer. While we are practicing with forms, we can learn how to use variables, strings and comments. These are skills that we want to commit to memory.

*** World Class CAD Challenge 190-3 * - Write a Visual C# Application that displays a single input form, allows the user to type in their numbers, and when executed, the program will give the user results to mathematical expressions.**

Continue this drill four times using some other form designs, each time completing the Visual C# Project in less than 1 hour to maintain your World Class ranking.