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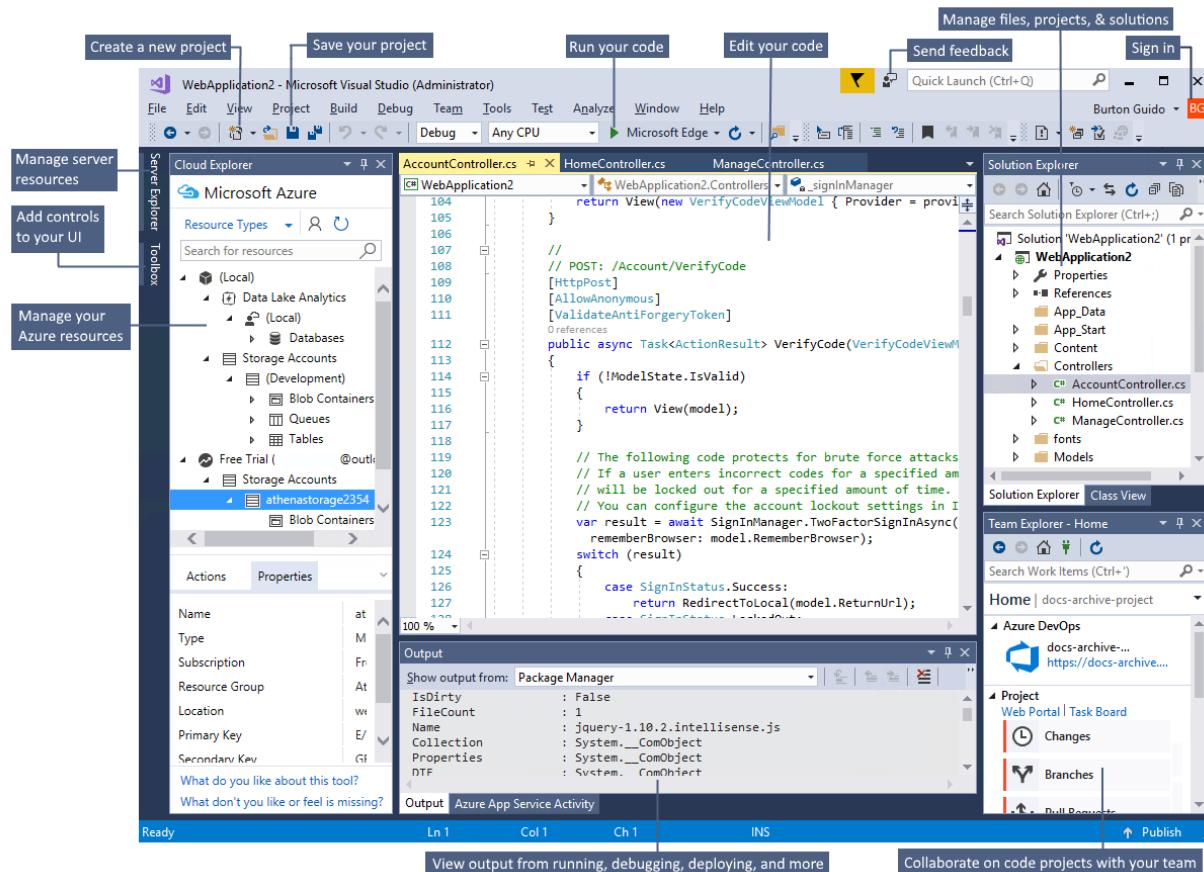
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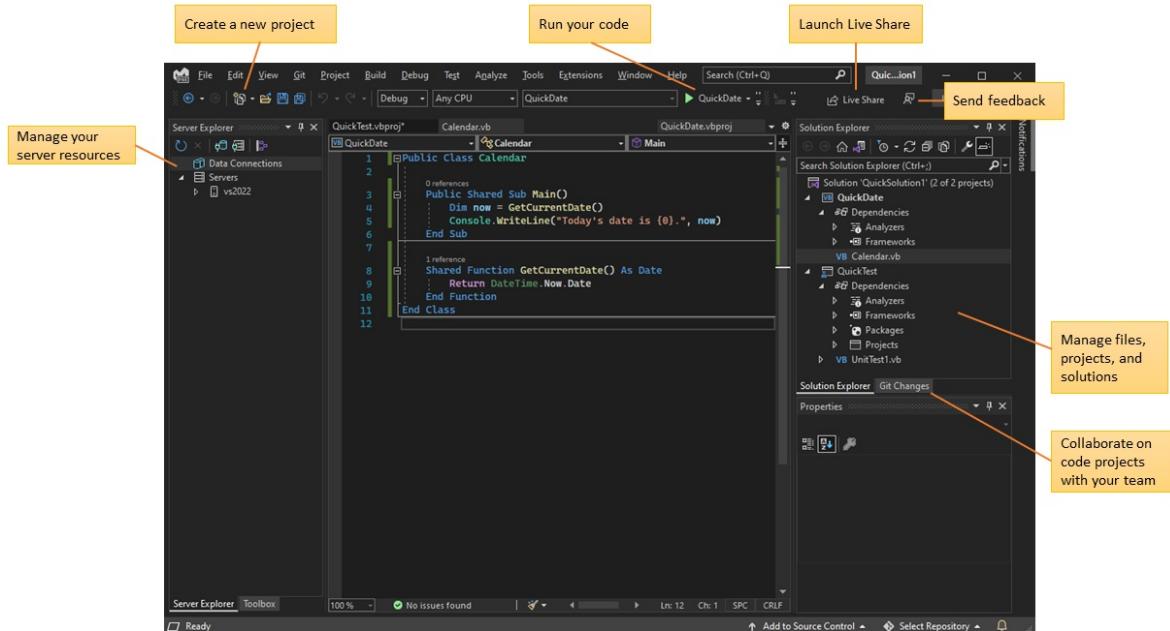
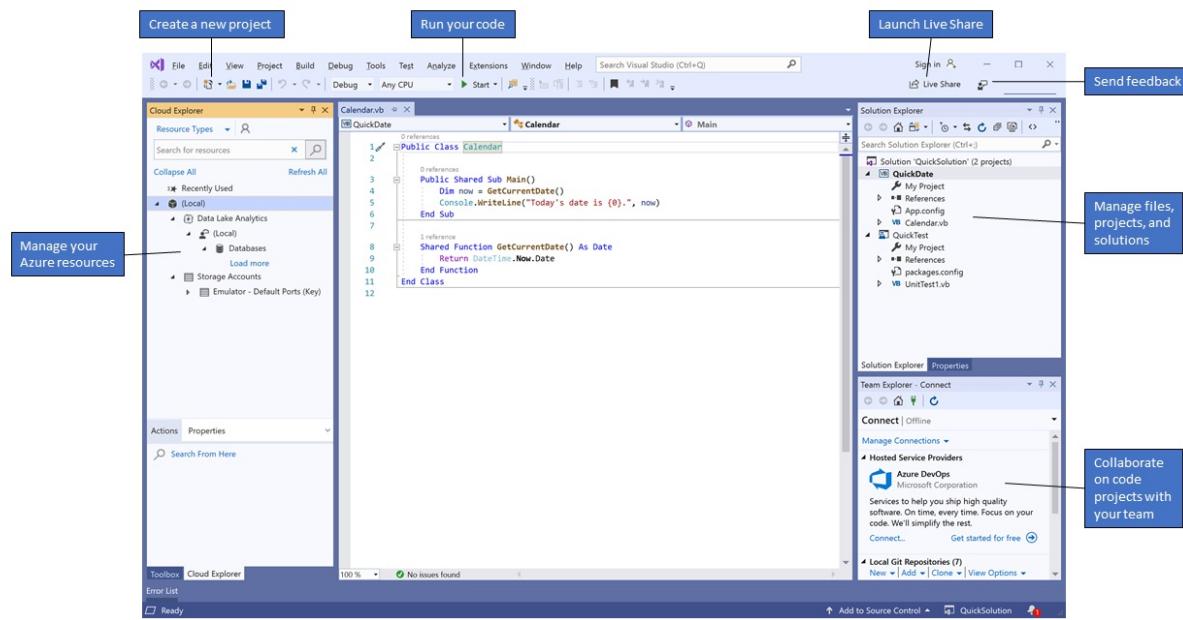
[Access data](#)

Welcome to the Visual Studio IDE | Visual Basic

11/13/2021 • 17 minutes to read • [Edit Online](#)

An *integrated development environment* (IDE) is a feature-rich program that supports many aspects of software development. The Visual Studio IDE is a creative launching pad that you can use to edit, debug, and build code, and then publish an app. Over and above the standard editor and debugger that most IDEs provide, Visual Studio includes compilers, code completion tools, graphical designers, and many more features to enhance the software development process.





The preceding image shows Visual Studio with an open Visual Basic project that shows key windows and their functionality:

- In **Solution Explorer**, at upper right, you can view, navigate, and manage your code files. **Solution Explorer** can help organize your code by grouping the files into **solutions and projects**.
- The central **editor window**, where you'll probably spend most of your time, displays file contents. In the editor window, you can edit code or design a user interface such as a window with buttons and text boxes.
- The **Output window** (bottom center) is where Visual Studio sends notifications such as debugging and error messages, compiler warnings, publishing status messages, and more. Each message source has its own tab.
- In **Team Explorer**, at lower right, you can track work items and share code using version control technologies such as **Git** and **Team Foundation Version Control (TFVC)**.
- In **Git Changes** at lower right, you can track work items and share code with others by using version control

technologies like [Git](#) and [GitHub](#).

Editions

Visual Studio is available for Windows and Mac. [Visual Studio for Mac](#) has many of the same features as Visual Studio for Windows, and is optimized for developing cross-platform and mobile apps. This article focuses on the Windows version of Visual Studio.

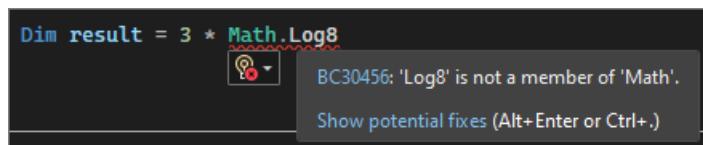
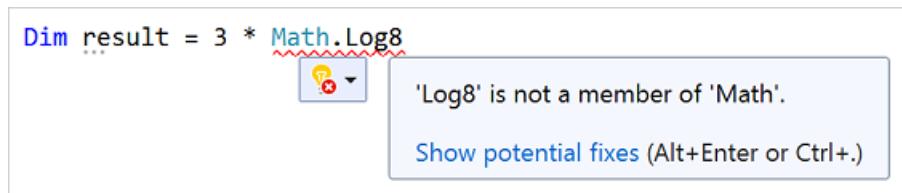
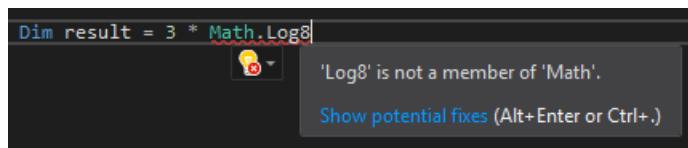
There are three editions of Visual Studio: Community, Professional, and Enterprise. See [Compare Visual Studio editions](#) to learn about which features each edition supports.

Popular productivity features

Some popular features in Visual Studio that improve your productivity when developing software include:

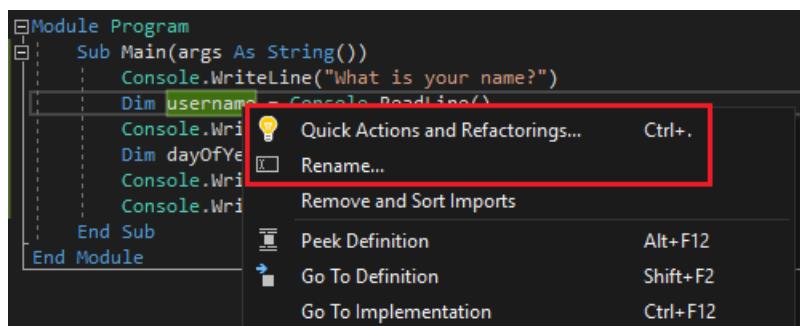
- Squiggles and [Quick Actions](#)

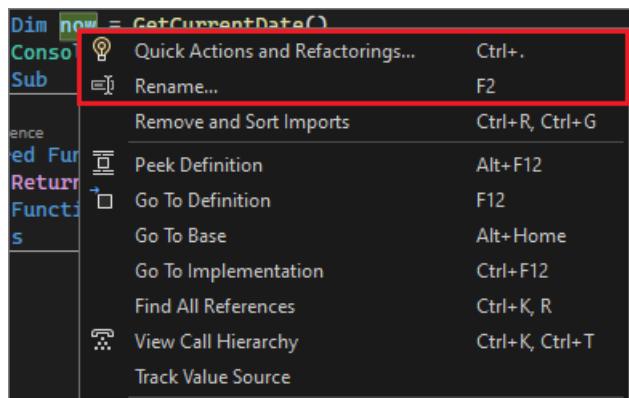
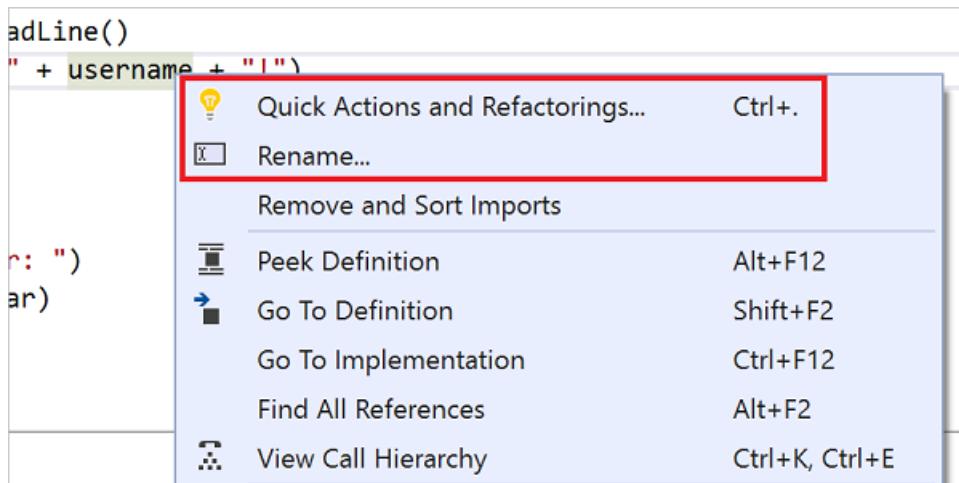
Squiggles are wavy underlines that alert you to errors or potential problems in your code as you type. These visual clues help you fix problems immediately, without waiting to discover errors during build or runtime. If you hover over a squiggle, you see more information about the error. A lightbulb might also appear in the left margin showing *Quick Actions* you can take to fix the error.



- Refactoring

Refactoring includes operations such as intelligent renaming of variables, extracting one or more lines of code into a new method, and changing the order of method parameters.

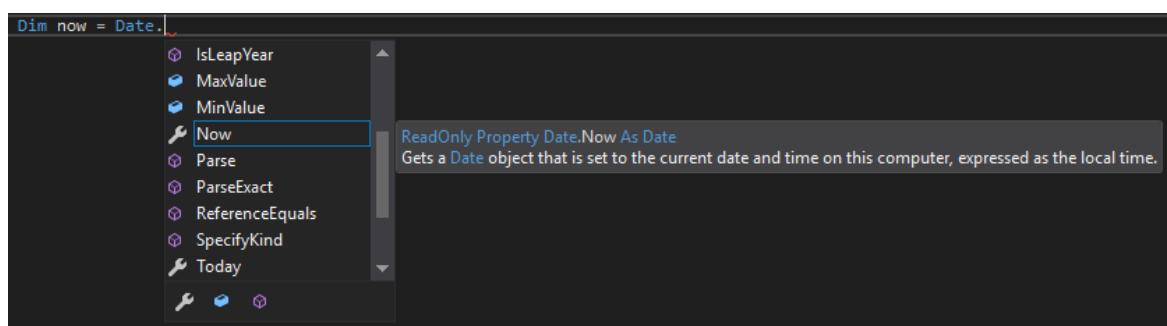


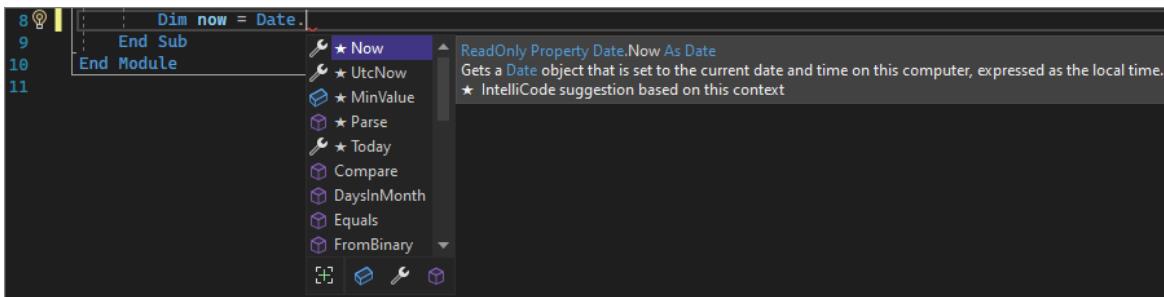


- **IntelliSense**

IntelliSense is a set of features that display information about your code directly in the editor and, in some cases, write small bits of code for you. It's like having basic documentation inline in the editor, so you don't have to look up type information elsewhere.

The following illustration shows how IntelliSense displays a member list for a type:



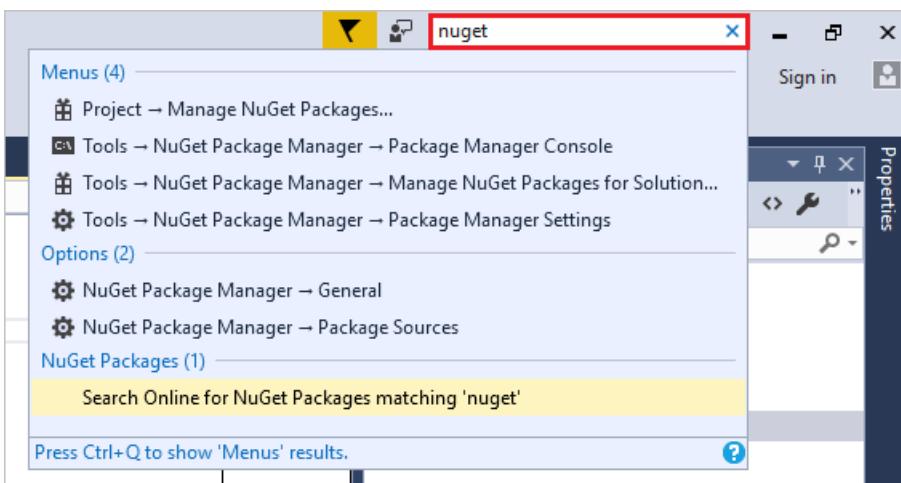


IntelliSense features vary by language. For more information, see [C# IntelliSense](#), [Visual C++ IntelliSense](#), [JavaScript IntelliSense](#), and [Visual Basic IntelliSense](#).

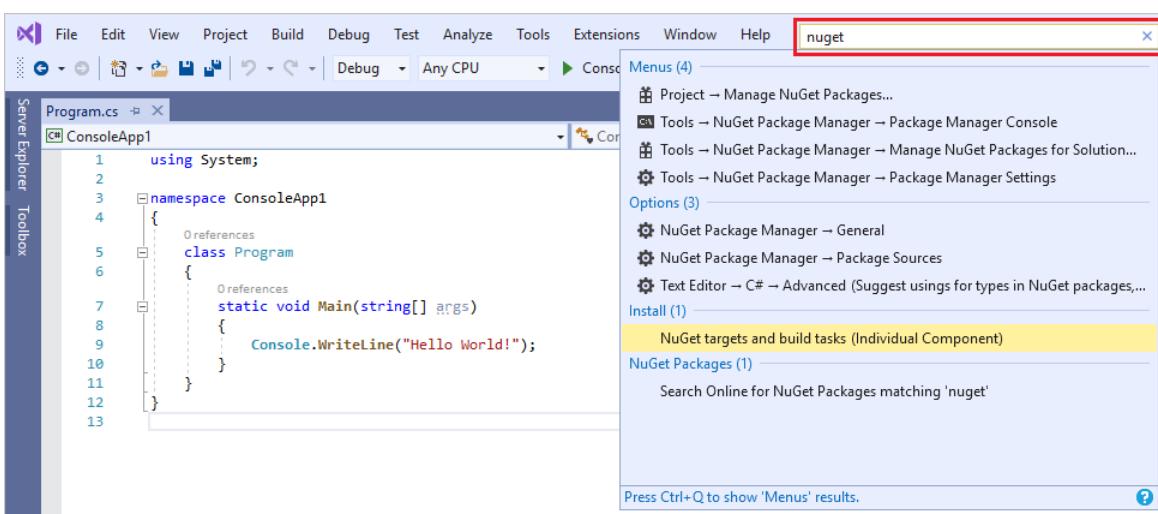
- [Visual Studio search](#)

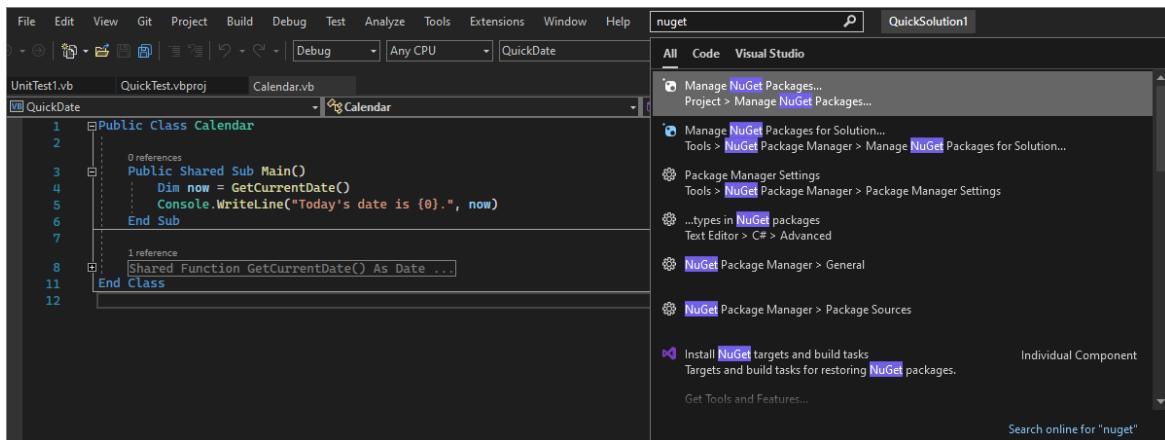
Visual Studio menus, options, and properties can seem overwhelming at times. Visual Studio search, or **Ctrl+Q**, is a great way to rapidly find IDE features and code in one place.

When you start typing the name of something you're looking for, Visual Studio lists results that take you where you need to go. If you need to add functionality, for example another programming language, you can open the Visual Studio Installer from the search box results to install the workload or component.



For more information, see [Quick Launch](#).



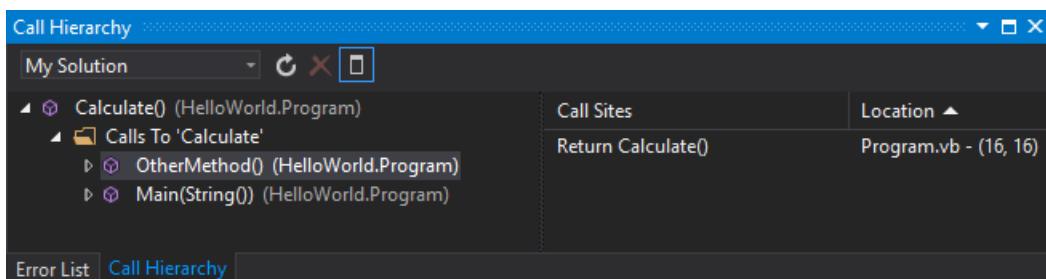
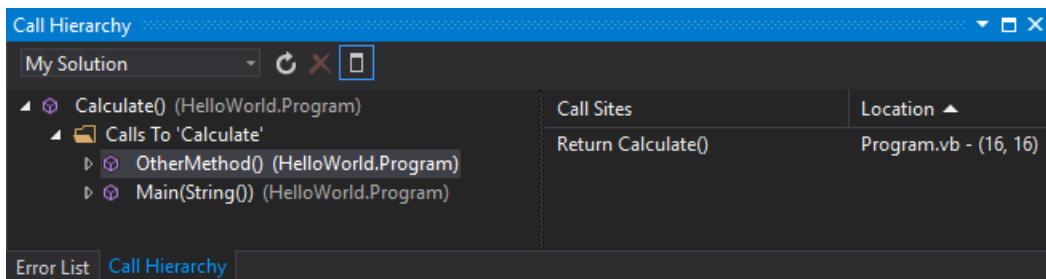


- [Live Share](#)

Collaboratively edit and debug with others in real time, regardless of your app type or programming language. You can instantly and securely share your project. You can also share debugging sessions, terminal instances, localhost web apps, voice calls, and more.

- [Call Hierarchy](#)

The **Call Hierarchy** window shows the methods that call a selected method. This information can be useful when you're thinking about changing or removing the method, or when you're trying to track down a bug.



- [CodeLens](#)

CodeLens helps you find code references, code changes, linked bugs, work items, code reviews, and unit tests, without leaving the editor.

▲ HelloWorld\MyMath.vb (1)

- ⌚ 3 : Calculate()

▲ HelloWorld\Program.vb (2)

- ⌚ 12 : Dim result = Calculate()
- ⌚ 16 : Return Calculate()

Show on Code Map | Collapse All

3 references

```
Function Calculate() As Double
    Format()
    Return 3 * Math.Log(10)
End Function
```

▲ HelloWorld\Program.vb (2)

- ⌚ 10 : Dim dayOfYear = GetDate()
- ⌚ 25 : GetDate()

Collapse All

21
22 Function GetDate() As Date
23 Return Date.Now.Date
24 End Function
25

▲ QuickDate\Calendar.vb (1)

- ⌚ 4 : Dim now = GetCurrentDate()

Collapse All

1 reference

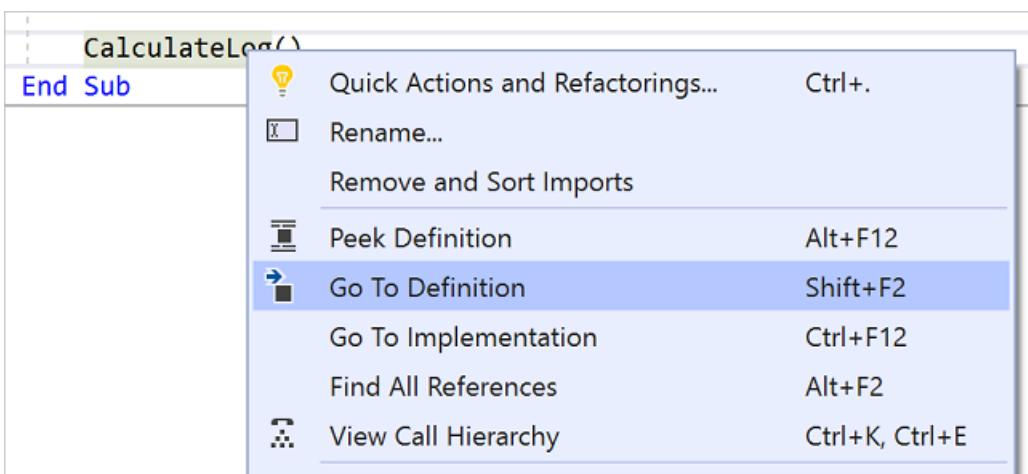
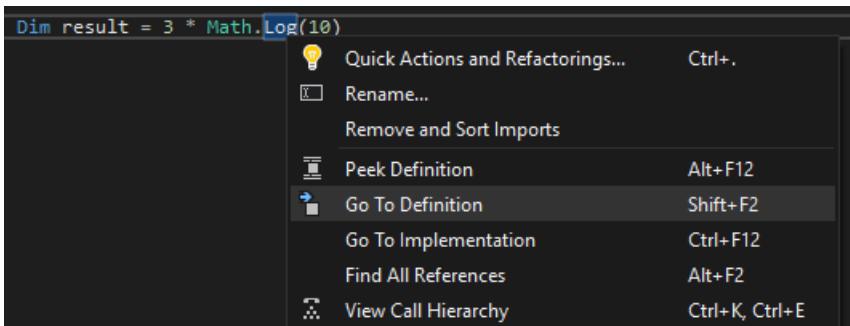
```
Shared Function GetCurrentDate() As Date
    Return DateTime.Now.Date
End Function
```

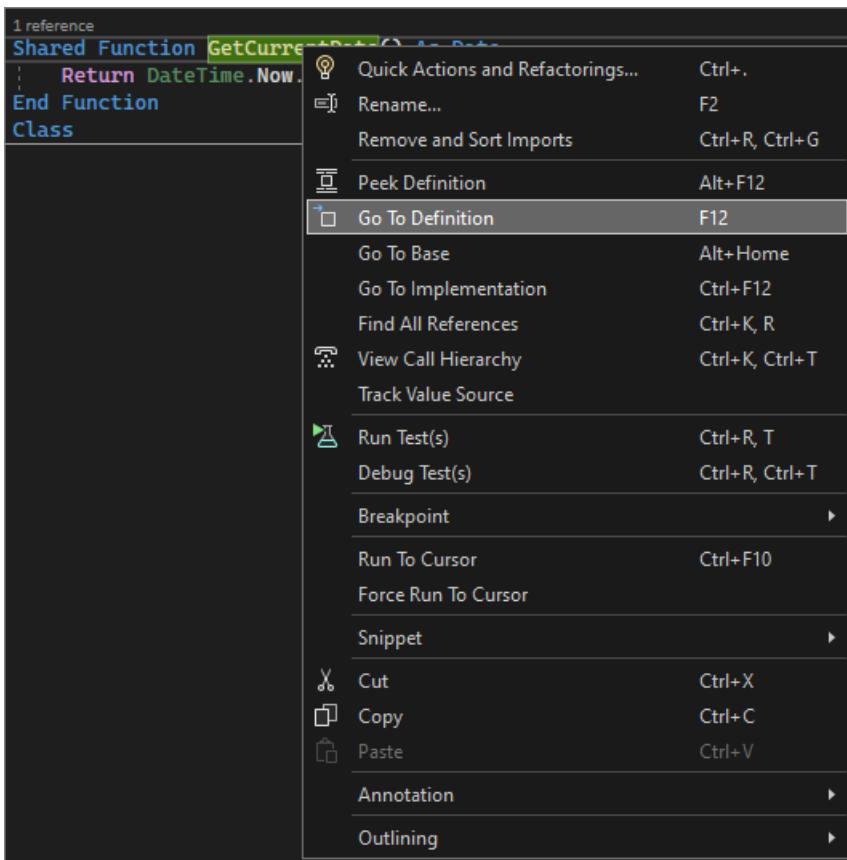
Calendar.vb (4, 19)

```
Public Shared Sub Main()
    Dim now = GetCurrentDate()
    Console.WriteLine("Today's date is {0}.", now)
End Sub
```

- Go To Definition

The Go To Definition feature takes you directly to the location of a function or type definition.





- **Peek Definition**

The Peek Definition window shows a method or type definition without opening a separate file.

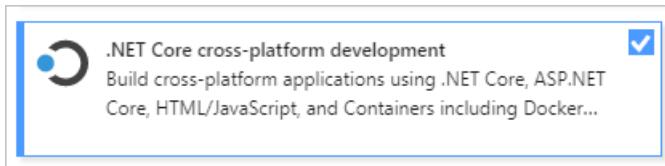
The image contains three screenshots of the Visual Studio interface demonstrating the Peek Definition feature:

- Screenshot 1:** Shows the 'Program.vb*' code editor with a tooltip for the 'Calculate' function. The tooltip displays the function signature 'Function Calculate() As Double' along with its body: 'Return 3 * Math.Log(10)'. The 'Program.vb*' tab is visible at the top.
- Screenshot 2:** Shows the 'Program.vb*' code editor with a tooltip for the 'CalculateLog' function. The tooltip displays the function signature 'Function CalculateLog() As Double' along with its body: 'Return 3 * Math.Log10'. The 'Program.vb*' tab is visible at the top.
- Screenshot 3:** Shows the 'Console [from metadata]' window, which is a peek definition view of the 'WriteLine' method from the System namespace. It lists multiple overloads of the 'WriteLine' method, each with its parameters and return type. The window has tabs for 'Ln: 560', 'Ch: 27', 'SPC', and 'CRLF'.

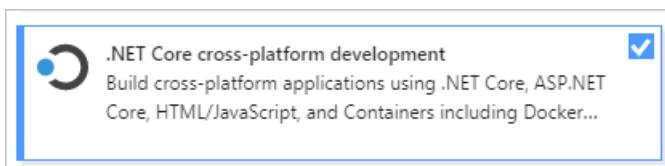
Install Visual Studio

In this section, you create a simple project to try out some of the things you can do with Visual Studio. You learn how to change the color theme, use [IntelliSense](#) as a coding aid, and debug an app to see a variable value during app execution.

To get started, [download Visual Studio](#) and install it on your system. The modular installer enables you to choose and install *workloads*, which are groups of features needed for the programming language or platform you prefer. To follow the steps for [creating a program](#), be sure to select the **.NET Core cross-platform development** workload during installation.



To get started, [download Visual Studio](#) and install it on your system. The modular installer enables you to select and install *workloads*, which are groups of features needed for the programming language or platform you prefer. To follow the steps for [creating a program](#), be sure to select the **.NET Core cross-platform development** workload during installation.



To get started, [download Visual Studio](#) and install it on your system. In the modular installer, you choose and install *workloads*, which are groups of features you need for the programming languages or platforms you want. To use the following steps to [create a program](#), be sure to select the **.NET desktop development** workload during installation.



When you open Visual Studio for the first time, you can [sign in](#) by using your Microsoft account or your work or school account.

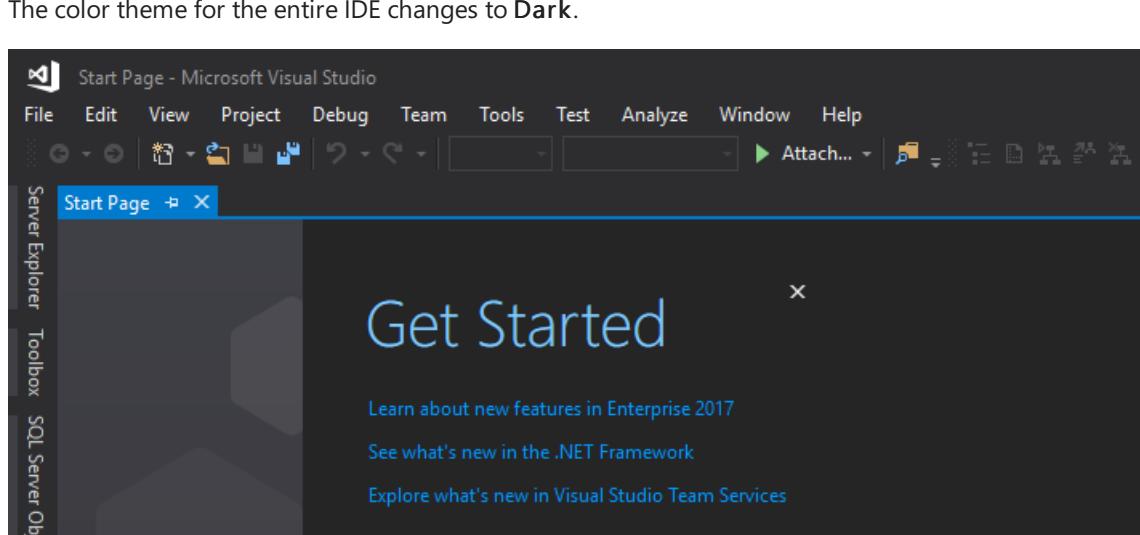
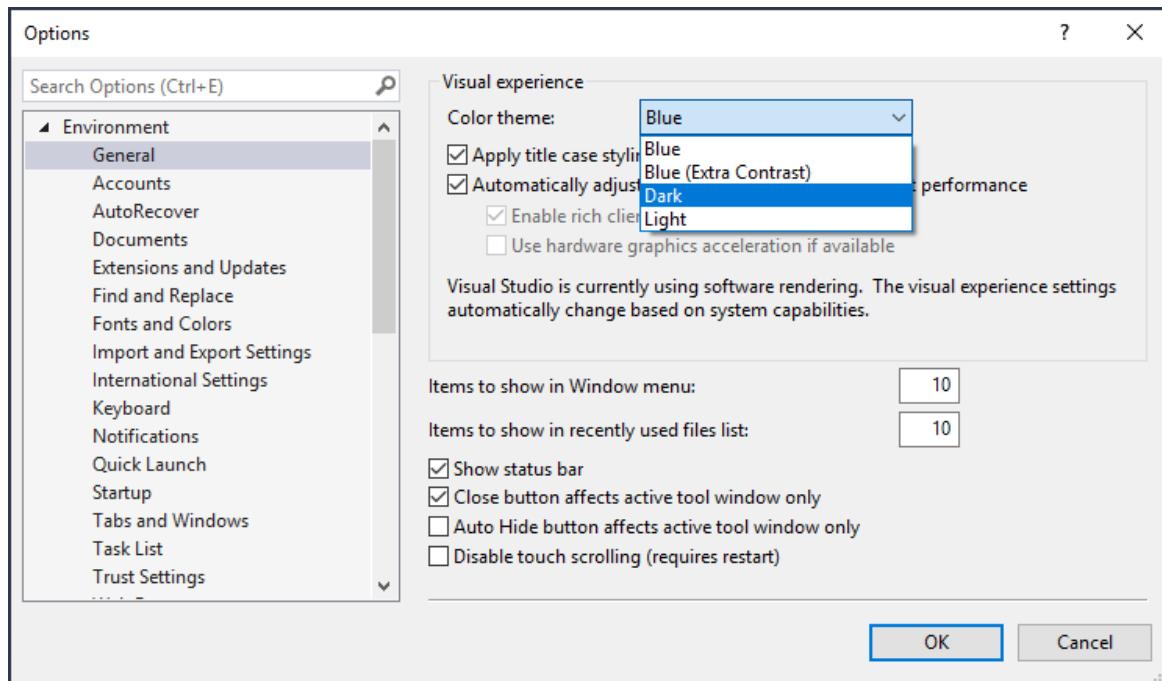
Customize Visual Studio

You can personalize the Visual Studio user interface, including changing the default color theme.

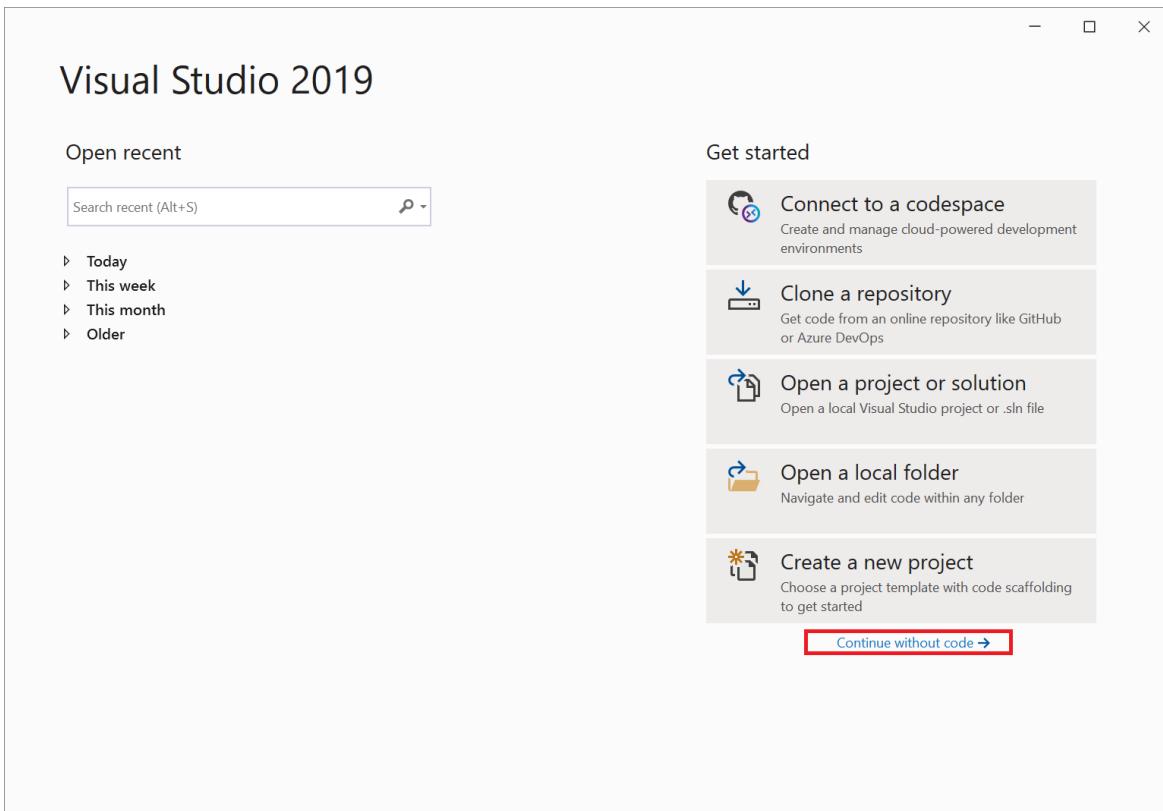
Change the color theme

To change the color theme:

1. Open Visual Studio.
2. On the menu bar, choose **Tools > Options** to open the Options dialog.
3. On the **Environment > General** options page, change the **Color theme** selection to **Dark**, and then click **OK**.

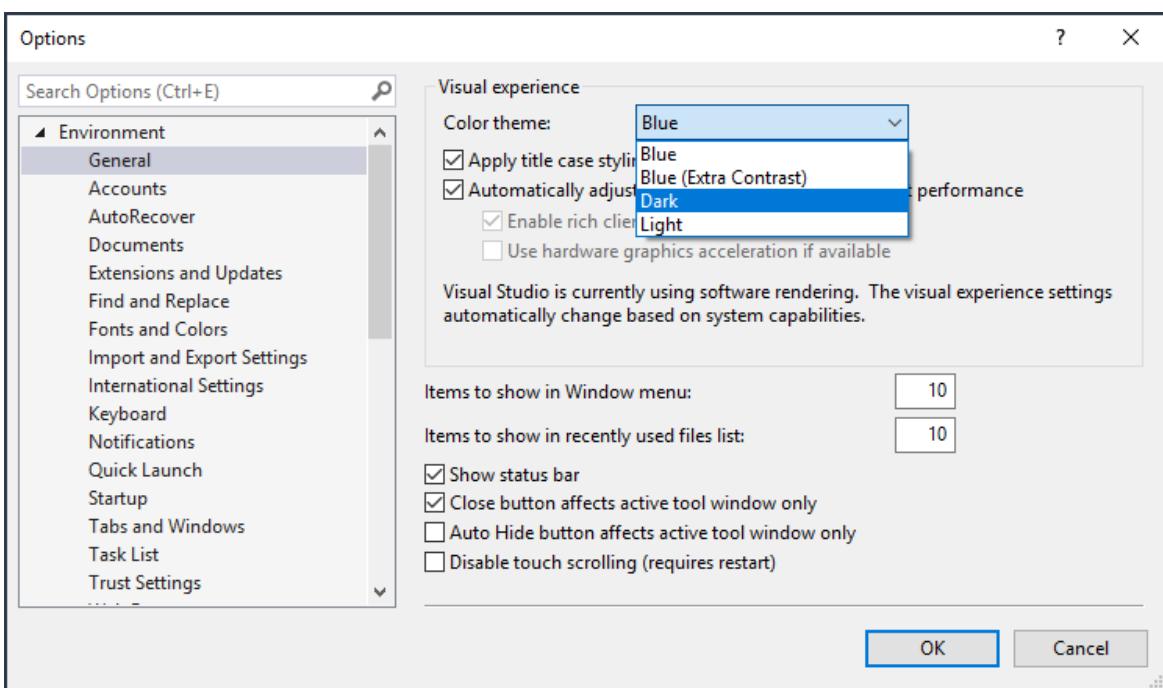


1. Open Visual Studio. On the start window, select Continue without code.

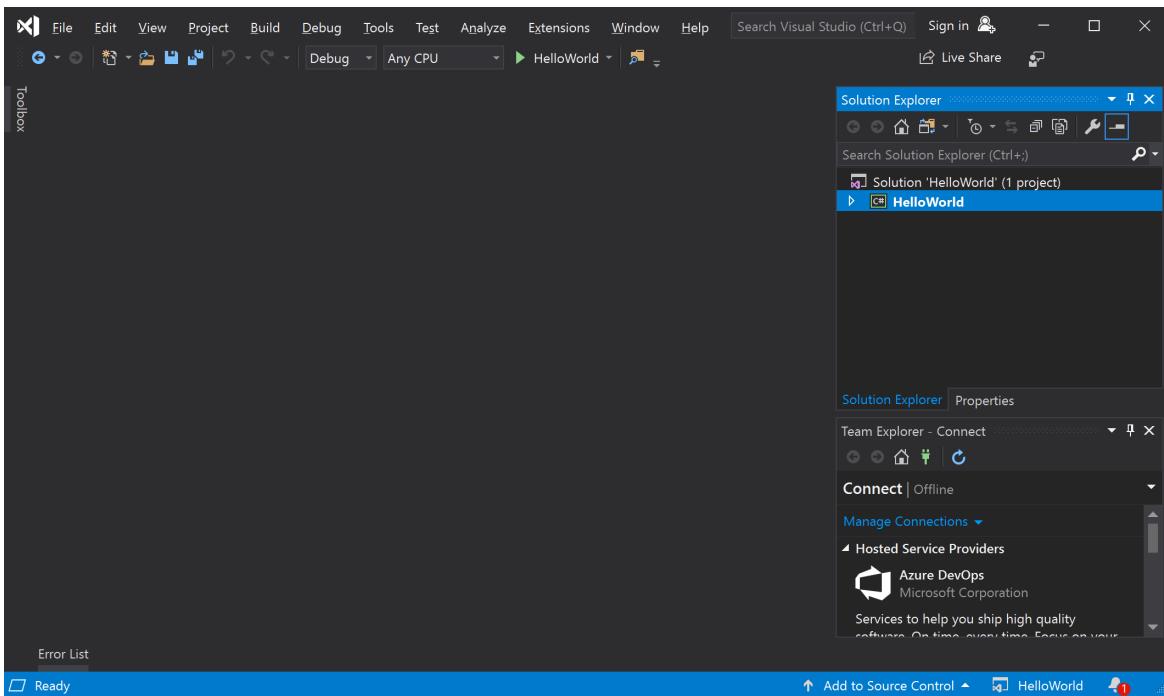


The IDE opens.

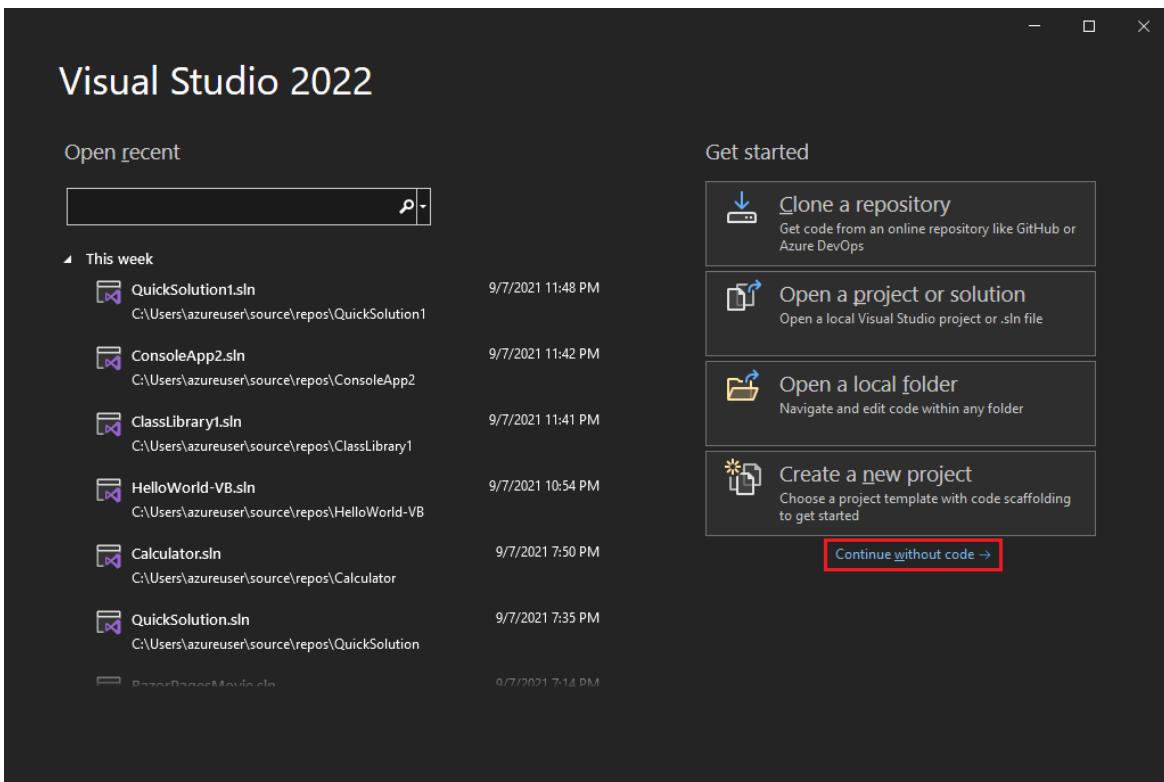
2. On the Visual Studio menu bar, choose **Tools** > **Options** to open the **Options** dialog.
3. On the **Environment** > **General** options page, change the **Color theme** selection to **Dark**, and then choose **OK**.



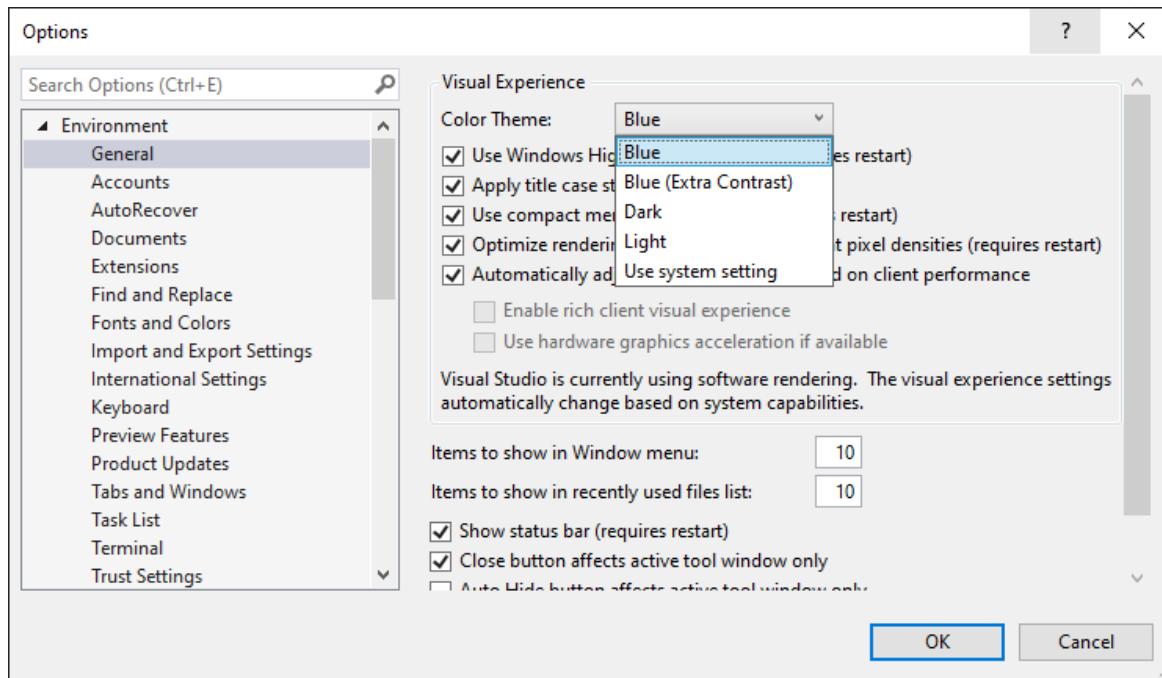
The color theme for the entire IDE changes to **Dark**.



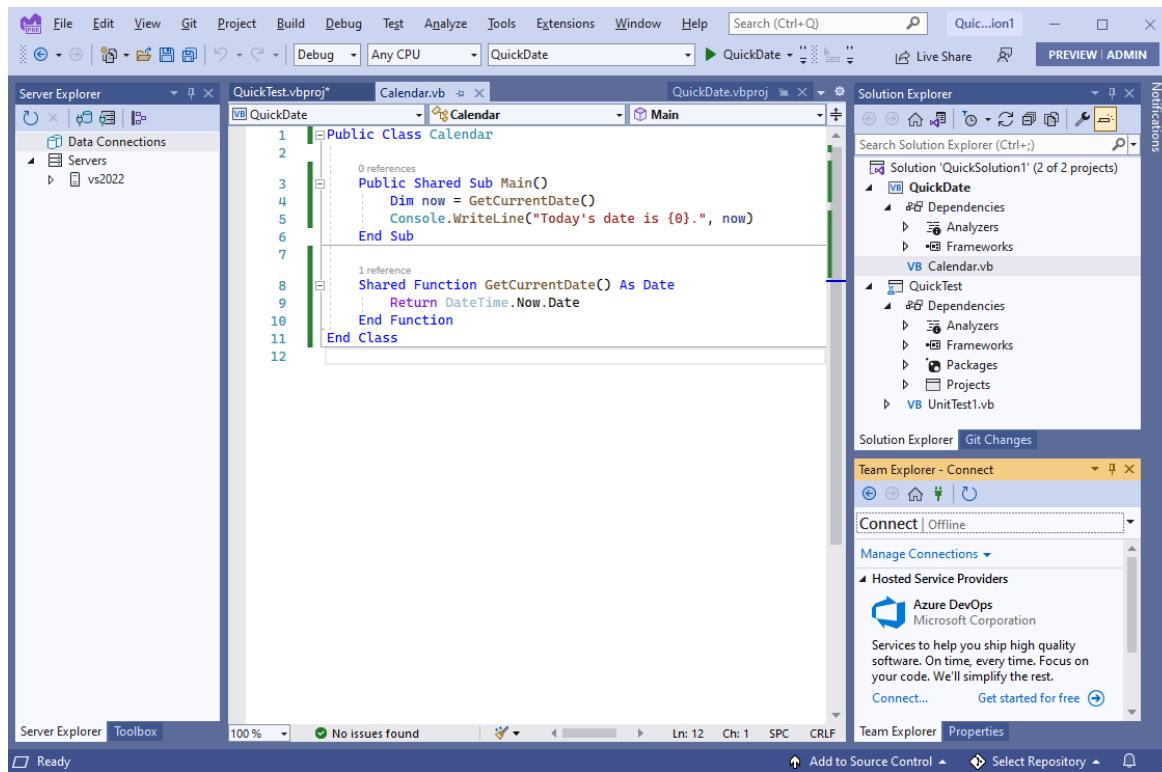
1. Open Visual Studio. On the start window, select **Continue without code**.



2. On the Visual Studio menu bar, choose **Tools > Options** to open the **Options** dialog.
3. On the **Environment > General** options page, change the **Color Theme** selection to **Blue** or **Light**, and then select **OK**.



The color theme for the entire IDE changes accordingly. The following screenshot shows the Blue theme:



Select environment settings

You can configure Visual Studio to use environment settings tailored to Visual Basic developers.

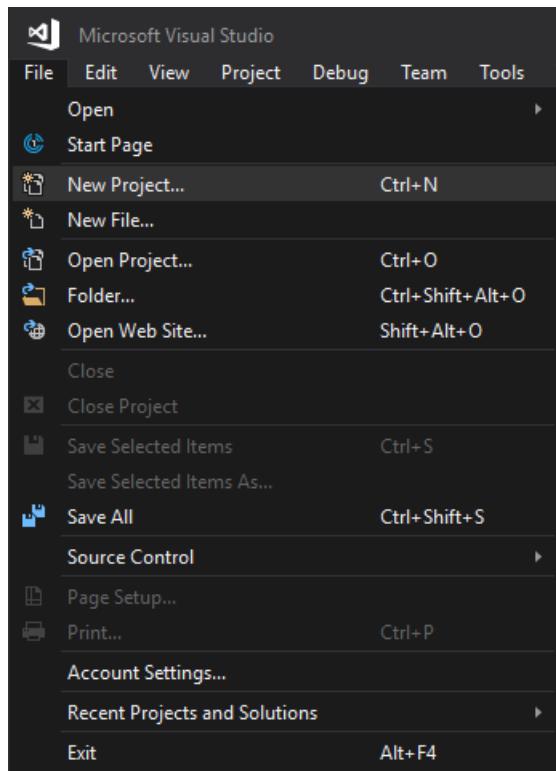
1. On the menu bar, choose **Tools > Import and Export Settings**.
2. In the **Import and Export Settings Wizard**, select **Reset all settings**, and then select **Next**.
3. On the **Save Current Settings** page, select whether to save your current settings before resetting. If you haven't customized any settings, select **No, just reset settings, overwriting my current settings**. Then select **Next**.
4. On the **Choose a Default Collection of Settings** page, choose **Visual Basic**, and then select **Finish**.
5. On the **Reset Complete** page, select **Close**.

To learn about other ways you can personalize the IDE, see [Personalize Visual Studio](#).

Create a program

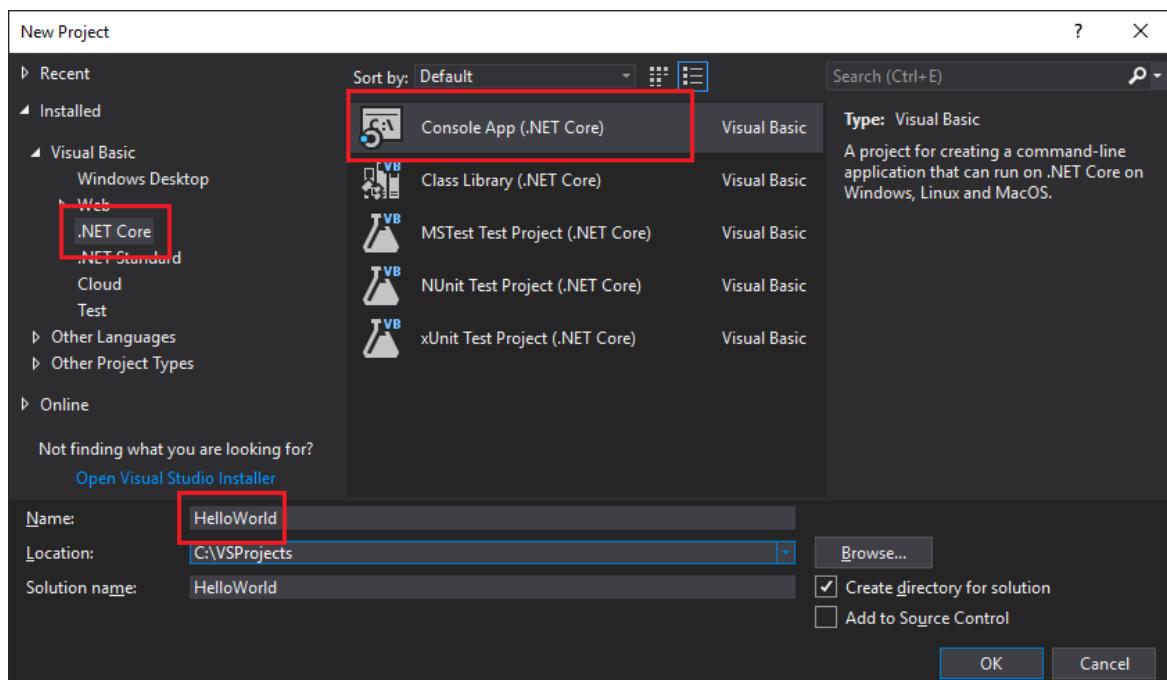
Dive in and create a simple program.

1. On the Visual Studio menu bar, choose **File > New Project**.



The **New Project** dialog box shows several project *templates*. A template contains the basic files and settings needed for a given project type.

2. Choose the **.NET Core** category under **Visual Basic**, and then choose the **Console App (.NET Core)** template. In the **Name** text box, type **HelloWorld**, and then select the **OK** button.

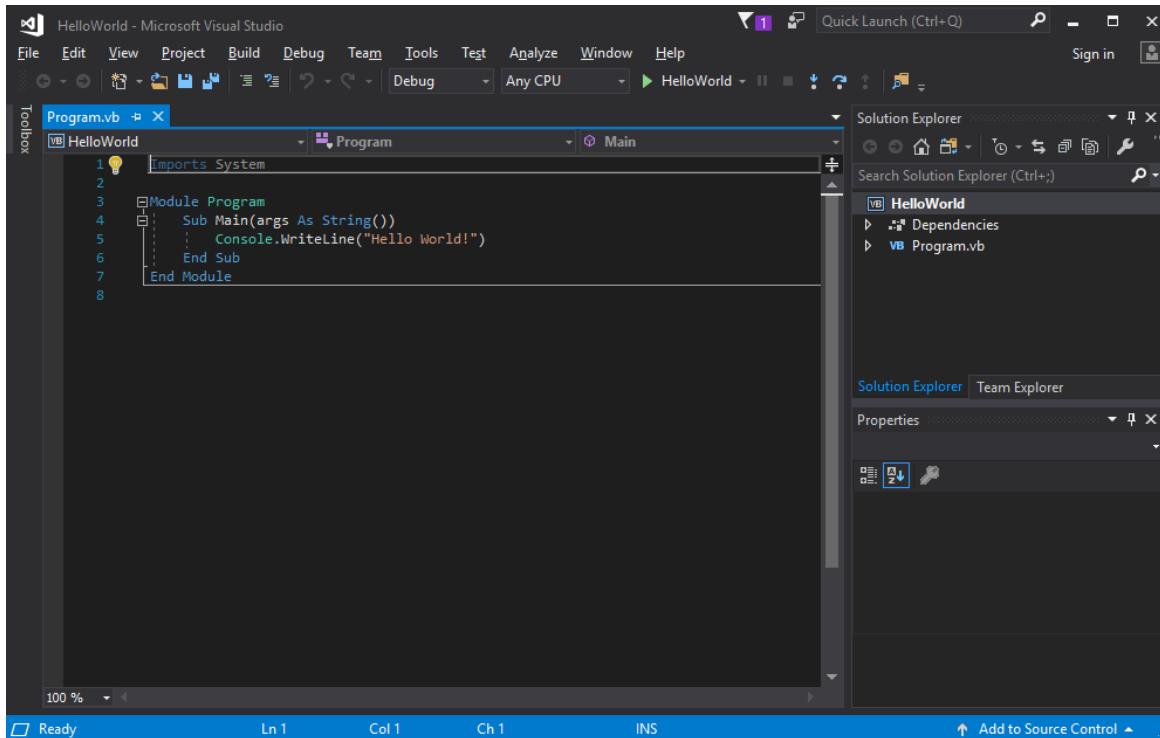


NOTE

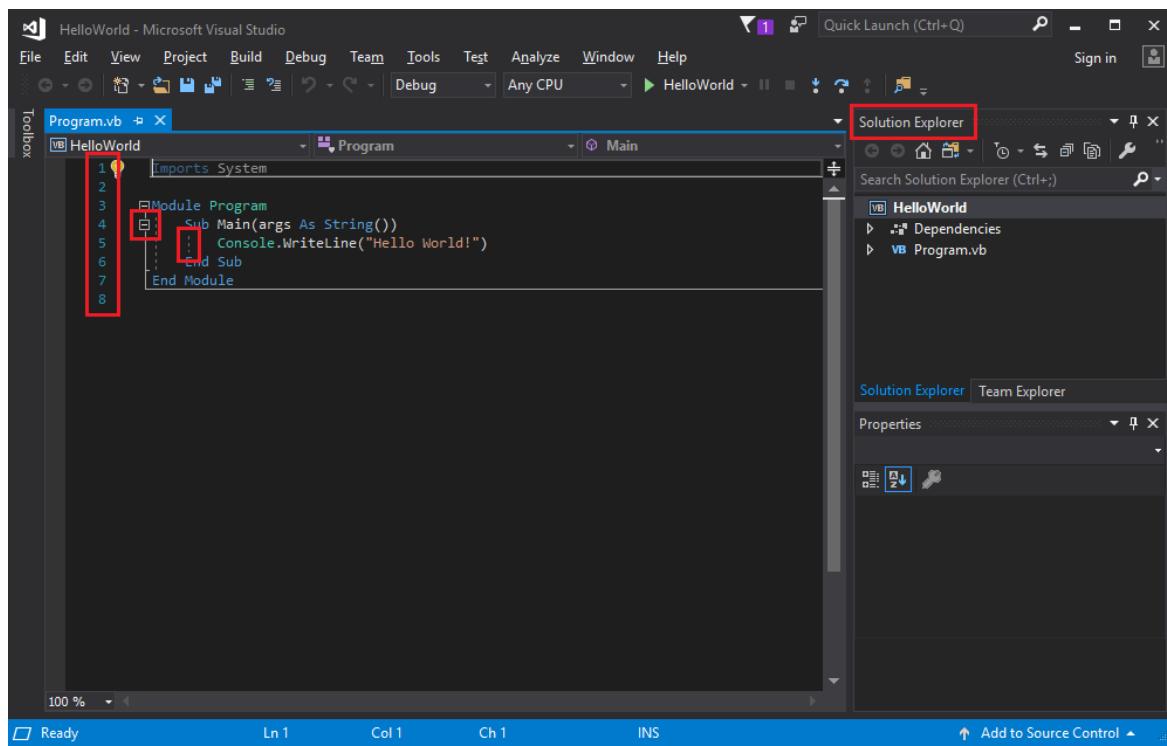
If you don't see the **.NET Core** category, you need to install the **.NET Core cross-platform development** workload. To do this, choose the [Open Visual Studio Installer](#) link on the bottom left of the **New Project** dialog. After Visual Studio Installer opens, scroll down and select the **.NET Core cross-platform development** workload, and then select **Modify**.

Visual Studio creates the project. It's a simple "Hello World" application that calls the `Console.WriteLine()` method to display the literal string "Hello World!" in the console (program output) window.

Shortly, you should see something like the following:

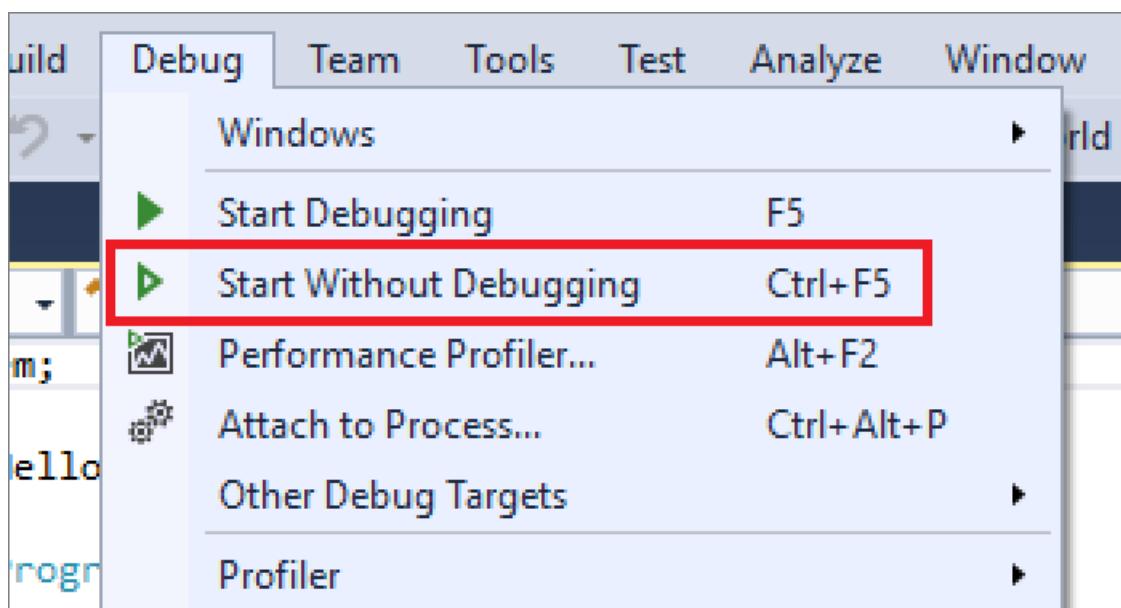


The Visual Basic code for the app appears in the editor window, which takes up most of the space. Notice that the text is automatically colorized to indicate different parts of the code, such as keywords and types. In addition, small, vertical dashed lines in the code indicate which braces match one another, and line numbers help you locate code later. You can choose the small, boxed minus signs to collapse or expand blocks of code. This code outlining feature lets you hide code you don't need, helping to minimize onscreen clutter. The project files are listed on the right side in a window called **Solution Explorer**.

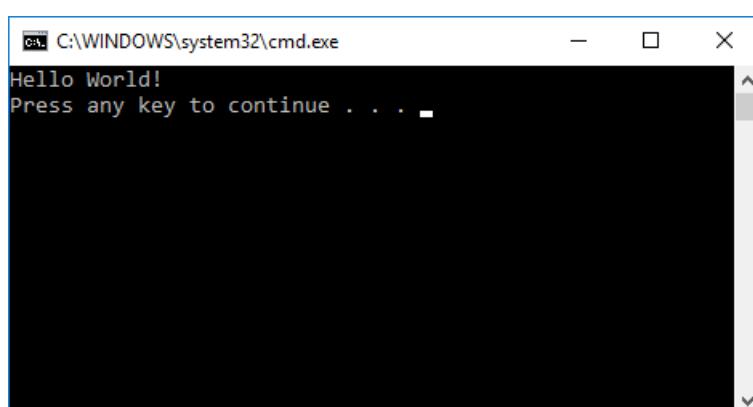


There are other menus and tool windows available, but let's move on for now.

- Now, start the app. You can do this by choosing **Start Without Debugging** from the **Debug** menu on the menu bar. You can also press **Ctrl+F5**.



Visual Studio builds the app, and a console window opens with the message **Hello World!**. You now have a running app!



- To close the console window, press any key on your keyboard.
- Let's add some additional code to the app. Add the following Visual Basic code before the line that says `Console.WriteLine("Hello World!")`:

```
Console.WriteLine("Hello World!")  
Console.WriteLine("What is your name?")  
Dim name = Console.ReadLine()
```

This code displays **What is your name?** in the console window, and then waits until the user enters some text followed by the **Enter** key.

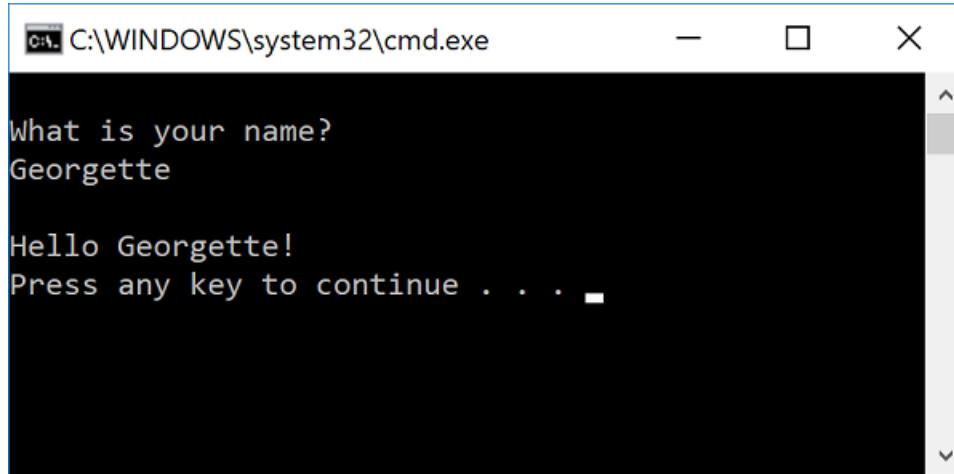
- Change the line that says `Console.WriteLine("Hello World!")` to the following code:

```
Console.WriteLine("Hello " + name + "!")
```

- Run the app again by pressing **Ctrl+F5**.

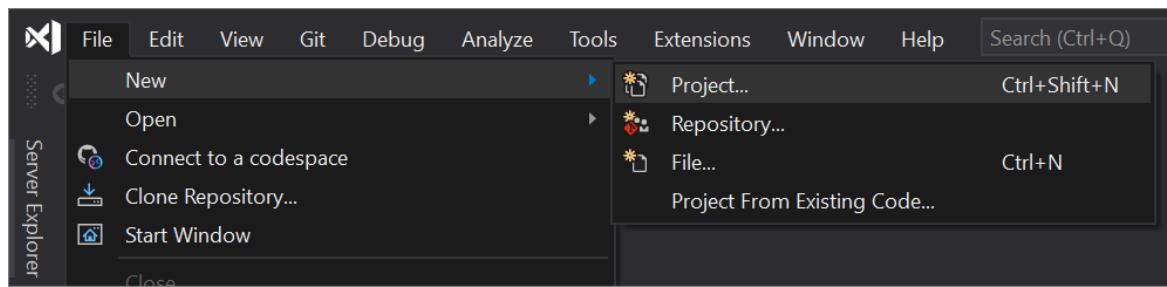
Visual Studio rebuilds the app, and a console window opens and prompts you for your name.

- Enter your name in the console window and press **Enter**.



- Press any key to close the console window and stop the running program.

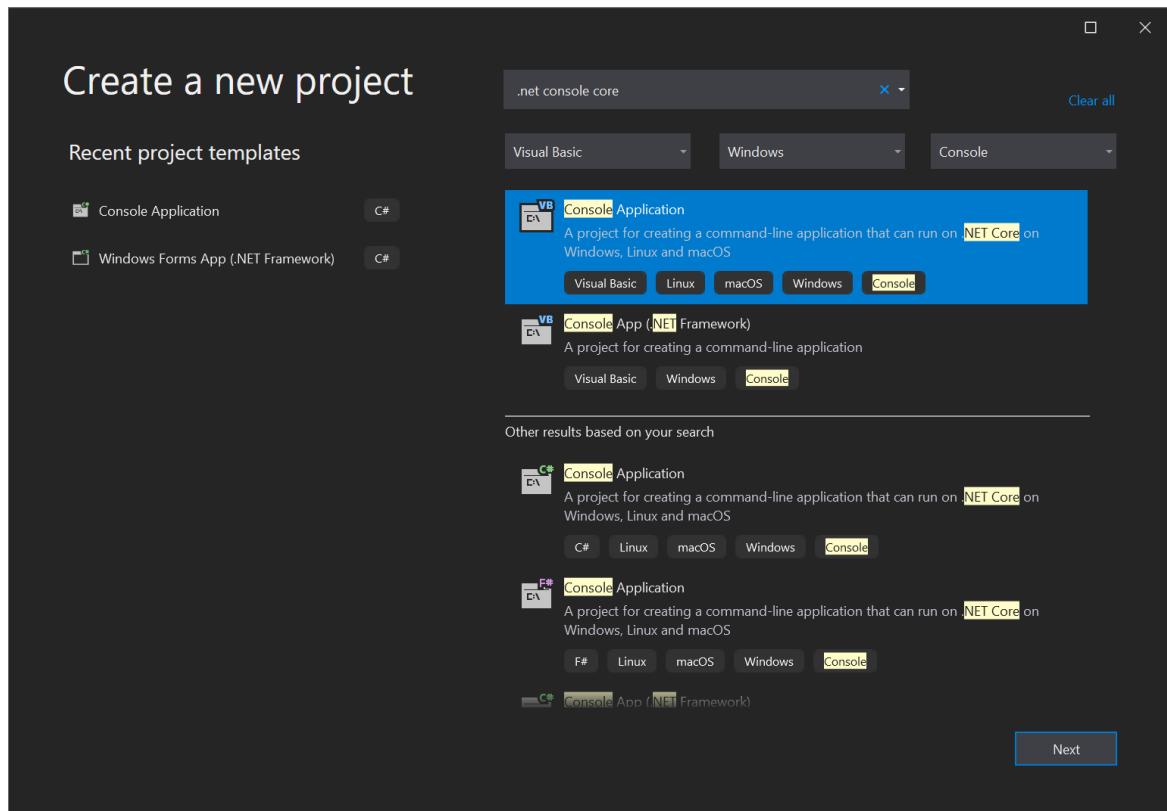
- On the Visual Studio menu bar, choose **File > New > Project**. (Alternatively, press **Ctrl+Shift+N**.)



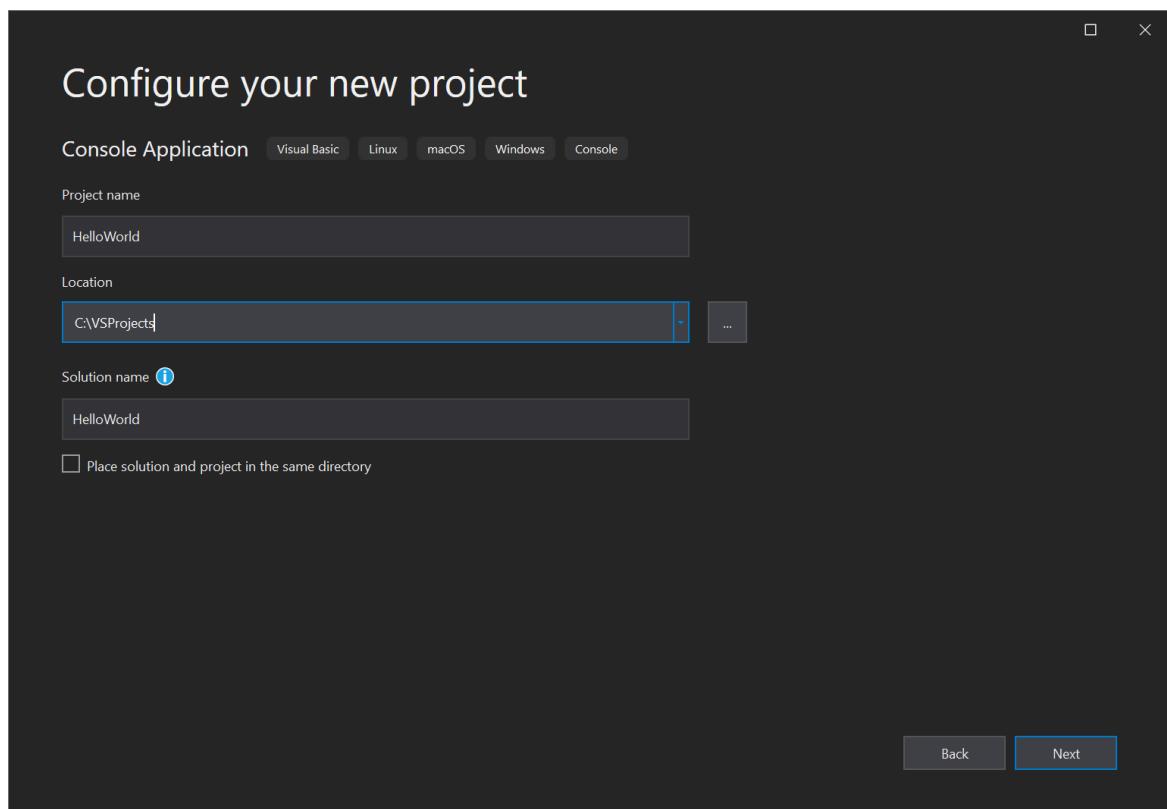
The **Create a new project** window opens and shows several project *templates*. A template contains the basic files and settings required for a given project type.

- To find the template we want, type or enter **.net core console** in the search box. The list of available templates is automatically filtered based on the keywords you entered. You can further filter the template results by choosing **Visual Basic** from the **All language** drop-down list, **Windows** from the **All platforms** list, and **Console** from the **All project types** list.

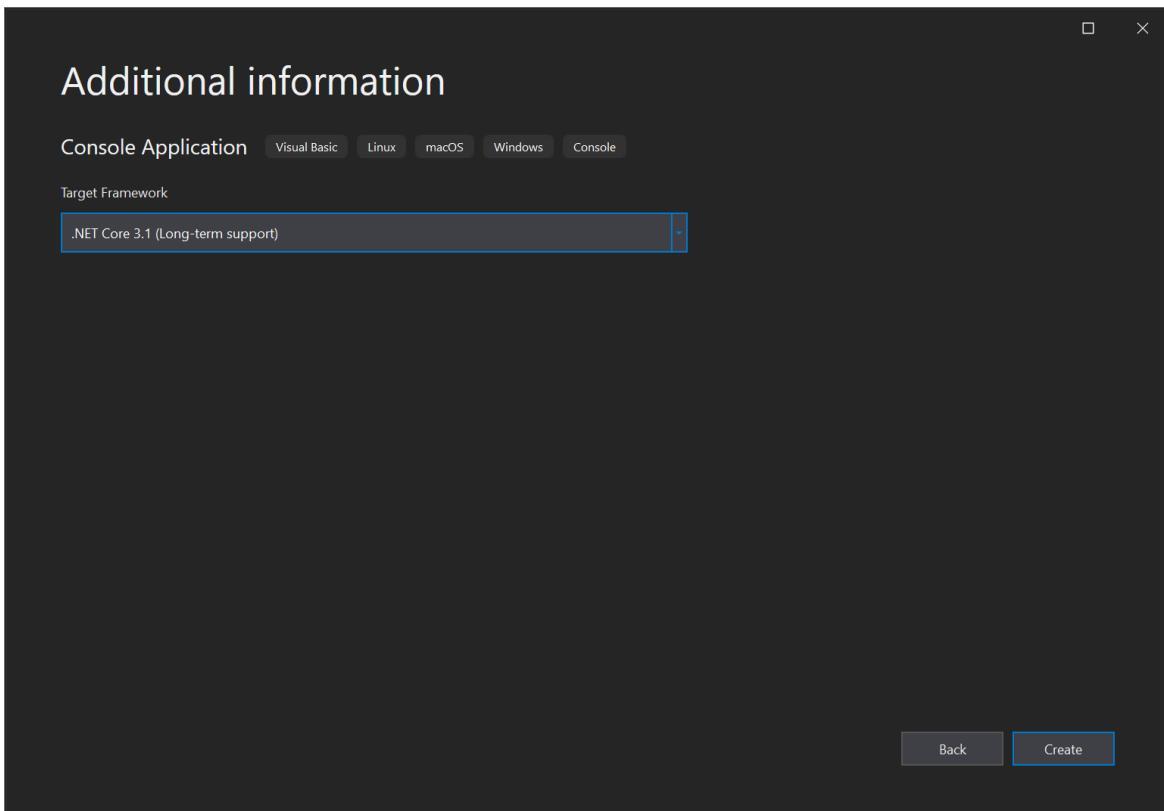
Select the **Console Application** template, and then click **Next**.



3. In the **Configure your new project** window, enter **HelloWorld** in the **Project name** box, optionally change the directory location for your project files (the default locale is `c:\Users<name>\source\repos`), and then click **Next**.

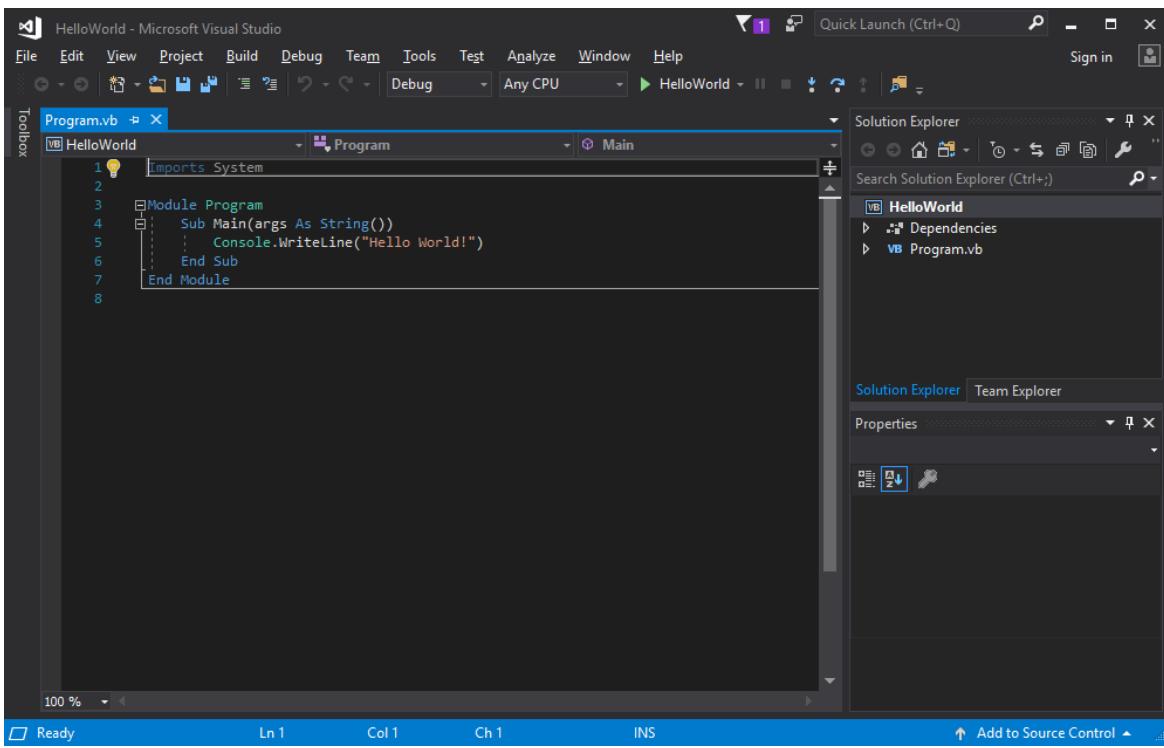


4. In the **Additional information** window, verify that **.NET Core 3.1** appears in the **Target Framework** drop-down menu, and then click **Create**.

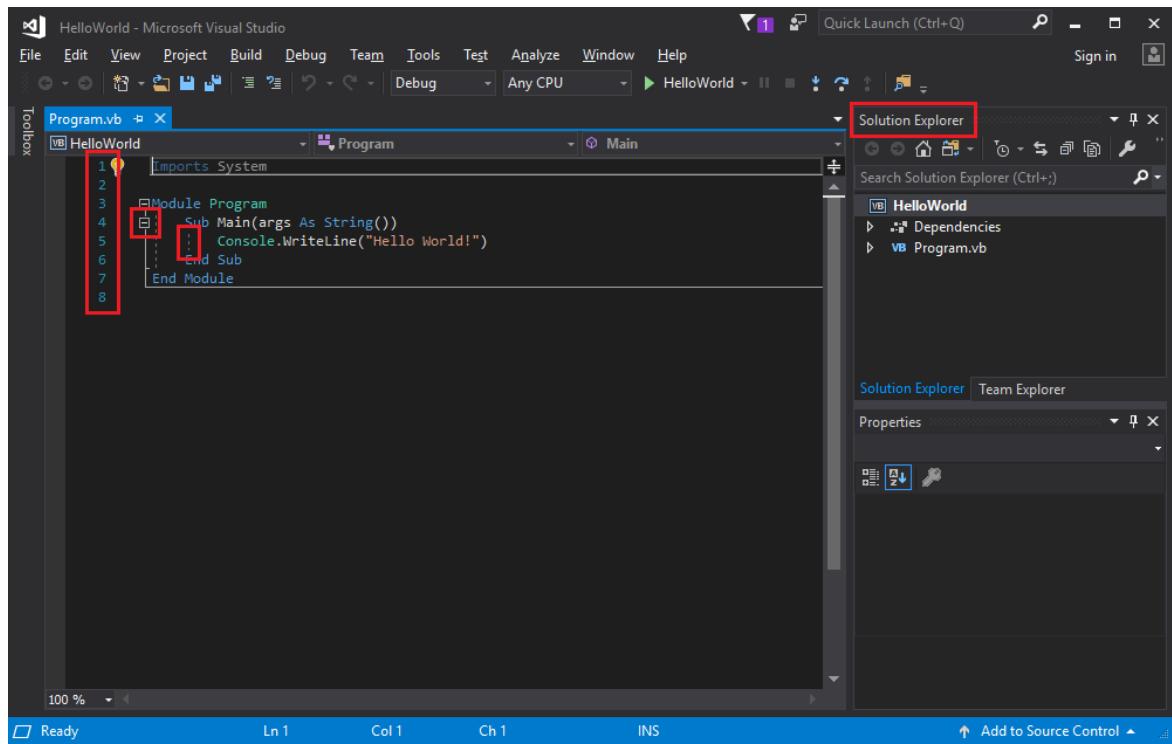


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Shortly, you should see something like the following:

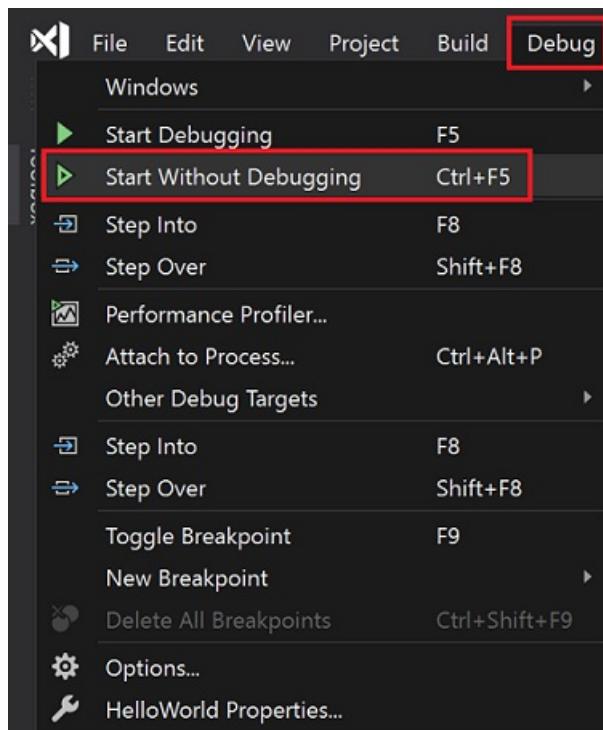


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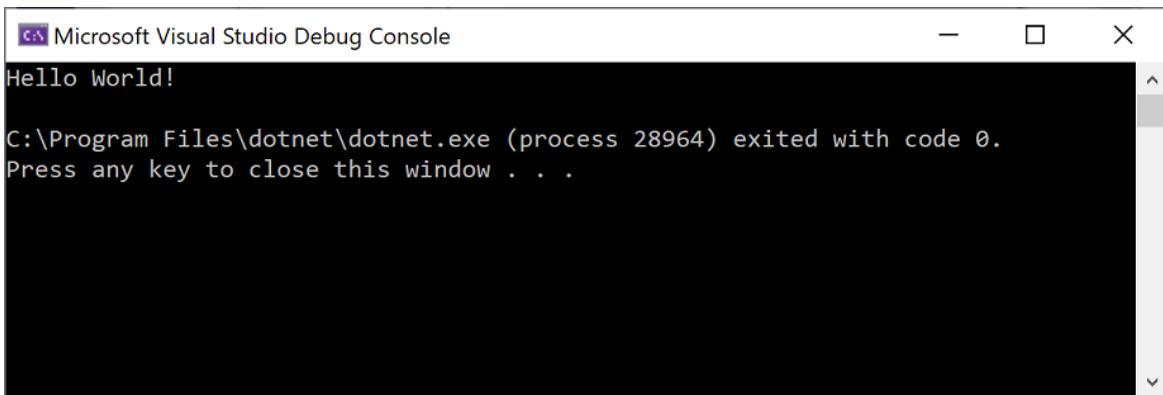


There are other menus and tool windows available, but let's move on for now.

- Now, start the app. You can do this by choosing **Start Without Debugging** from the **Debug** menu on the menu bar. You can also press **Ctrl+F5**.



Visual Studio builds the app, and a console window opens with the message **Hello World!**. You now have a running app!



```
Microsoft Visual Studio Debug Console
Hello World!
C:\Program Files\dotnet\dotnet.exe (process 28964) exited with code 0.
Press any key to close this window . . .
```

6. To close the console window, press any key on your keyboard.
7. Let's add some additional code to the app. Add the following Visual Basic code before the line that says

```
Console.WriteLine("Hello World!") :
```

```
Console.WriteLine("What is your name?")
Dim name = Console.ReadLine()
```

This code displays **What is your name?** in the console window, and then waits until the user enters some text followed by the **Enter** key.

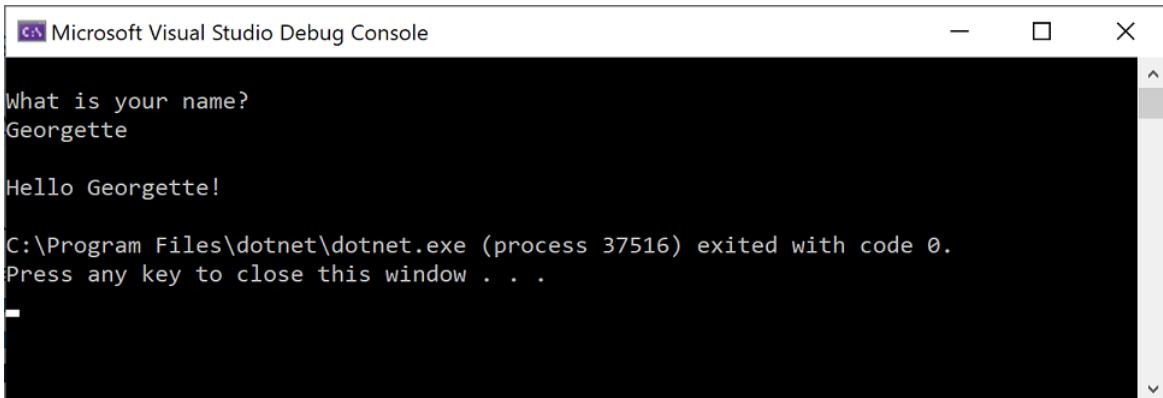
8. Change the line that says `Console.WriteLine("Hello World!")` to the following code:

```
Console.WriteLine("Hello " + name + "!")
```

9. Run the app again by pressing **Ctrl+F5**.

Visual Studio rebuilds the app, and a console window opens and prompts you for your name.

10. Enter your name in the console window and press **Enter**.

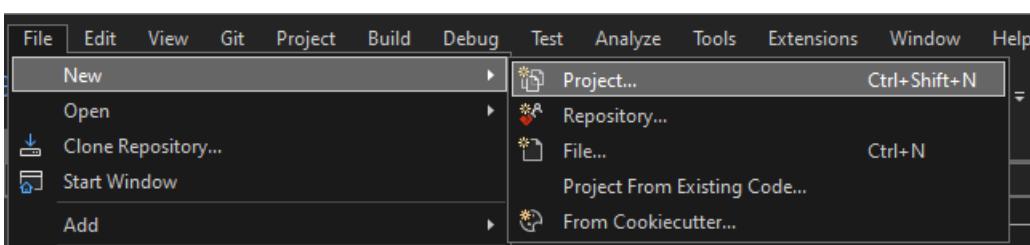


```
Microsoft Visual Studio Debug Console
What is your name?
Georgette

Hello Georgette!
C:\Program Files\dotnet\dotnet.exe (process 37516) exited with code 0.
Press any key to close this window . . .
```

11. Press any key to close the console window and stop the running program.

1. On the Visual Studio menu bar, choose **File > New > Project**. You can also press **Ctrl+Shift+N**.

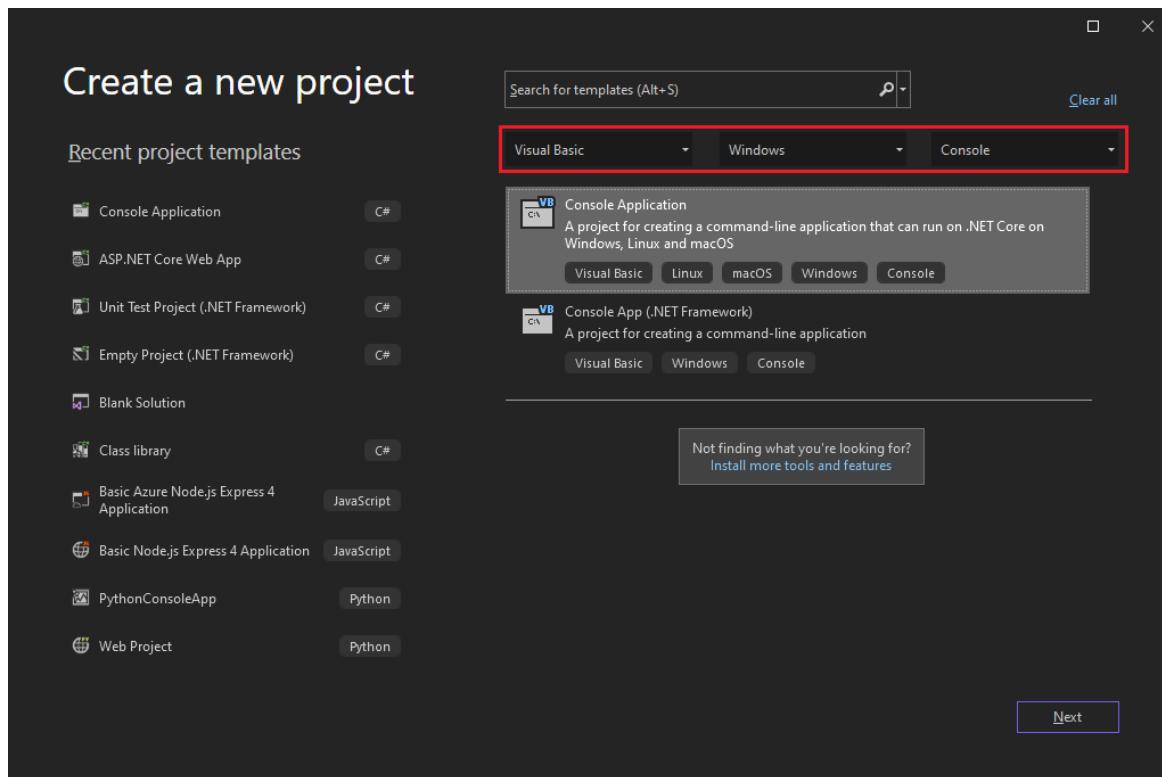


The **Create a new project** window opens and shows several project *templates*. A template contains the

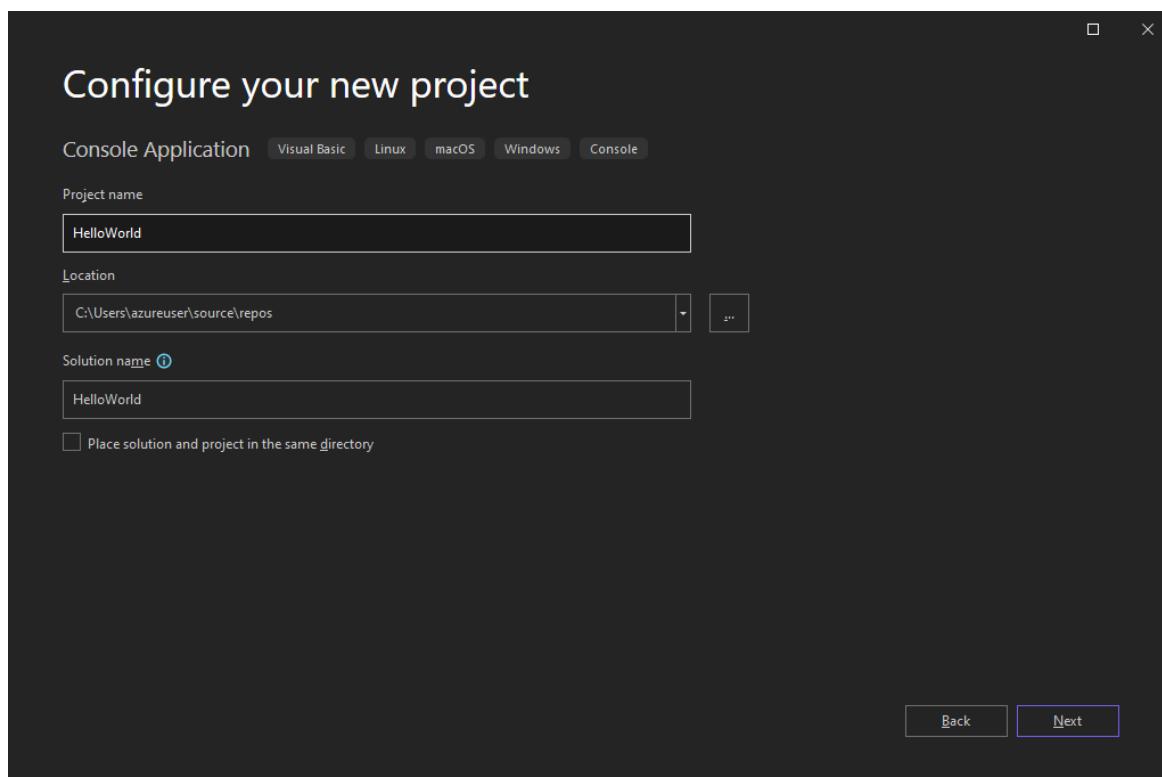
basic files and settings that a given project type requires.

2. To find a template, you can type or enter keywords in the search box. The list of available templates filters based on the keywords you enter. You can further filter the template results by choosing **Visual Basic** from the **All languages** dropdown list, **Windows** from the **All platforms** list, and **Console** from the **All project types** list.

Select the **Visual Basic Console Application** template, and then select **Next**.

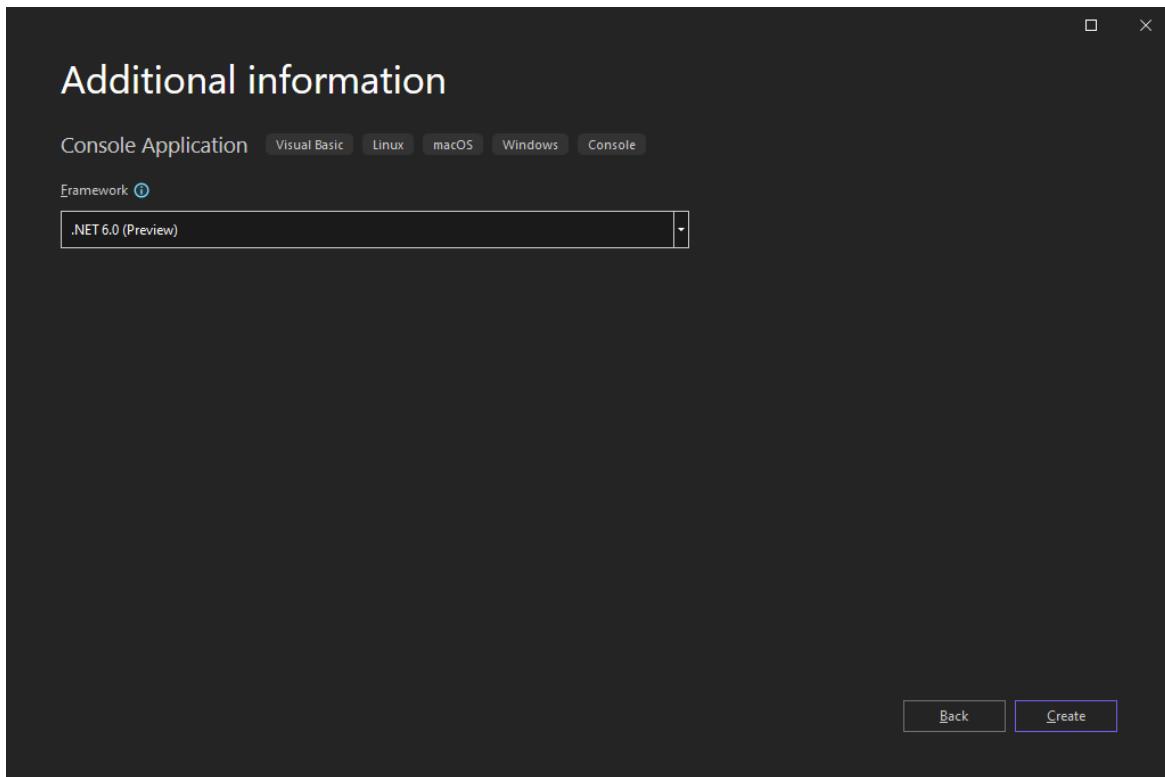


3. In the **Configure your new project** window, enter **HelloWorld** in the **Project name** box. Optionally, change the project directory location from the default location of **C:\Users\<name>\source\repos**, and then select **Next**.



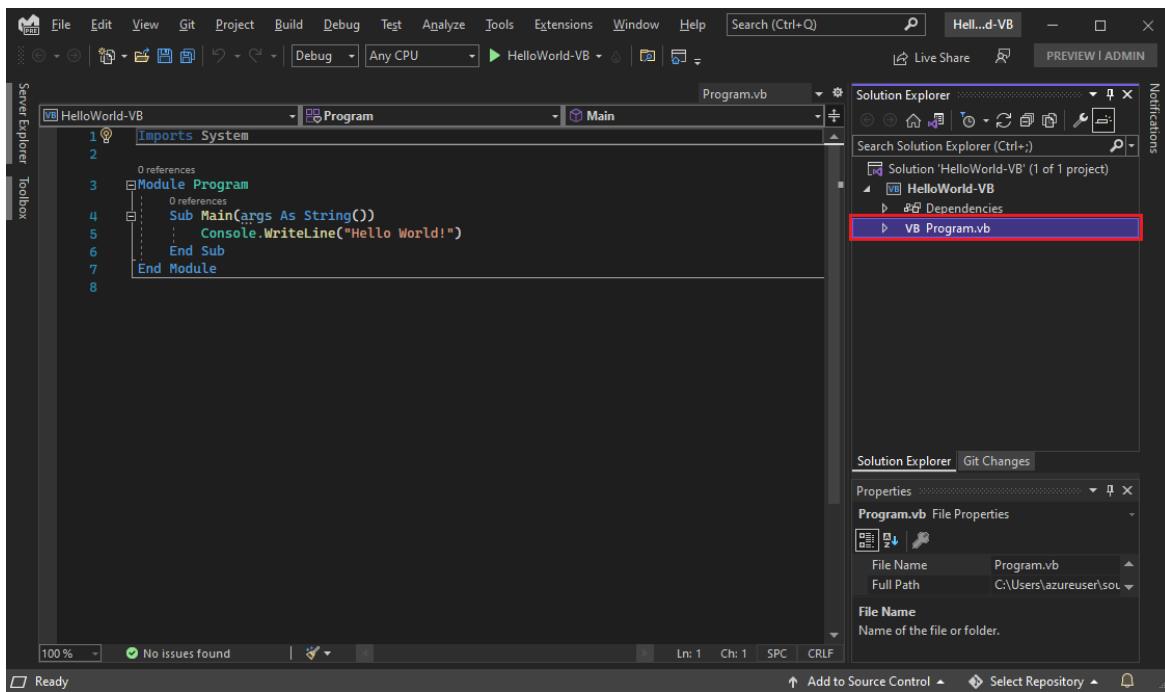
4. In the **Additional information** window, verify that **.NET 6.0** appears in the **Target Framework** drop-

down menu, and then select **Create**.



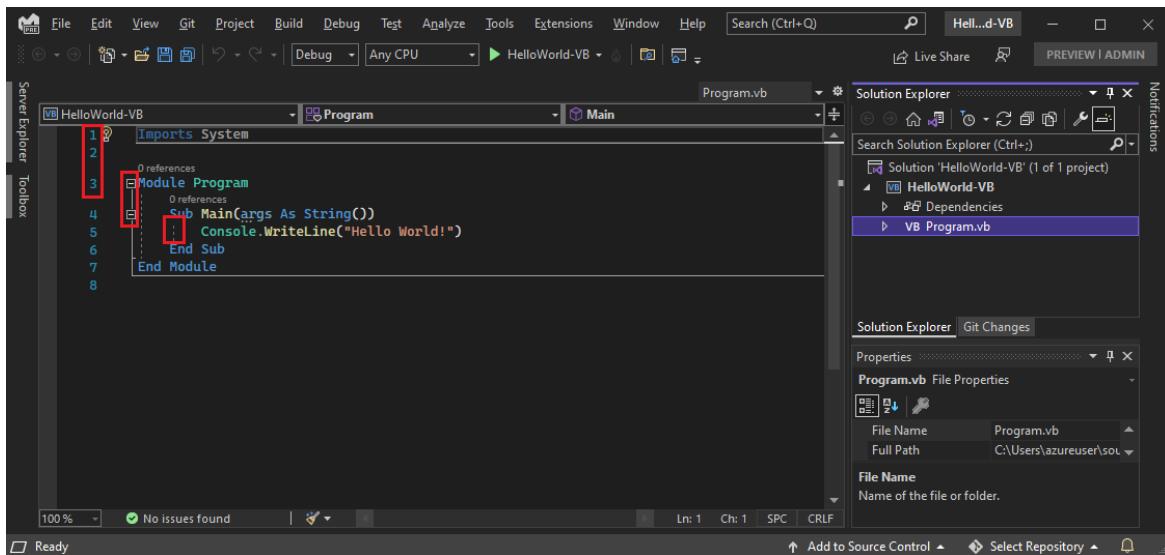
Visual Studio creates the project. The program is a simple "Hello World" application that calls the [Console.WriteLine\(\)](#) method to display the string **Hello, World!** in a console window.

The project files appear on the right side of the Visual Studio IDE, in a window called the **Solution Explorer**. In the **Solution Explorer** window, select the **Program.vb** file. The Visual Basic code for the app opens in the central editor window, which takes up most of the space.



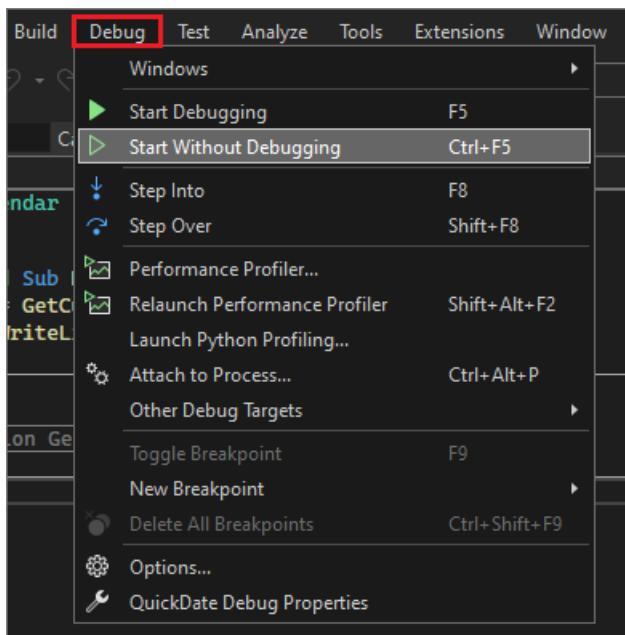
The code is automatically colorized to indicate different parts, such as keywords and types. Line numbers help you locate code.

Small, vertical dashed lines in the code indicate code structure or code blocks that go together. You can also select the small, boxed minus or plus signs to collapse or expand blocks of code. This code outlining feature lets you hide code you don't need to see, helping to minimize onscreen clutter.

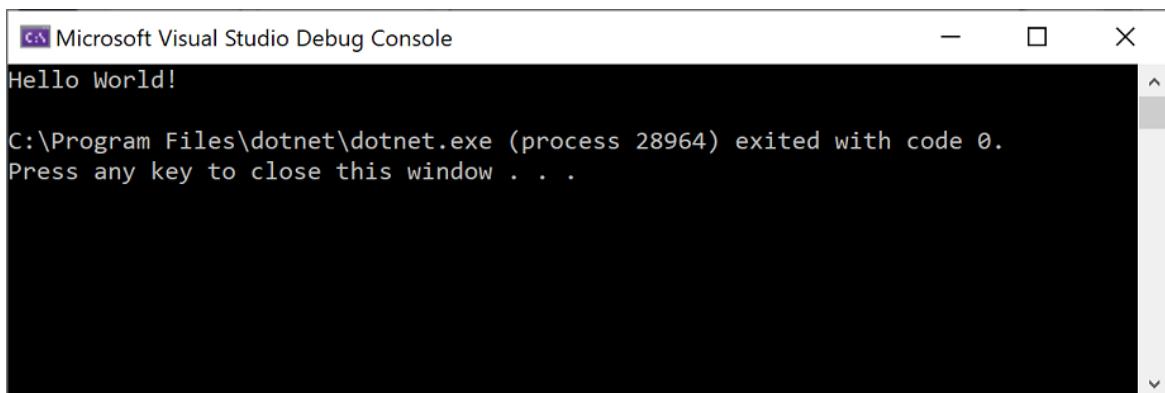


Many other menus and tool windows are available.

5. Start the app by choosing **Debug > Start Without Debugging** from the Visual Studio top menu. You can also press **Ctrl+F5**.



Visual Studio builds the app, and a console window opens with the message **Hello World!**. You now have a running app!



6. To close the console window, press any key.
7. Let's add more code to the app. Add the following Visual Basic code before the line that says `Console.WriteLine("Hello World!")`:

```
Console.WriteLine("What is your name?")
Dim name = Console.ReadLine()
```

This code displays **What is your name?** in the console window, and then waits until the user enters some text.

8. Change the line that says `Console.WriteLine("Hello World!")` to the following line:

```
Console.WriteLine("Hello " + name + "!")
```

9. Run the app again by selecting **Debug > Start Without Debugging** or pressing **Ctrl+F5**.

Visual Studio rebuilds the app, and a console window opens and prompts you for your name.

10. Type your name in the console window and press **Enter**.

```
Microsoft Visual Studio Debug Console

What is your name?
Georgette

Hello Georgette!

C:\Users\azureuser\source\repos\HelloWorld\bin\Debug\net6.0\HelloWorld.exe
(process 9232) exited with code 0. Press any key to close this window . . .
```

11. Press any key to close the console window and stop the running program.

Use refactoring and IntelliSense

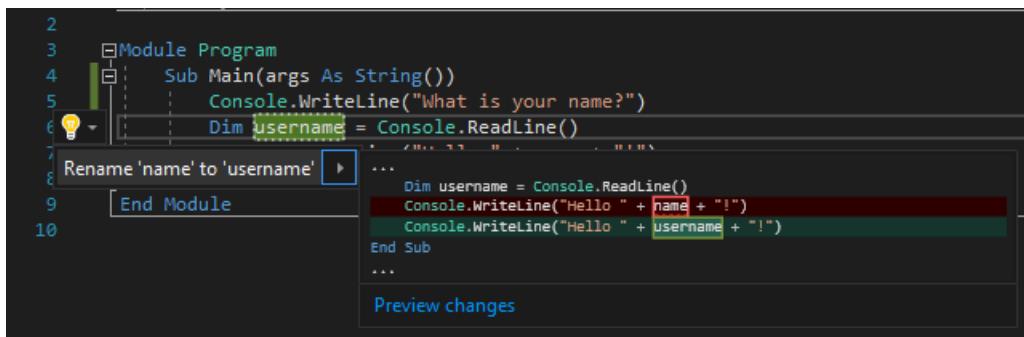
Let's look at a couple of the ways that [refactoring](#) and [IntelliSense](#) can help you code more efficiently.

First, rename the `name` variable:

1. Double-click the `name` variable, and type the new name for the variable, `username`.

A box appears around the variable, and a light bulb appears in the margin.

2. Select the lightbulb icon to show the available [Quick Actions](#). Select **Rename 'name' to 'username'**.



```

3 0 references
Module Program
4 0 references
Sub Main(args As String())
    Console.WriteLine("What is your name?")
    Dim username = Console.ReadLine()
8 Rename 'name' to 'username' ▾
9 Suppress or Configure issues ▾
10
    Dim username = Console.ReadLine()
    Console.WriteLine("Hello " + name + "!")
    Console.WriteLine("Hello " + username + "!")
End Sub

```

Preview changes

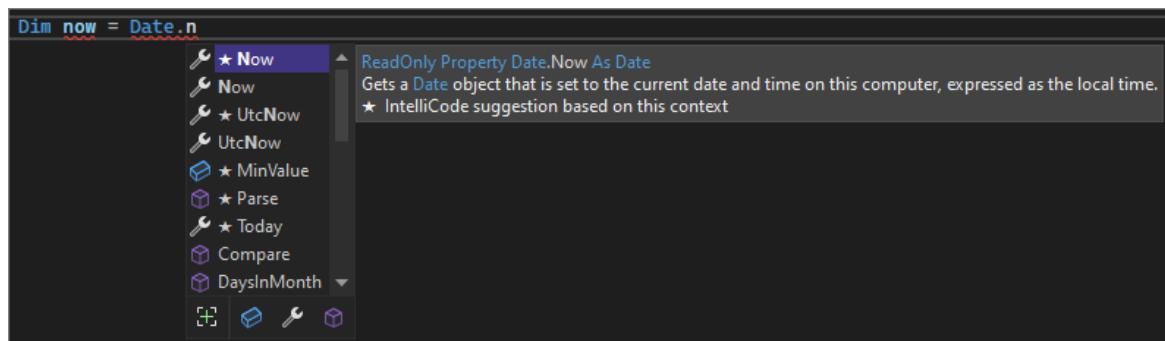
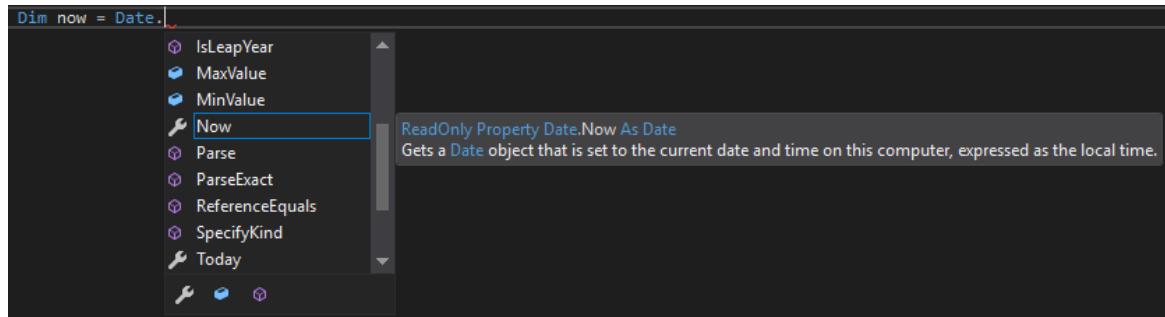
The variable renames across the project, which in this case is only two places.

Now take a look at IntelliSense.

- Below the line that says `Console.WriteLine("Hello " + username + "!")`, type the following code:

```
Dim now = Date.
```

A box displays the members of the `DateTime` class. The description of the currently selected member also displays in a separate box.



- Choose the member named **Now**, which is a property of the class. Either double-click on **Now**, or select it and press **Tab**.

- Below that line, enter the following lines of code:

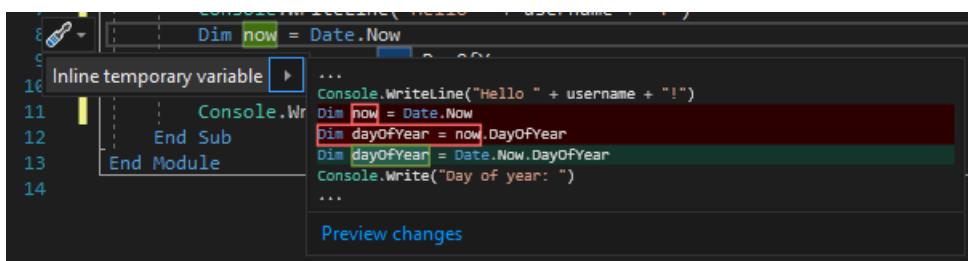
```
Dim dayOfYear = now.DayOfYear
Console.Write("Day of year: ")
Console.WriteLine(dayOfYear)
```

TIP

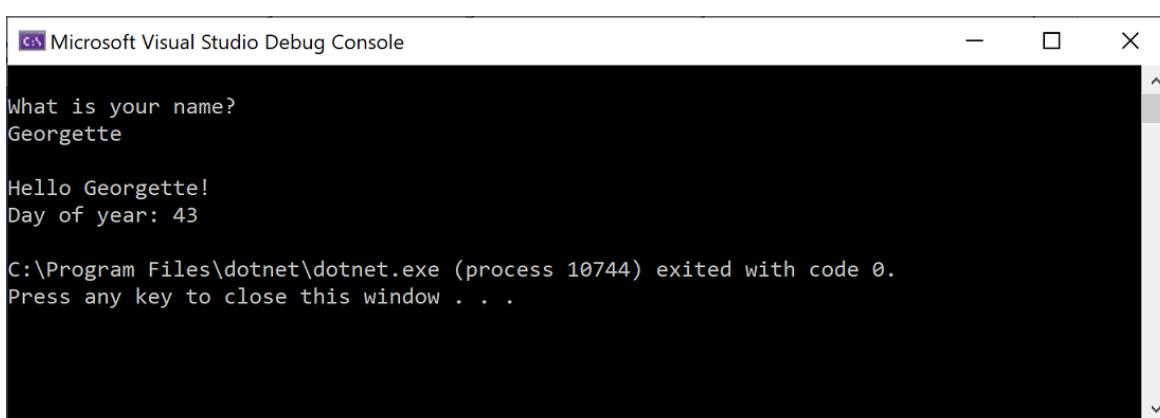
`Console.Write` is different from `Console.WriteLine` in that it doesn't add a line terminator after it prints. That means that the next piece of text that's sent to the output will print on the same line. You can hover over each of these methods in your code to see their descriptions.

Next, use refactoring again to make the code a little more concise.

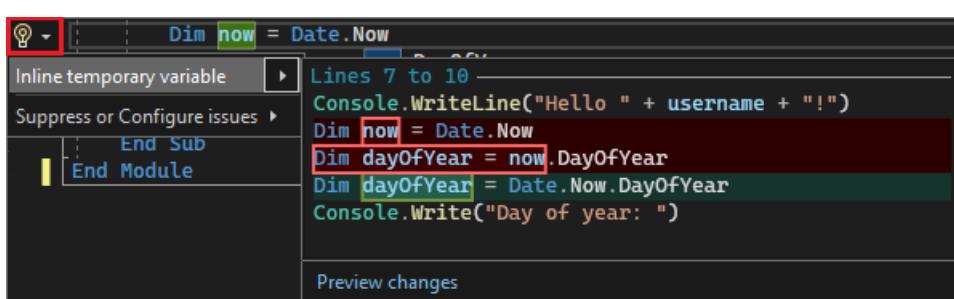
1. Select the variable `now` in the line `Dim now = Date.Now`. A screwdriver icon appears in the margin on that line.
2. Select the screwdriver icon to see available suggestions from Visual Studio. This case shows the [Inline temporary variable](#) refactoring to remove a line of code without changing the overall code behavior.



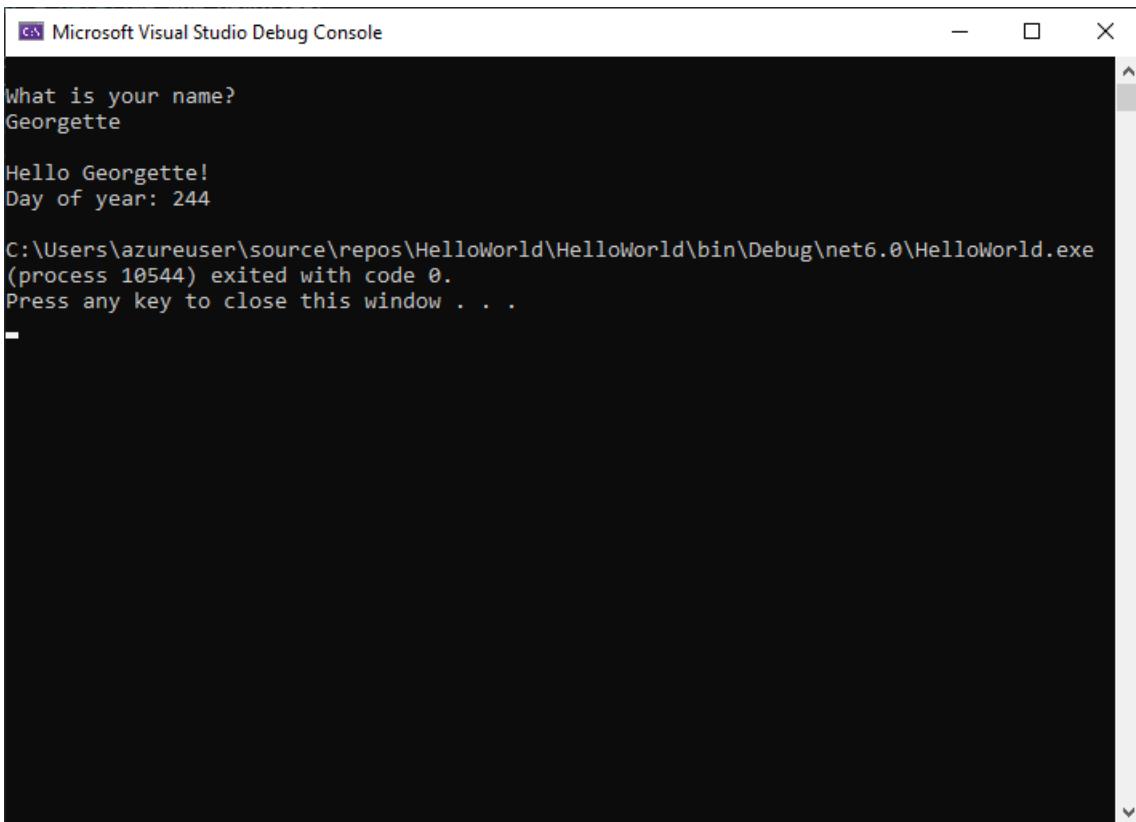
3. Select **Inline temporary variable** to refactor the code.
4. Run the program again by pressing **Ctrl+F5**. The output looks something like this:



1. Select the variable `now` in the line `Dim now = Date.Now`. A lightbulb icon appears in the margin on that line.
2. Select the lightbulb icon to see available suggestions from Visual Studio. This case shows the [Inline temporary variable](#) refactoring to remove a line of code without changing the overall code behavior.



3. Select **Inline temporary variable** to refactor the code.
4. Run the program again by pressing **Ctrl+F5**. The output looks something like this:



Microsoft Visual Studio Debug Console

```
What is your name?  
Georgette  
  
Hello Georgette!  
Day of year: 244  
  
C:\Users\azureuser\source\repos\HelloWorld\HelloWorld\bin\Debug\net6.0\HelloWorld.exe  
(process 10544) exited with code 0.  
Press any key to close this window . . .
```

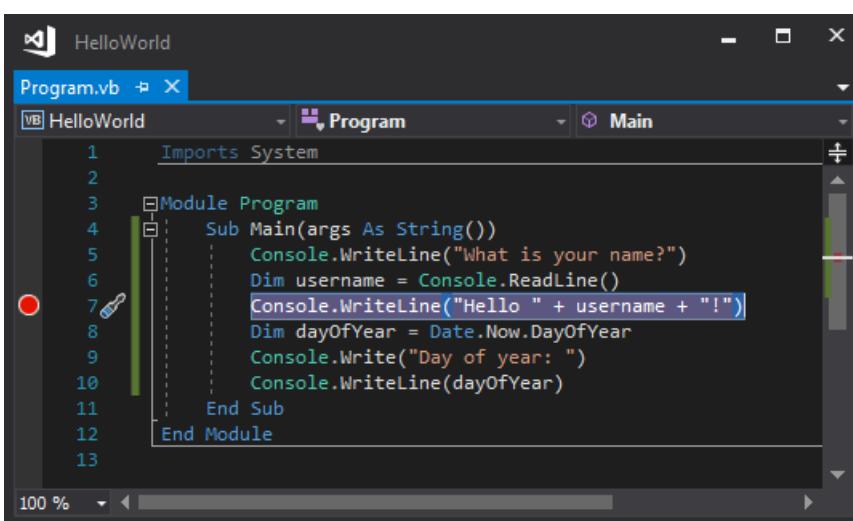
Debug code

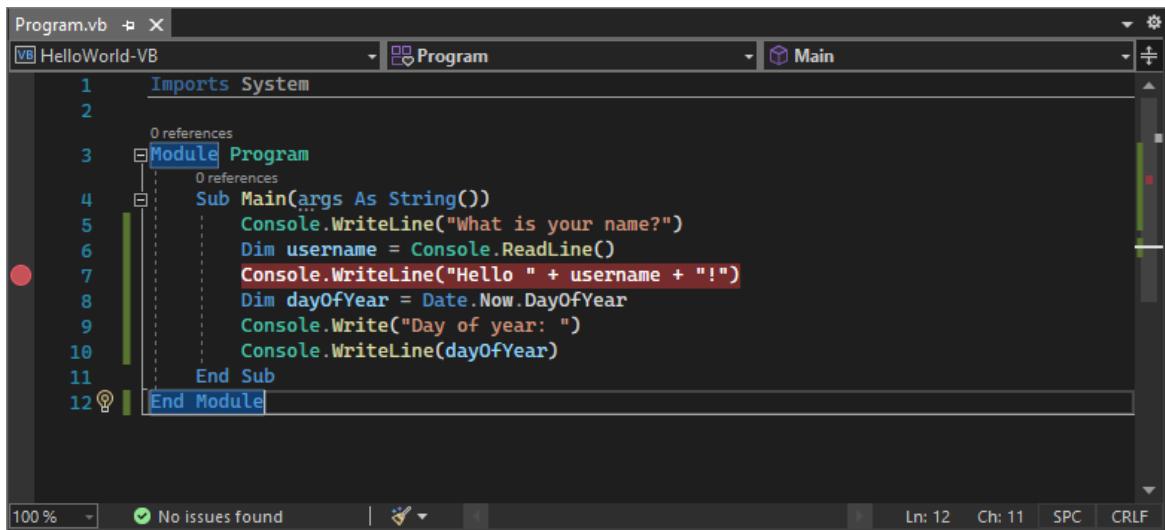
When you write code, you should run it and test it for bugs. Visual Studio's debugging system lets you step through code one statement at a time and inspect variables as you go. You can set *breakpoints* that stop execution of the code at a particular line, and observe how the variable value changes as the code runs.

Set a breakpoint to see the value of the `username` variable while the program is running.

1. Set a breakpoint on the line of code that says `Console.WriteLine("Hello " + username + "!")` by clicking in the far-left margin, or gutter, next to the line. You can also select the line of code and then press F9.

A red circle appears in the gutter, and the line is highlighted.





The screenshot shows the Visual Studio code editor with a file named "Program.vb". The code is a simple VB.NET application that prompts the user for their name, prints a greeting, and displays the current day of the year. A red circular breakpoint icon is placed on the line "Console.WriteLine("Hello " + username + "!")". The status bar at the bottom indicates "100 %", "No issues found", and "Ln: 12 Ch: 11 SPC CRLF".

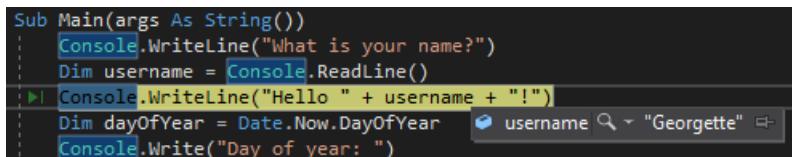
```
1 Imports System
2
3 Module Program
4 Sub Main(args As String())
5     Console.WriteLine("What is your name?")
6     Dim username = Console.ReadLine()
7     Console.WriteLine("Hello " + username + "!")
8     Dim dayOfYear = Date.Now.DayOfYear
9     Console.Write("Day of year: ")
10    Console.WriteLine(dayOfYear)
11 End Sub
12 End Module
```

2. Start debugging by selecting **Debug > Start Debugging** or pressing F5.

3. When the console window appears and asks for your name, enter your name.

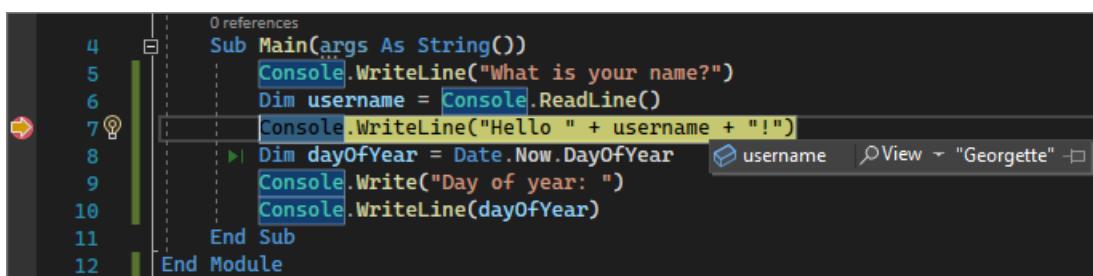
The focus returns to the Visual Studio code editor, and the line of code with the breakpoint is highlighted in yellow. The yellow highlight means that this line of code will execute next. The breakpoint makes the app pause execution at this line.

4. Hover your mouse over the `username` variable to see its value. You can also right-click on `username` and select **Add Watch** to add the variable to the **Watch** window, where you can also see its value.



A tooltip for the variable `username` is displayed, showing its current value as "Georgette". The code editor shows the same code as the first screenshot, with the line containing `Console.WriteLine("Hello " + username + "!"")` highlighted in yellow.

```
Sub Main(args As String())
    Console.WriteLine("What is your name?")
    Dim username = Console.ReadLine()
    Console.WriteLine("Hello " + username + "!")
    Dim dayOfYear = Date.Now.DayOfYear
    Console.Write("Day of year: ")
```



The screenshot shows the Visual Studio code editor with the `username` variable added to the **Watch** window. The variable is listed with the value "Georgette". The code editor shows the same code as the previous screenshots.

```
0 references
Sub Main(args As String())
    Console.WriteLine("What is your name?")
    Dim username = Console.ReadLine()
    Console.WriteLine("Hello " + username + "!")
    Dim dayOfYear = Date.Now.DayOfYear
    Console.Write("Day of year: ")
```

5. Press F5 again to finish running the app.

For more information about debugging in Visual Studio, see the [Debugger feature tour](#).

Next steps

Explore Visual Studio further by following along with one of these introductory articles:

[Learn to use the code editor](#)

[Learn about projects and solutions](#)

See also

- Discover [more Visual Studio features](#).
- Visit visualstudio.microsoft.com.
- Read the [Visual Studio blog](#).

Learn to use the code editor with Visual Basic

11/13/2021 • 11 minutes to read • [Edit Online](#)

In this 10-minute introduction to the code editor in Visual Studio, we'll add code to a file to look at some of the ways that Visual Studio makes writing, navigating, and understanding Visual Basic code easier.

TIP

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

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If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

This article assumes you're already familiar with Visual Basic. If you aren't, we suggest you look at a tutorial such as [Get started with Visual Basic in Visual Studio](#) first.

TIP

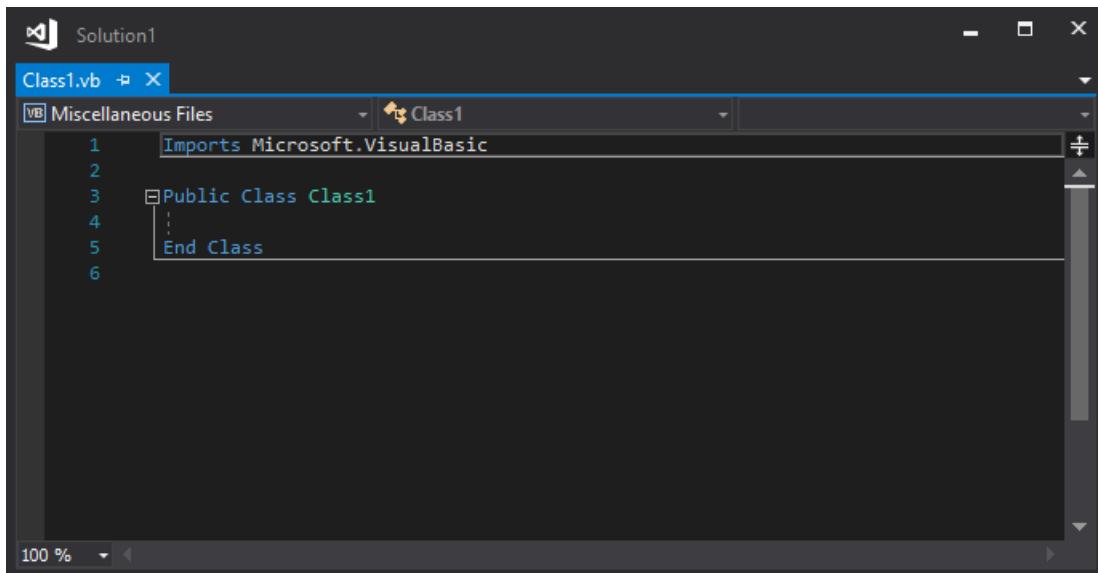
To follow along with this article, make sure you have the Visual Basic settings selected for Visual Studio. For information about selecting settings for the integrated development environment (IDE), see [Select environment settings](#).

Create a new code file

Start by creating a new file and adding some code to it.

1. Open Visual Studio.
2. From the **File** menu on the menu bar, choose **New File**.
3. In the **New File** dialog box, under the **General** category, choose **Visual Basic Class**, and then choose **Open**.

A new file opens in the editor with the skeleton of a Visual Basic class. (You can already notice that you don't have to create a full Visual Studio project to gain some of the benefits that the code editor offers, such as syntax highlighting. All you need is a code file!)

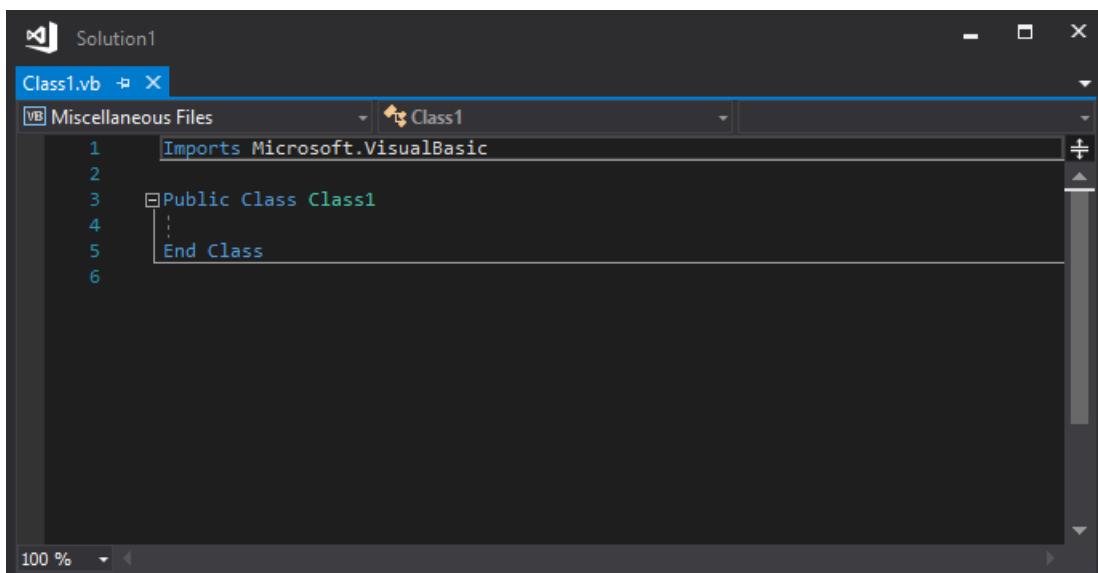


The screenshot shows the Visual Studio code editor with a dark theme. A single file named "Class1.vb" is open, containing the following code:

```
Imports Microsoft.VisualBasic
Public Class Class1
End Class
```

1. Open Visual Studio. Press **Esc** or click **Continue without code** on the start window to open the development environment.
2. From the **File** menu on the menu bar, choose **New File**.
3. In the **New File** dialog box, under the **General** category, choose **Visual Basic Class**, and then choose **Open**.

A new file opens in the editor with the skeleton of a Visual Basic class. (You can already notice that you don't have to create a full Visual Studio project to gain some of the benefits that the code editor offers, such as syntax highlighting. All you need is a code file!)



The screenshot shows the Visual Studio code editor with a dark theme. A single file named "Class1.vb" is open, containing the following code:

```
Imports Microsoft.VisualBasic
Public Class Class1
End Class
```

1. Open Visual Studio. Press **Esc** or select **Continue without code** on the start window to open the development environment.
2. From the **File** menu on the menu bar, choose **New > File**.
3. In the **New File** dialog box, under the **General** category, choose **Visual Basic Class**, and then choose **Open**.

A new file opens in the editor with the skeleton of a Visual Basic class. (You can already notice that you don't have to create a full Visual Studio project to gain some of the benefits that the code editor offers, such as syntax highlighting. All you need is a code file!)

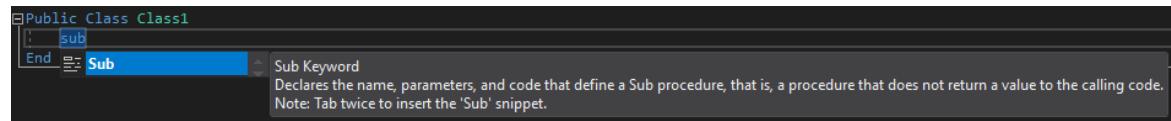
```
Imports Microsoft.VisualBasic
Public Class Class1
End Class
```

Use code snippets

Visual Studio provides useful *code snippets* that you can use to quickly and easily generate commonly used code blocks. [Code snippets](#) are available for different programming languages including Visual Basic, C#, and C++. Let's add the Visual Basic **Sub** snippet to our file.

1. Place your cursor above the line that says `End Class`, and type **sub**.

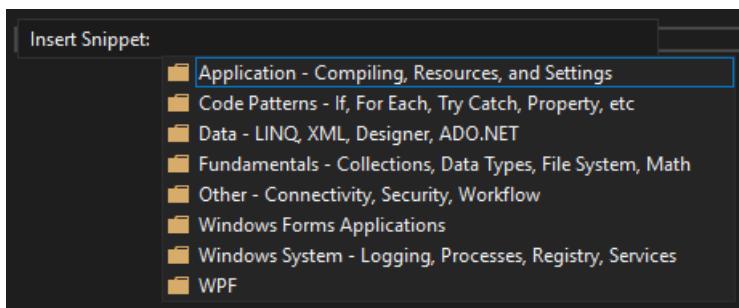
A pop-up dialog box appears with information about the `Sub` keyword and how to insert the **Sub** code snippet.



2. Press **Tab** twice to insert the code snippet.

The outline for the Sub procedure `MySub()` is added to the file.

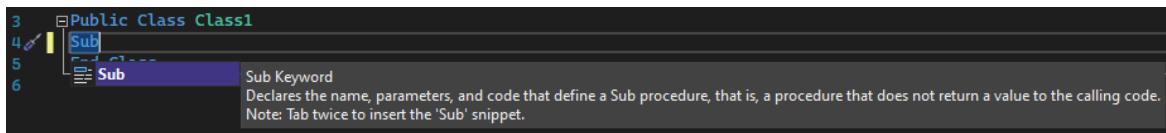
The available code snippets vary for different programming languages. You can look at the available code snippets for Visual Basic by choosing **Edit > IntelliSense > Insert Snippet** (or press **Ctrl+K, Ctrl+X**). For Visual Basic, code snippets are available for the following categories:



There are snippets for determining if a file exists on the computer, writing to a text file, reading a registry value, executing a SQL query, or creating a [For Each...Next statement](#), and many more.

1. Place your cursor above the line that says `End Class`, and type **sub**.

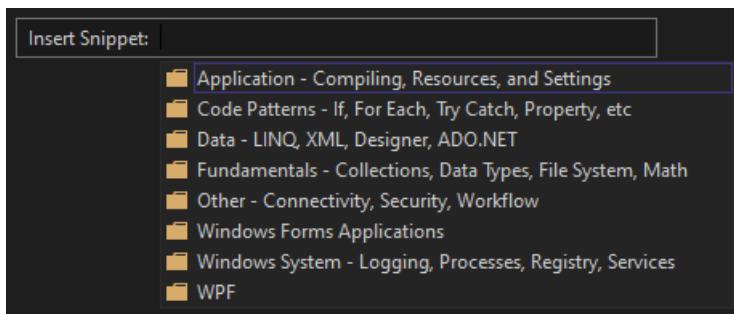
A pop-up dialog box appears with information about the `Sub` keyword and how to insert the **Sub** code snippet.



2. Press **Tab** twice to insert the code snippet.

The outline for the Sub procedure `MySub()` is added to the file.

The available code snippets vary for different programming languages. You can look at the available code snippets for Visual Basic by opening the right-click or context menu in the code editor and choosing **Snippet > Insert Snippet** (or press **Ctrl+K, Ctrl+X**). For Visual Basic, code snippets are available for the following categories:



Comment out code

The toolbar, which is the row of buttons under the menu bar in Visual Studio, can help make you more productive as you code. For example, you can toggle IntelliSense completion mode, increase or decrease a line indent, or comment out code that you don't want to compile. ([IntelliSense](#) is a coding aid that displays a list of matching methods, amongst other things.) In this section, we'll comment out some code.



1. Paste the following code into the `MySub()` procedure body.

```
' _words is a string array that we'll sort alphabetically
Dim _words = New String() {
    "the",
    "quick",
    "brown",
    "fox",
    "jumps"
}

Dim morewords = New String() {
    "over",
    "the",
    "lazy",
    "dog"
}

Dim query = From word In _words
            Order By word.Length
            Select word
```

2. We're not using the `morewords` array, but we may use it later so we don't want to completely delete it. Instead, let's comment out those lines. Select the entire definition of `morewords` to the closing curly brace, and then choose the **Comment out the selected lines** button on the toolbar. If you prefer to use the keyboard, press **Ctrl+K, Ctrl+C**.



The Visual Basic comment character `'` is added to the beginning of each selected line to comment out the code.



- Paste the following code into the `MySub()` procedure body.

```
' _words is a string array that we'll sort alphabetically
Dim _words = New String() {
    "the",
    "quick",
    "brown",
    "fox",
    "jumps"
}

Dim morewords = New String() {
    "over",
    "the",
    "lazy",
    "dog"
}

Dim query = From word In _words
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            Select word
```

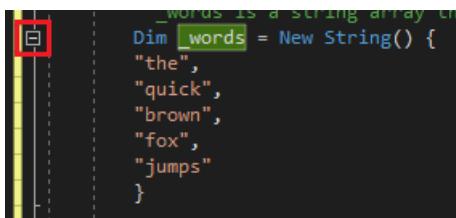
- We're not using the `morewords` array, but we may use it later so we don't want to completely delete it. Instead, let's comment out those lines. Select the entire definition of `morewords` to the closing curly brace, and then choose the **Comment out the selected lines** button on the toolbar. If you prefer to use the keyboard, press **Ctrl+K, Ctrl+C**.



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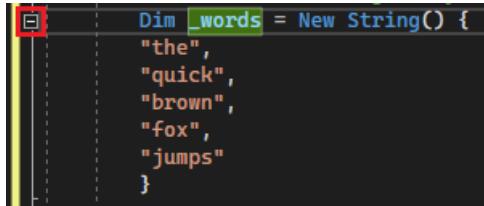
Collapse code blocks

You can collapse sections of code to focus just on the parts that are of interest to you. To practice, let's collapse the `_words` array to one line of code. Choose the small gray box with the minus sign inside it in the margin of the line that says `Dim _words = New String() {`. Or, if you're a keyboard user, place the cursor anywhere in the array definition and press **Ctrl+M, Ctrl+M**.



The code block collapses to just the first line, followed by an ellipsis (...). To expand the code block again, click the same gray box that now has a plus sign in it, or press **Ctrl+M, Ctrl+M** again. This feature is called **Outlining** and is especially useful when you're collapsing long methods or entire classes.

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```
Dim _words = New String() {
    "the",
    "quick",
    "brown",
    "fox",
    "jumps"
}
```

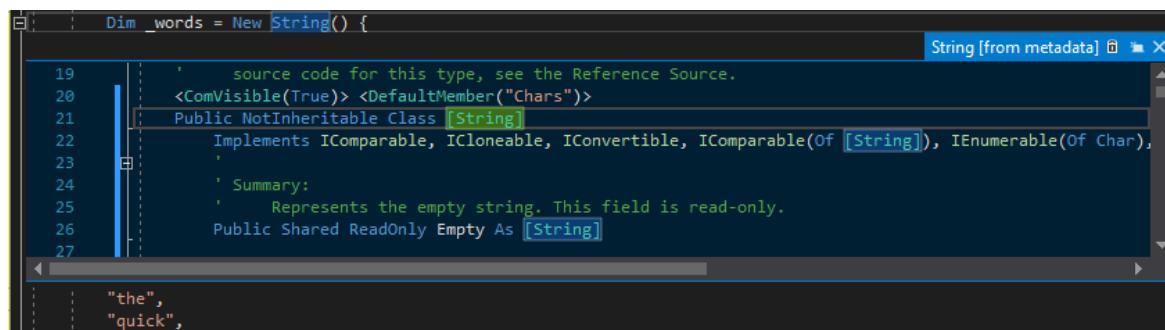
The code block collapses to just the first line, followed by an ellipsis (`...`). To expand the code block again, choose the same gray box that now has a plus sign in it, or press **Ctrl+M, Ctrl+M** again. This feature is called [Outlining](#) and is especially useful when you're collapsing long methods or entire classes.

View symbol definitions

The Visual Studio editor makes it easy to inspect the definition of a type, method, etc. One way is to navigate to the file that contains the definition, for example by choosing [Go to Definition](#) anywhere the symbol is referenced. An even quicker way that doesn't move your focus away from the file you're working in is to use [Peek Definition](#). Let's peek at the definition of the `String` type.

1. Right-click on the word `String` and choose [Peek Definition](#) from the content menu. Or, press **Alt+F12**.

A pop-up window appears with the definition of the `String` class. You can scroll within the pop-up window, or even peek at the definition of another type from the peeked code.



2. Close the peeked definition window by choosing the small box with an "x" at the top right of the pop-up window.

The Visual Studio editor makes it easy to inspect the definition of a type or class member. One way is to navigate to the file that contains the definition, for example by choosing [Go to Definition](#) anywhere the symbol is referenced. An even quicker way that doesn't move your focus away from the file you're working in is to use [Peek Definition](#). Let's peek at the definition of the `String` type.

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A pop-up window appears with the definition of the `String` class. You can scroll within the pop-up window, or even peek at the definition of another type from the peeked code.

A screenshot of the Visual Studio IDE showing the `String` class definition in the Object Browser. The code shows the declaration of the `String` class, its inheritance from `Object`, and its implementation of various interfaces like `IComparable`, `ICloneable`, etc. A tooltip for the `String` class is open, providing detailed information about its members.

2. Close the peek definition window by choosing the small box with an "x" at the top right of the pop-up window.

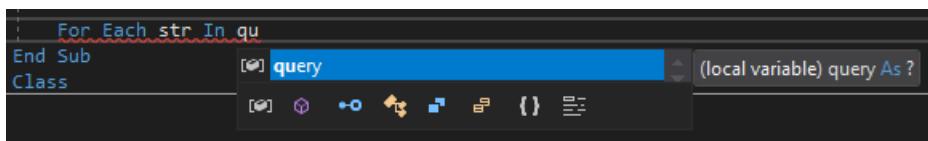
Use IntelliSense to complete words

IntelliSense is an invaluable resource when you're coding. It can show you information about available members of a type, or parameter details for different overloads of a method. You can also use IntelliSense to complete a word after you type enough characters to disambiguate it. Let's add a line of code to print out the ordered strings to the console window, which is the standard place for output from the program to go.

1. Below the `query` variable, start typing the following code:

```
For Each str In qu
```

You see IntelliSense show you **Quick Info** about the `query` symbol.



2. To insert the rest of the word `query` by using IntelliSense's word completion functionality, press **Tab**.
3. Finish off the code block to look like the following code.

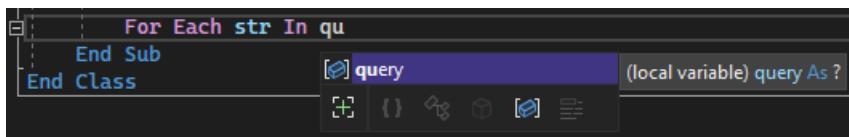
```
For Each str In query
    Console.WriteLine(str)
Next
```

IntelliSense is an invaluable resource when you're coding. It can show you information about available members of a type, or parameter details for different overloads of a method. You can also use IntelliSense to complete a word after you type enough characters to disambiguate it. Let's add a line of code to print out the ordered strings to the console window, which is the standard place for output from the program to go.

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```

You see IntelliSense show you **Quick Info** about the `query` symbol.



2. To insert the rest of the word `query` by using IntelliSense's word completion functionality, press **Tab**.
3. Finish off the code block to look like the following code.

```
For Each str In query
    Console.WriteLine(str)
Next
```

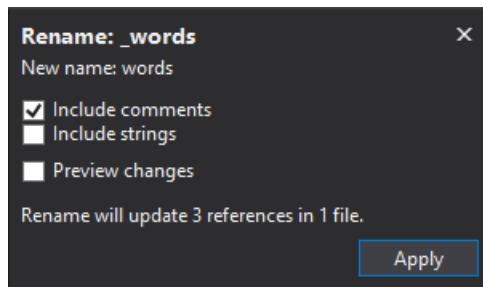
Refactor a name

Nobody gets code right the first time, and one of the things you might have to change is the name of a variable or method. Let's try out Visual Studio's [refactor](#) functionality to rename the `_words` variable to `words`.

1. Place your cursor over the definition of the `_words` variable and choose **Rename** from the right-click or context menu.

A pop-up **Rename** dialog box appears at the top right of the editor.

2. With the variable `_words` still selected, type in the desired name of `words`. Notice that the reference to `words` in the query is also automatically renamed. Before you press **Enter** or click **Apply**, select the **Include comments** checkbox in the **Rename** pop-up box.



3. Press **Enter** or click **Apply**.

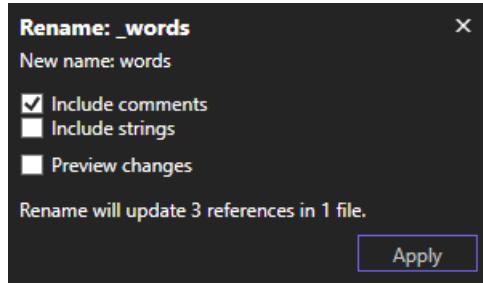
Both occurrences of `words` are renamed, as well as the reference to `words` in the code comment.

Nobody gets code right the first time, and one of the things you might have to change is the name of a variable or method. Let's try out Visual Studio's [refactor](#) functionality to rename the `_words` variable to `words`.

1. Place your cursor over the definition of the `_words` variable and choose **Rename** from the right-click or context menu.

A pop-up **Rename** dialog box appears at the top right of the editor.

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3. Press **Enter** or choose **Apply**.

Both occurrences of `words` are renamed, as well as the reference to `words` in the code comment.

Next steps

See also

- [Code snippets](#)
- [Navigate code](#)
- [Outlining](#)
- [Go To Definition and Peek Definition](#)
- [Refactoring](#)
- [Use IntelliSense](#)

Learn about projects and solutions using Visual Basic

11/13/2021 • 12 minutes to read • [Edit Online](#)

In this introductory article, we'll explore what it means to create a *solution* and a *project* in Visual Studio. A solution is a container that's used to organize one or more related code projects, for example a class library project and a corresponding test project. We'll look at the properties of a project and some of the files it can contain. We'll also create a reference from one project to another.

TIP

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

TIP

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

We'll construct a solution and project from scratch as an educational exercise to understand the concept of a project. In your general use of Visual Studio, you'll likely use some of the various project *templates* that Visual Studio offers when you create a new project.

NOTE

Solutions and projects aren't required to develop apps in Visual Studio. You can also just open a folder that contains code and start coding, building, and debugging. For example, if you clone a [GitHub](#) repo, it might not contain Visual Studio projects and solutions. For more information, see [Develop code in Visual Studio without projects or solutions](#).

Solutions and projects

Despite its name, a solution is not an "answer". A solution is simply a container used by Visual Studio to organize one or more related projects. When you open a solution in Visual Studio, it automatically loads all the projects that the solution contains.

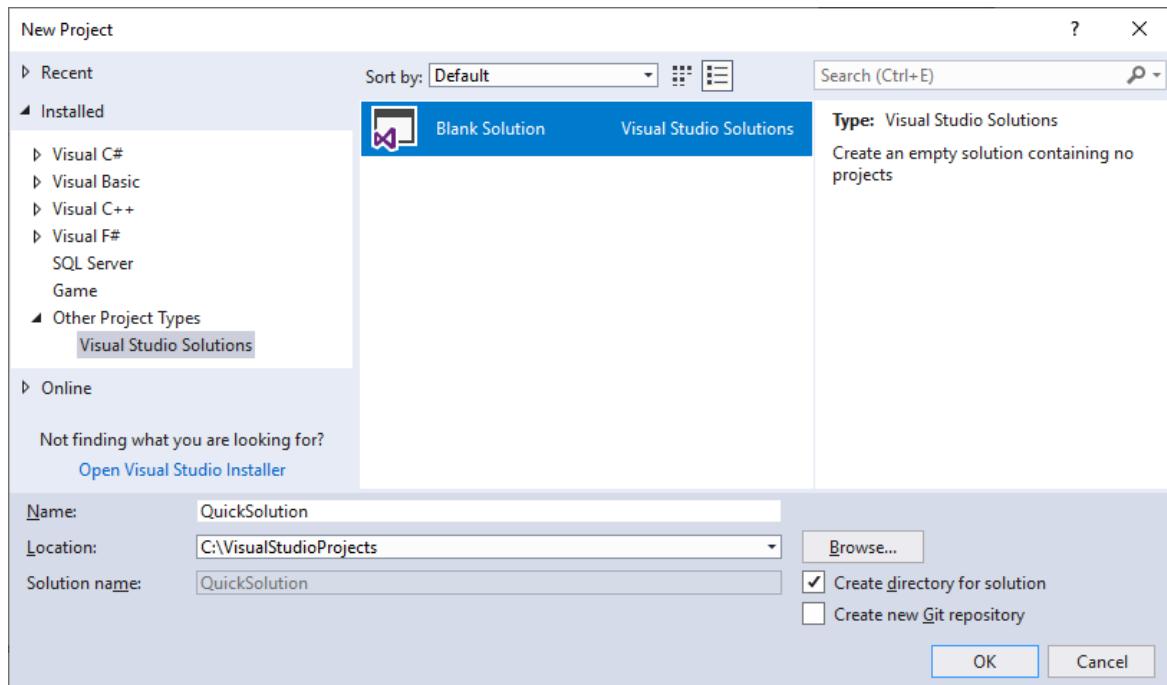
Create a solution

We'll start our exploration by creating an empty solution. After you get to know Visual Studio, you probably won't find yourself creating empty solutions often. When you create a new project, Visual Studio automatically creates a solution to house the project if there's not a solution already open.

1. Open Visual Studio.
2. On the menu bar, choose **File > New > Project**.

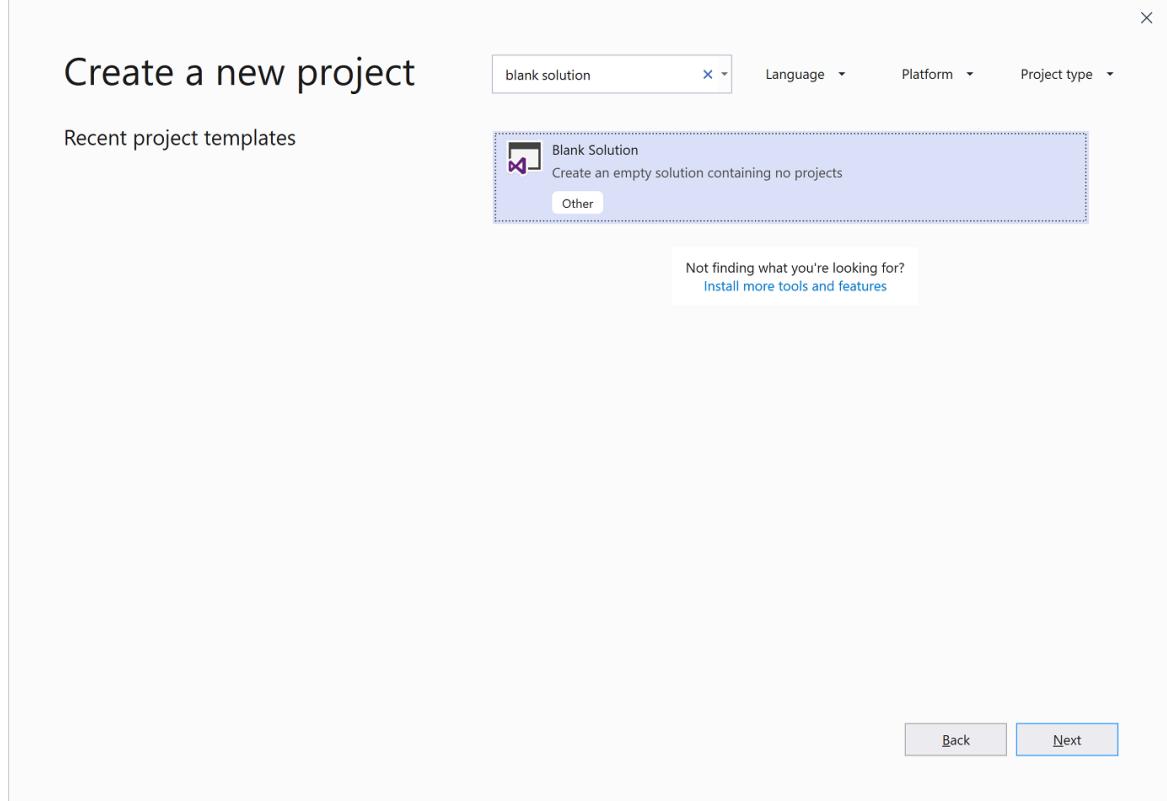
The **New Project** dialog box opens.

3. In the left pane, expand **Other Project Types**, then choose **Visual Studio Solutions**. In the center pane, choose the **Blank Solution** template. Name your solution **QuickSolution**, and then choose **OK**.



The Start Page closes, and a solution appears in **Solution Explorer** on the right-hand side of the Visual Studio window. You'll probably use **Solution Explorer** often, to browse the contents of your projects.

1. Open Visual Studio.
2. On the start window, choose **Create a new project**.
3. On the **Create a new project** page, enter **blank solution** into the search box, select the **Blank Solution** template, and then choose **Next**.

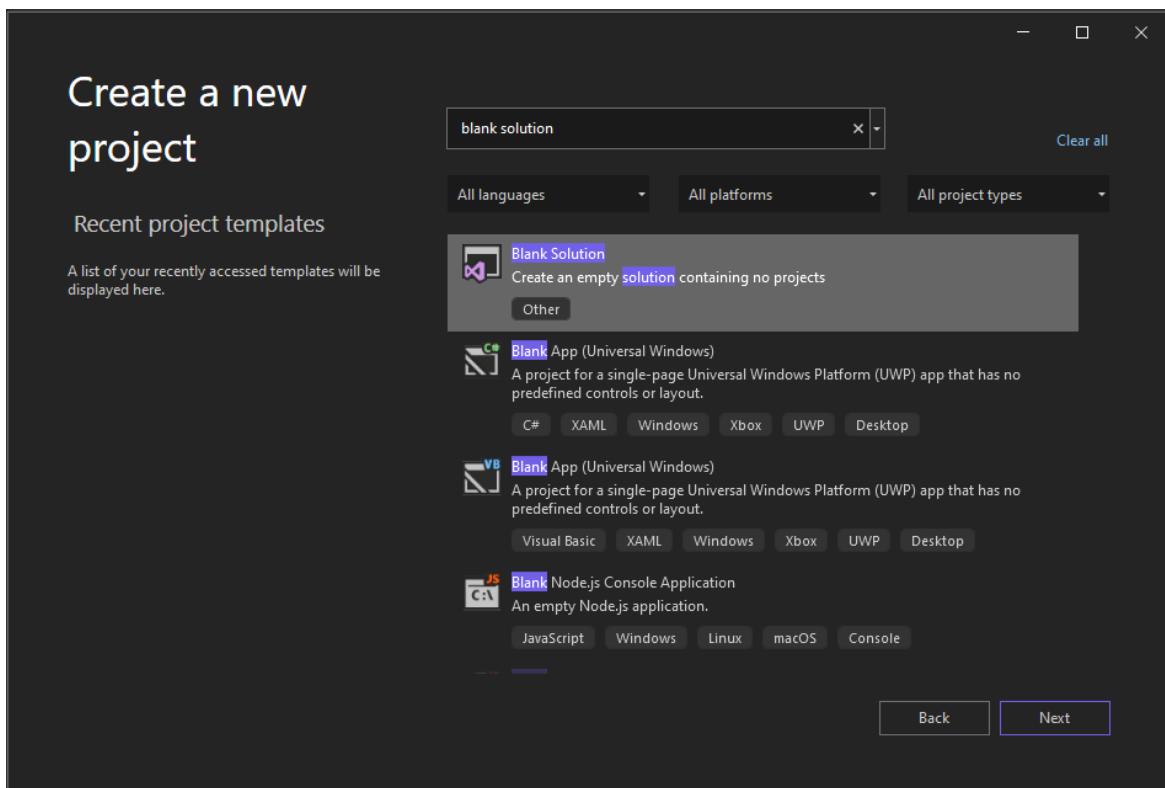


4. Name the solution **QuickSolution**, and then choose **Create**.

A solution appears in **Solution Explorer** on the right-hand side of the Visual Studio window. You'll probably use **Solution Explorer** often, to browse the contents of your projects.

1. Open Visual Studio.

2. On the start window, choose **Create a new project**.
3. On the **Create a new project** page, enter **blank solution** into the search box, select the **Blank Solution** template, and then choose **Next**.



4. Name the solution **QuickSolution**, and then choose **Create**.

A solution appears in **Solution Explorer** on the right-hand side of the Visual Studio window. You'll probably use **Solution Explorer** often, to browse the contents of your projects.

Add a project

Now let's add our first project to the solution. We'll start with an empty project and add the items we need to the project.

1. From the right-click or context menu of **Solution 'QuickSolution'** in **Solution Explorer**, choose **Add > New Project**.

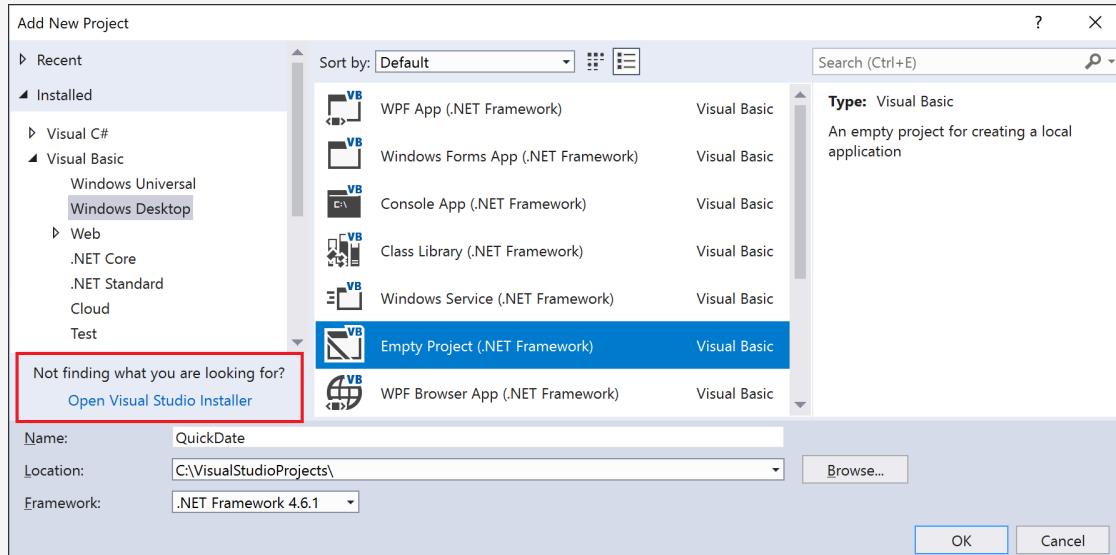
The **Add New Project** dialog box opens.

2. In the left pane, expand **Visual Basic** and choose **Windows Desktop**. Then, in the middle pane, choose the **Empty Project (.NET Framework)** template. Name the project **QuickDate**, then choose the **OK** button.

A project named QuickDate appears beneath the solution in **Solution Explorer**. Currently it contains a single file called *App.config*.

NOTE

If you don't see **Visual Basic** in the left pane of the dialog box, you need to install the **.NET desktop development** Visual Studio *workload*. Visual Studio uses workload-based installation to only install the components you need for the type of development you do. An easy way to install a new workload is to choose the **Open Visual Studio Installer** link in the bottom left corner of the **Add New Project** dialog box. After Visual Studio Installer launches, choose the **.NET desktop development** workload and then the **Modify** button.

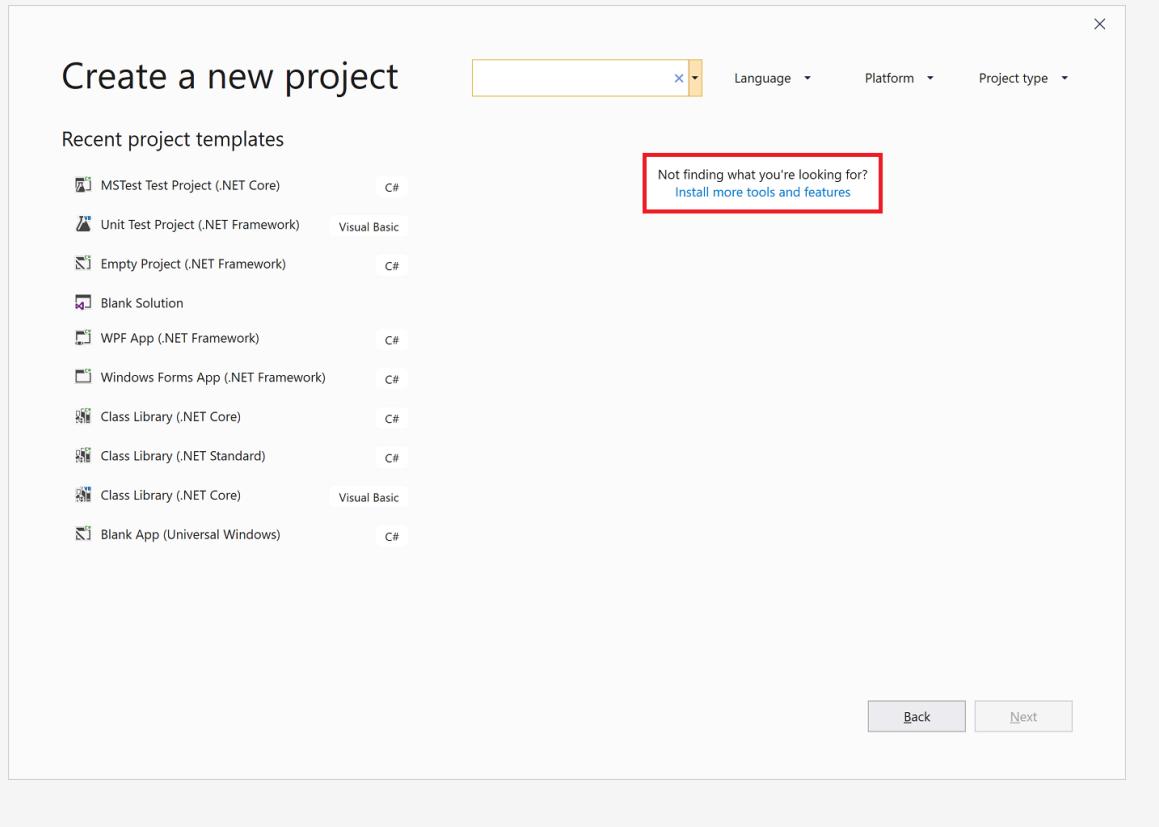


1. From the right-click or context menu of **Solution 'QuickSolution'** in **Solution Explorer**, choose **Add > New Project**.
2. Enter the text **empty** into the search box at the top, and then select **Visual Basic** under **Language**.
3. Select the **Empty Project (.NET Framework)** template, and then choose **Next**.
4. Name the project **QuickDate**, then choose **Create**.

A project named **QuickDate** appears beneath the solution in **Solution Explorer**. Currently it contains a single file called *App.config*.

NOTE

If you don't see the **Empty Project (.NET Framework)** template, you need to install the **.NET desktop development** Visual Studio *workload*. Visual Studio uses workload-based installation to only install the components you need for the type of development you do. An easy way to install a new workload when you're creating a new project is to choose the **Install more tools and features** link under the text that says **Not finding what you're looking for?**. After Visual Studio Installer launches, choose the **.NET desktop development** workload and then the **Modify** button.



1. From the right-click or context menu of **Solution 'QuickSolution'** in **Solution Explorer**, choose **Add > New Project**.

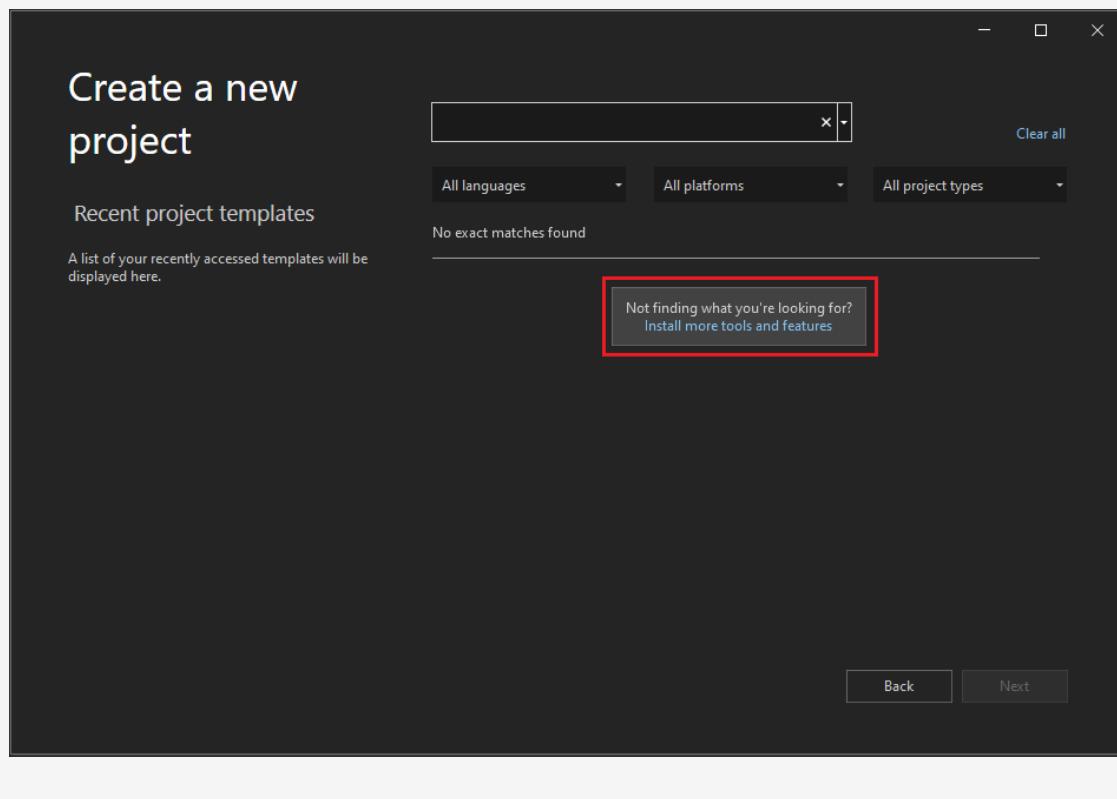
A dialog box opens that says **Add a new project**.

2. Enter the text **empty** into the search box at the top, and then select **Visual Basic** in the **All languages** drop-down list.
3. Select the **Empty Project (.NET Framework)** template, and then choose **Next**.
4. Name the project **QuickDate**, then choose **Create**.

A project named **QuickDate** appears beneath the solution in **Solution Explorer**. Currently it contains a single file called *App.config*.

NOTE

If you don't see the **Empty Project (.NET Framework)** template, you need to install the **.NET desktop development** Visual Studio *workload*. Visual Studio uses workload-based installation to only install the components you need for the type of development you do. An easy way to install a new workload when you're creating a new project is to choose the **Install more tools and features** link under the text that says **Not finding what you're looking for?**. After Visual Studio Installer launches, choose the **.NET desktop development** workload and then the **Modify** button.



Add an item to the project

We have an empty project. Let's add a code file.

1. From the right-click or context menu of the **QuickDate** project in **Solution Explorer**, choose **Add > New Item**.

The **Add New Item** dialog box opens.

2. Expand **Common Items**, then choose **Code**. In the middle pane, choose the **Class** item template. Name the class **Calendar**, and then choose the **Add** button.

A file named *Calendar.vb* is added to the project. The *.vb* on the end is the file extension that's given to Visual Basic code files. The file appears in the visual project hierarchy in **Solution Explorer**, and its contents open in the editor.

3. Replace the contents of the *Calendar.vb* file with the following code:

```
Class Calendar
    Public Shared Function GetCurrentDate() As Date
        Return DateTime.Now.Date
    End Function
End Class
```

The `Calendar` class contains a single function, `GetCurrentDate`, that returns the current date.

4. Open the project properties by double-clicking **My Project** in Solution Explorer. On the Application tab, change **Application type** to **Class Library**. This step is necessary to build the project successfully.
5. Build the project by right-clicking on **QuickDate** in Solution Explorer and choosing **Build**. You should see a successful build message in the **Output** window.

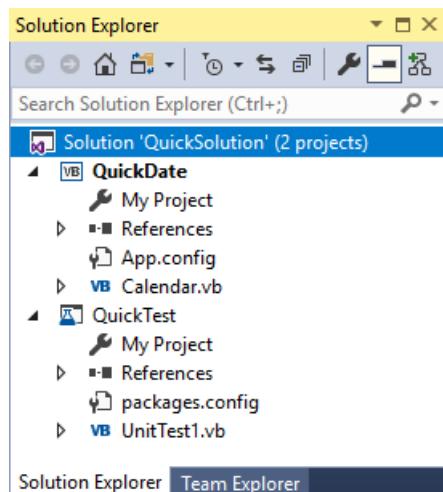
Add a second project

It's common for solutions to contain more than one project, and often these projects reference each other. Some projects in a solution might be class libraries, some executable applications, and some might be unit test projects or websites.

Let's add a unit test project to our solution. This time we'll start from a project template so we don't have to add an additional code file to the project.

1. From the right-click or context menu of **Solution 'QuickSolution'** in **Solution Explorer**, choose **Add > New Project**.
2. In the left pane, expand **Visual Basic** and choose the **Test** category. In the middle pane, choose the **Unit Test Project (.NET Framework)** project template. Name the project **QuickTest**, and then choose **OK**.

A second project is added to **Solution Explorer**, and a file named *UnitTest1.vb* opens in the editor.



2. In the **Add a new project** dialog box, enter the text **unit test** into the search box at the top, and then select **Visual Basic** under **Language**.
3. Choose the **Unit Test Project (.NET Framework)** project template, and then choose **Next**.
4. Name the project **QuickTest**, and then choose **Create**.

A second project is added to **Solution Explorer**, and a file named *UnitTest1.vb* opens in the editor.

2. In the **Add a new project** dialog box, enter the text **unit test** into the search box at the top, and then select **Visual Basic** in the **All languages** drop-down list.
3. Choose the **Unit Test Project (.NET Framework)** project template, and then choose **Next**.
4. Name the project **QuickTest**, and then choose **Create**.

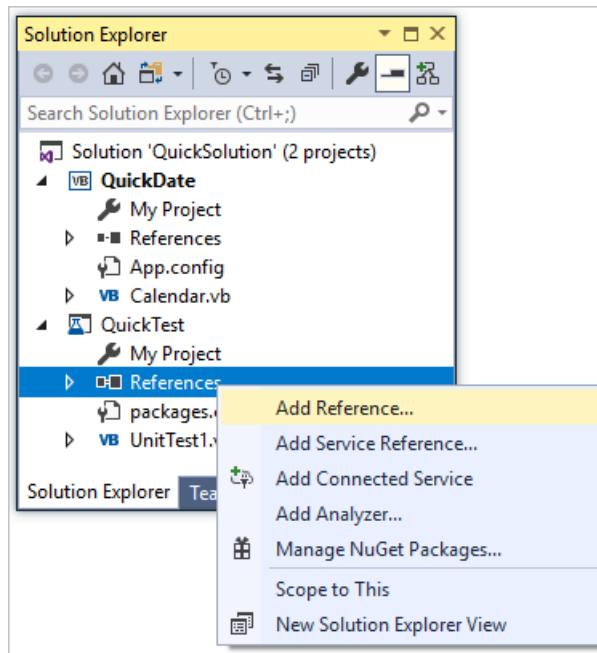
A second project is added to **Solution Explorer**, and a file named *UnitTest1.vb* opens in the editor.

Add a project reference

We're going to use the new unit test project to test our method in the **QuickDate** project, so we need to add a reference to that project. The reference creates a *build dependency* between the two projects, meaning that

when you build the solution, **QuickDate** is built before **QuickTest**.

1. Choose the **References** node in the **QuickTest** project, and from the right-click or context menu, choose **Add Reference**.

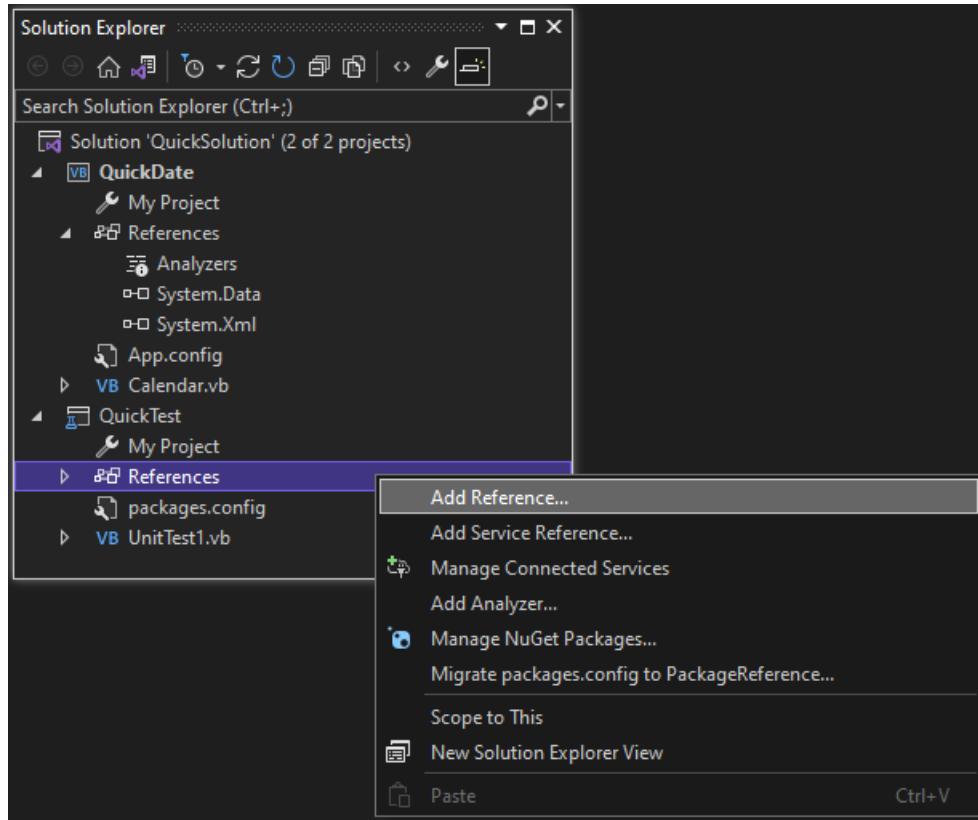


The **Reference Manager** dialog box opens.

2. In the left pane, expand **Projects** and choose **Solution**. In the middle pane, choose the checkbox next to **QuickDate**, and then choose the **OK** button.

A reference to the **QuickDate** project is added.

1. Choose the **References** node in the **QuickTest** project, and from the right-click or context menu, choose **Add Reference**.



The **Reference Manager** dialog box opens.

2. In the left pane, expand **Projects** and choose **Solution**. In the middle pane, choose the checkbox next to **QuickDate**, and then choose the **OK** button.

A reference to the **QuickDate** project is added.

Add test code

1. Now we'll add test code to the Visual Basic code file. Replace the contents of *UnitTest1.vb* with the following code.

```
<TestClass()> Public Class UnitTest1

    <TestMethod()> Public Sub TestGetCurrentDate()
        Assert.AreEqual(Date.Now.Date, QuickDate.Calendar.GetCurrentDate())
    End Sub

End Class
```

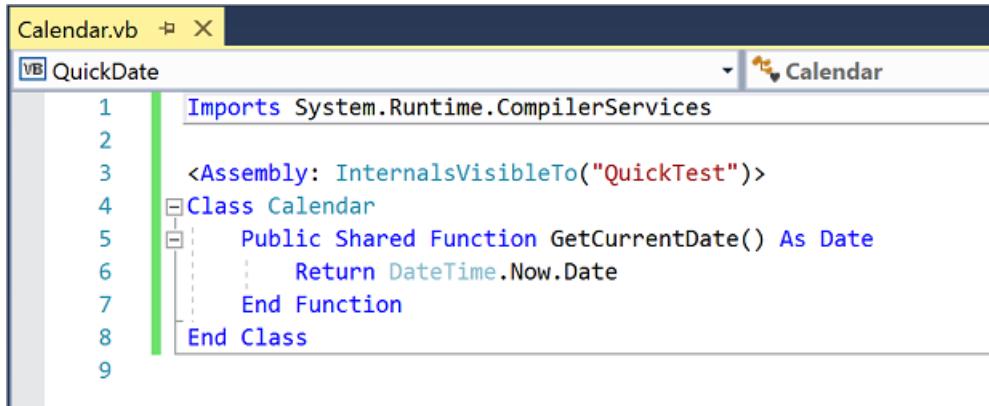
You'll see a red squiggle under some of the code. We'll fix this error by making the test project a [friend assembly](#) to the **QuickDate** project.

2. Back in the **QuickDate** project, open the *Calendar.vb* file if it's not already open, and add the following [Imports statement](#) and [InternalsVisibleToAttribute](#) attribute, to resolve the error in the test project.

```
Imports System.Runtime.CompilerServices

<Assembly: InternalsVisibleTo("QuickTest")>
```

The code file should look like this:



1. Now we'll add test code to the Visual Basic code file. Replace the contents of *UnitTest1.vb* with the following code.

```
<TestClass()> Public Class UnitTest1

    <TestMethod()> Public Sub TestGetCurrentDate()
        Assert.AreEqual(Date.Now.Date, QuickDate.Calendar.GetCurrentDate())
    End Sub

End Class
```

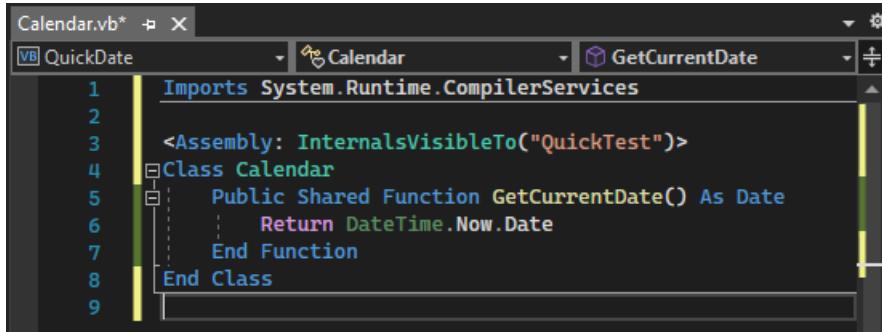
You'll see a red squiggle under some of the code. We'll fix this error by making the test project a [friend assembly](#) to the **QuickDate** project.

2. Back in the **QuickDate** project, open the *Calendar.vb* file if it's not already open, and add the following

[Imports statement](#) and [InternalsVisibleToAttribute](#) attribute, to resolve the error in the test project.

```
Imports System.Runtime.CompilerServices  
  
<Assembly: InternalsVisibleTo("QuickTest")>
```

The code file should look like this:



A screenshot of a code editor window titled "Calendar.vb". The code is as follows:

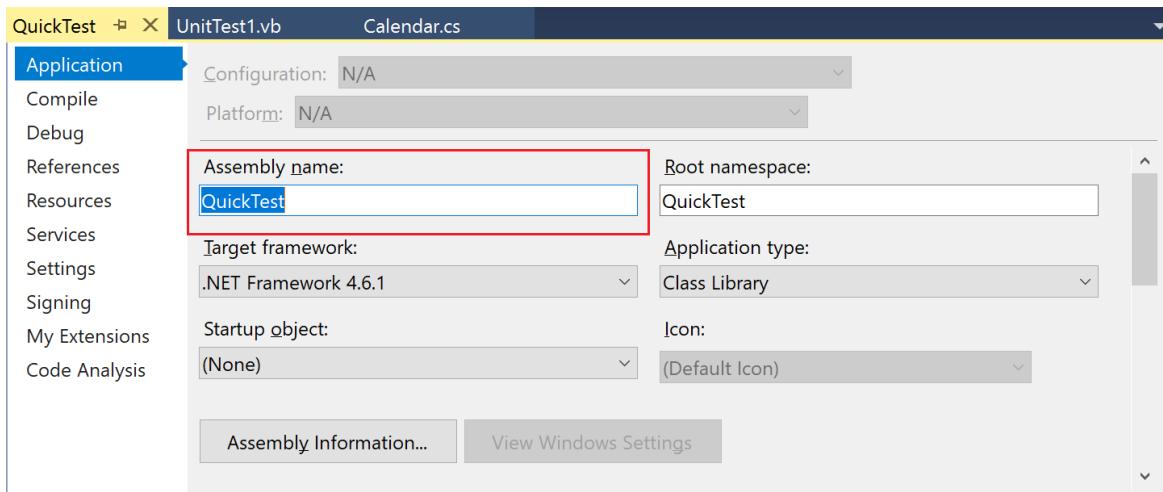
```
Imports System.Runtime.CompilerServices  
  
<Assembly: InternalsVisibleTo("QuickTest")>  
Class Calendar  
    Public Shared Function GetCurrentDate() As Date  
        Return DateTime.Now.Date  
    End Function  
End Class
```

Project properties

The line in the *Calendar.vb* file that contains the [InternalsVisibleToAttribute](#) attribute references the assembly name (file name) of the **QuickTest** project. The assembly name might not always be the same as the project name. To find the assembly name of a project, open the project properties.

1. In **Solution Explorer**, select the **QuickTest** project. From the right-click or context menu, select **Properties**, or just press **Alt+Enter**. (You can also double-click **My Project** in **Solution Explorer**.)

The *property pages* for the project open on the **Application** tab. The property pages contain various settings for the project. Notice that the assembly name of the **QuickTest** project is indeed "QuickTest". If you wanted to change the assembly name, this is where you'd do that. Then, when you build the test project, the name of the resulting binary file would change from *QuickTest.dll* to whatever you chose.



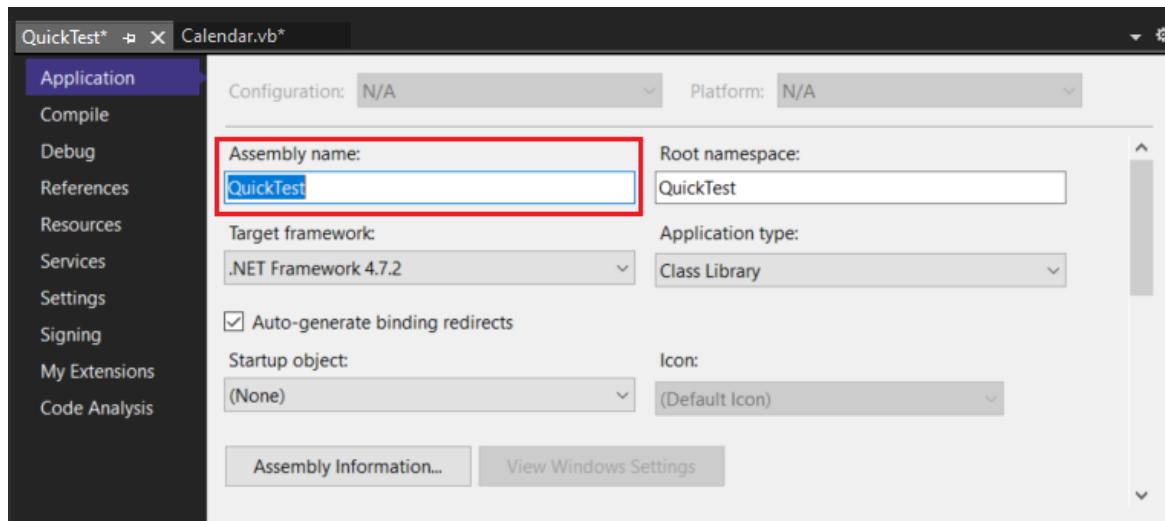
2. Explore some of the other tabs of the project's property pages, such as **Compile** and **Settings**. These tabs are different for different types of projects.

The line in the *Calendar.vb* file that contains the [InternalsVisibleToAttribute](#) attribute, references the assembly name (file name) of the **QuickTest** project. The assembly name might not always be the same as the project name. To find the assembly name of a project, open the project properties.

1. In **Solution Explorer**, select the **QuickTest** project. From the right-click or context menu, select **Properties**, or just press **Alt+Enter**. (You can also double-click **My Project** in **Solution Explorer**.)

The *property pages* for the project open on the **Application** tab. The property pages contain various

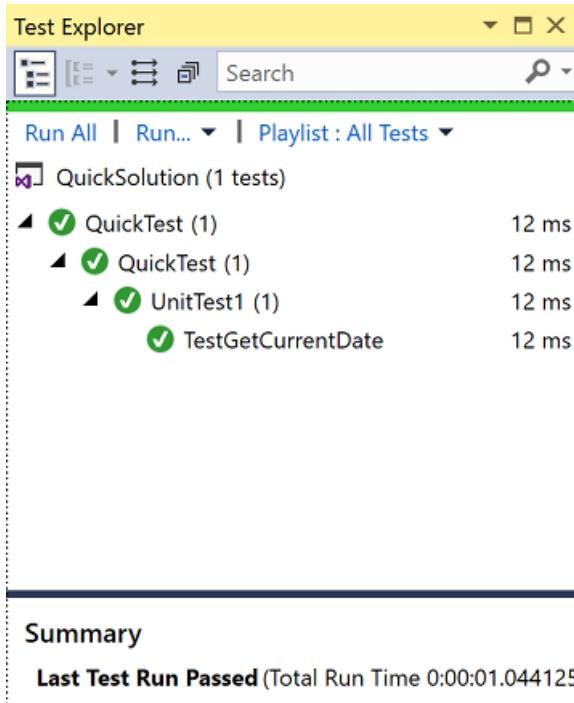
settings for the project. Notice that the assembly name of the **QuickTest** project is indeed "QuickTest". If you wanted to change the assembly name, this is where you'd do that. Then, when you build the test project, the name of the resulting binary file would change from *QuickTest.dll* to whatever you chose.



2. Explore some of the other tabs of the project's property pages, such as **Compile** and **Settings**. These tabs are different for different types of projects.

(Optional) Run the test

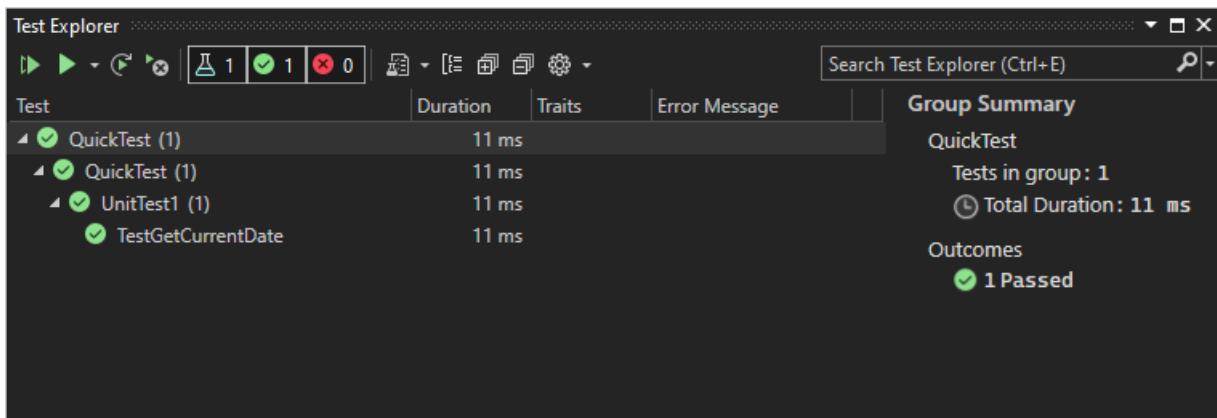
If you want to check that your unit test is working, choose **Test > Run > All Tests** from the menu bar. A window called **Test Explorer** opens, and you should see that the **TestGetCurrentDate** test passes.



TIP

If **Test Explorer** doesn't open automatically, open it by choosing **Test > Windows > Test Explorer** from the menu bar.

If you want to check that your unit test is working, choose **Test > Run All Tests** from the menu bar. A window called **Test Explorer** opens, and you should see that the **TestGetCurrentDate** test passes.



TIP

If Test Explorer doesn't open automatically, open it by choosing **Test > Windows > Test Explorer** from the menu bar.

Next steps

If you want to further explore Visual Studio, consider creating an app by following one of the [Visual Basic tutorials](#).

See also

- [Create projects and solutions](#)
- [Manage project and solution properties](#)
- [Manage references in a project](#)
- [Develop code in Visual Studio without projects or solutions](#)
- [Visual Studio IDE overview](#)

Features of Visual Studio

11/13/2021 • 8 minutes to read • [Edit Online](#)

This article describes features for experienced developers, or developers who are already familiar with Visual Studio. For a basic introduction to Visual Studio, see the [Visual Studio IDE overview](#).

Modular installation

In Visual Studio's modular installer, you choose and install the *workloads* you want. Workloads are groups of features that programming languages or platforms need to work. This modular strategy helps keep the Visual Studio installation footprint smaller, so it installs and updates faster.

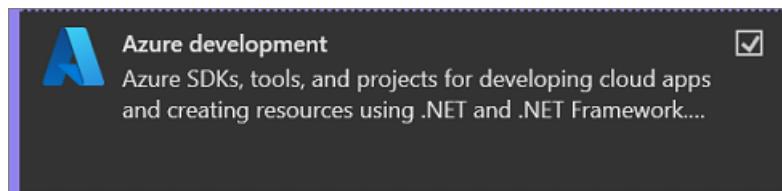
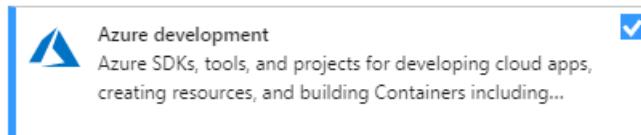
If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

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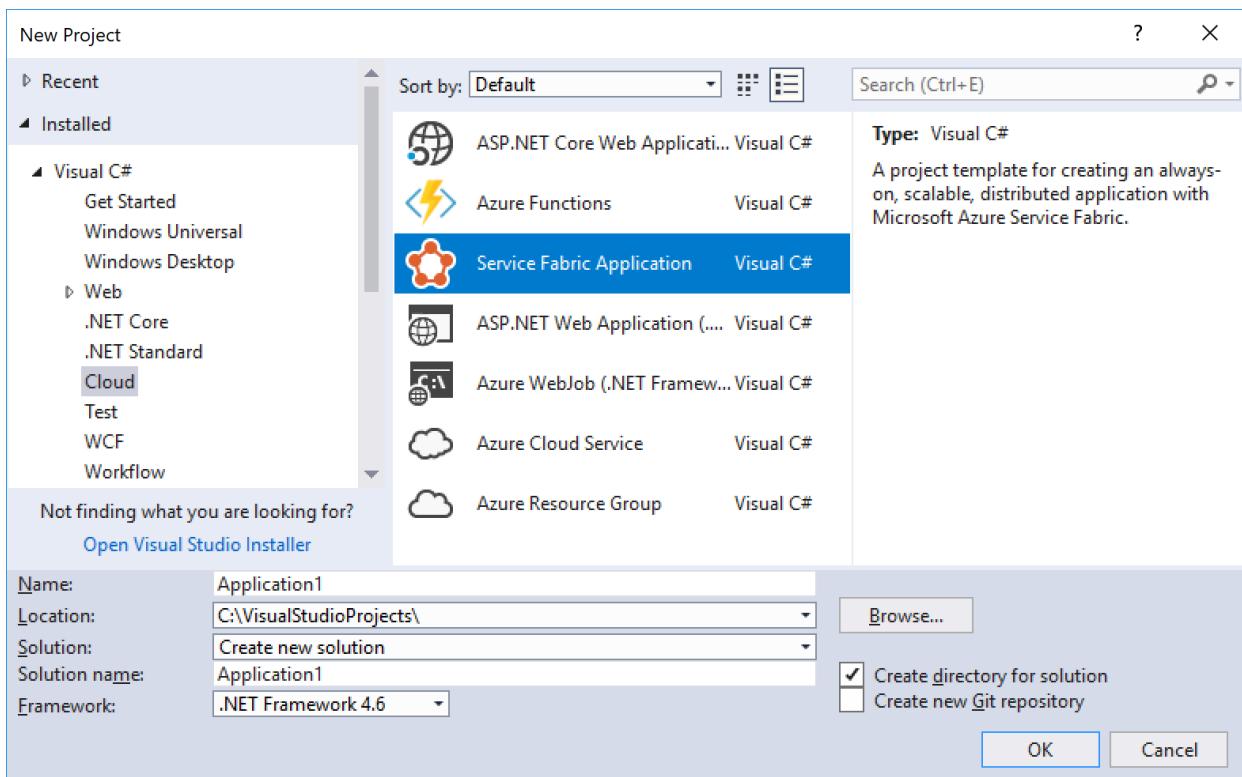
To learn more about setting up Visual Studio on your system, see [Install Visual Studio](#).

Create cloud-enabled Azure apps

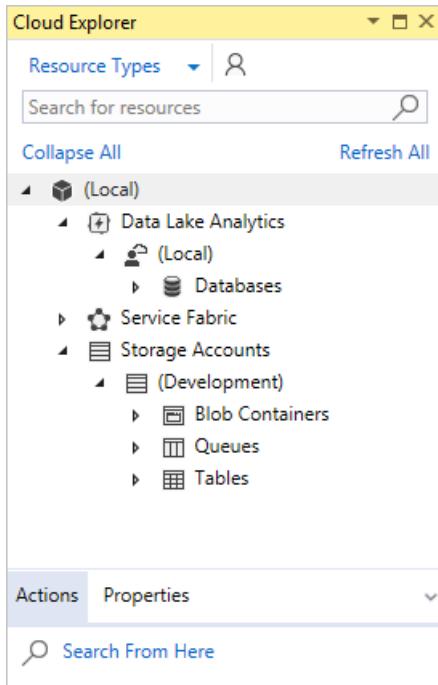
Visual Studio has a suite of tools to easily create Microsoft Azure cloud-enabled applications. You can configure, build, debug, package, and deploy Azure apps and services directly from the Visual Studio integrated development environment (IDE). To get the Azure tools and project templates, select the **Azure development** workload when you install Visual Studio.



After you install the **Azure development** workload, the following **Cloud** templates for C# are available in the **New Project** dialog:



In Visual Studio, use [Cloud Explorer](#) to view and manage your Azure-based cloud resources. Cloud resources might include virtual machines (VMs), tables, and SQL databases. [Cloud Explorer](#) shows the Azure resources in all the accounts under the Azure subscription you're signed into. If an operation requires the Azure portal, [Cloud Explorer](#) has links to the place in the portal you need to go.



IMPORTANT

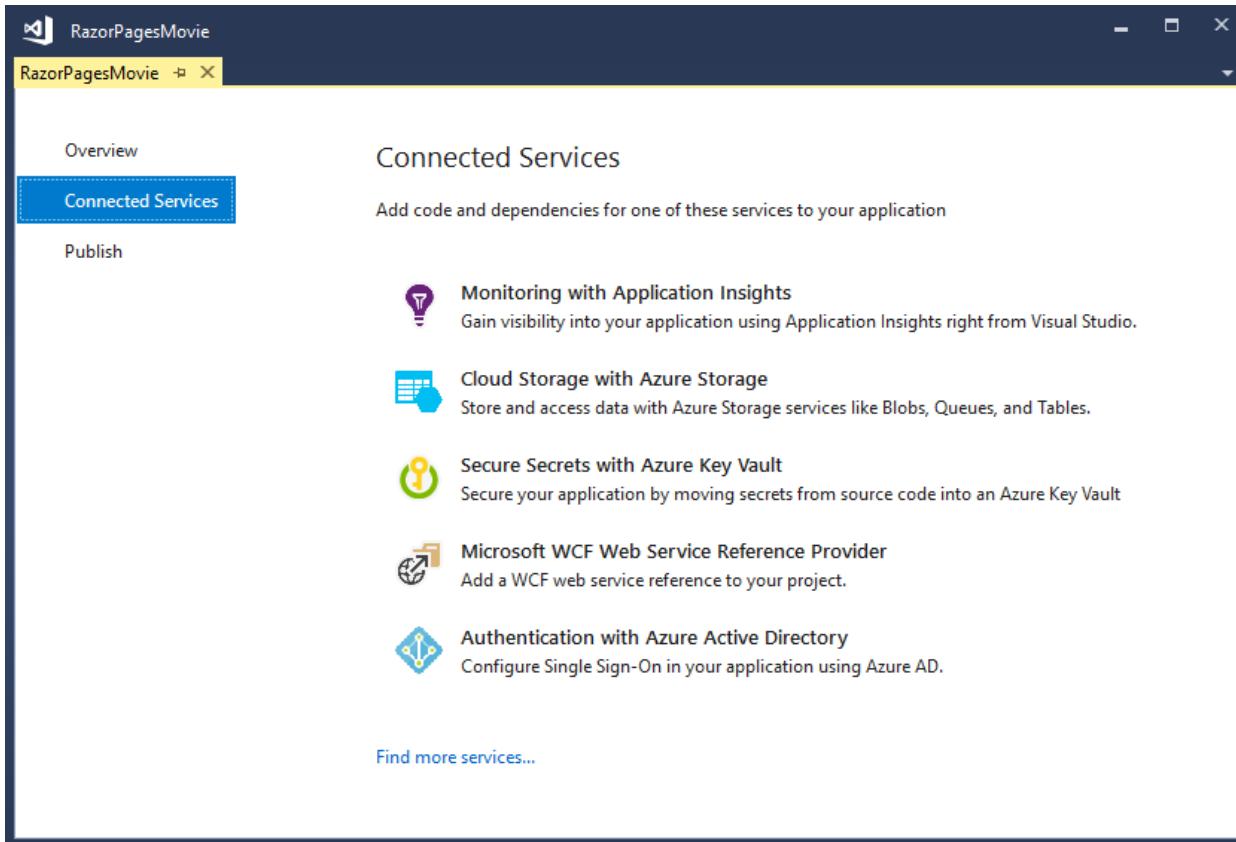
The Cloud Explorer window is retired in Visual Studio 2022. For more information, see [Manage the resources associated with your Azure accounts in Visual Studio Cloud Explorer](#).

Use the Azure portal to access Azure resources as necessary. You can continue to use the Azure node of Server Explorer in previous versions of Visual Studio.

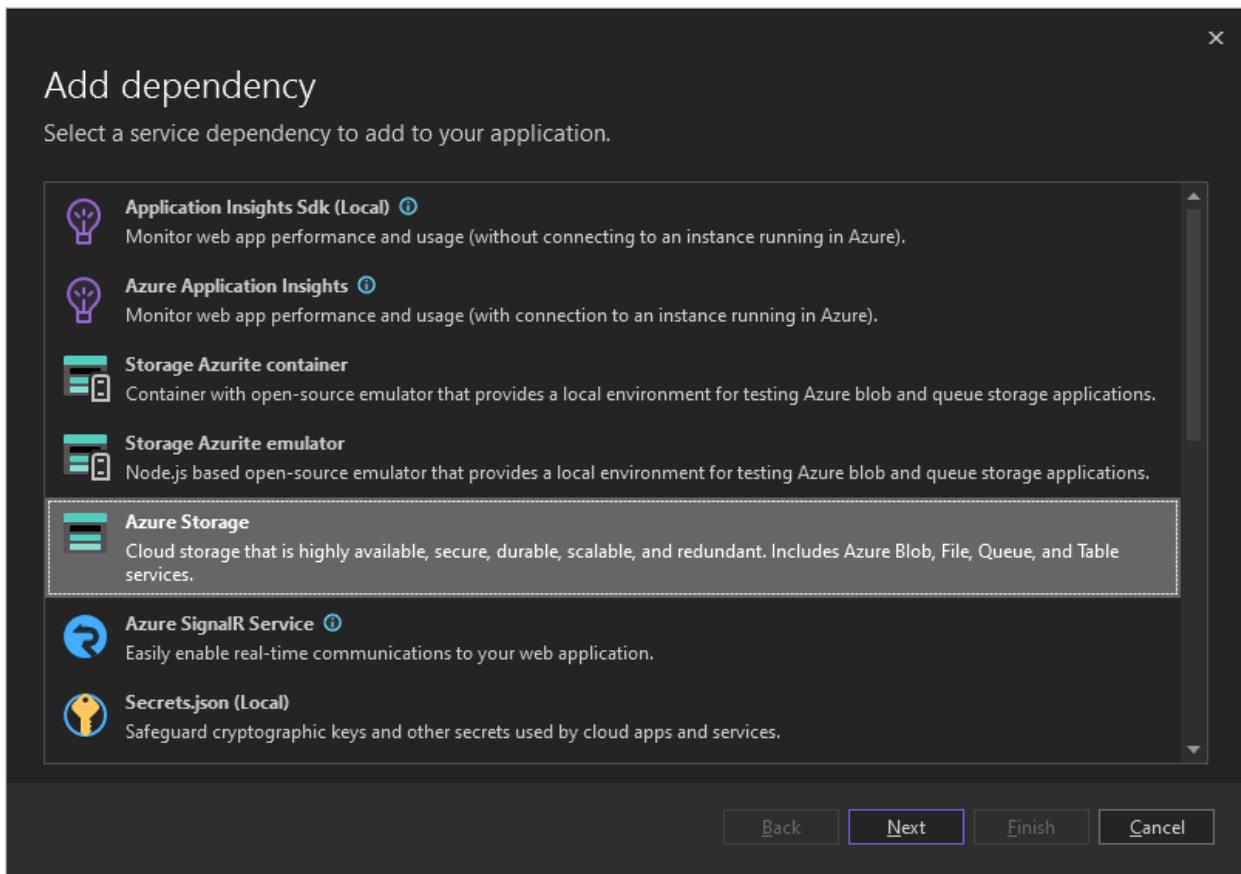
You can use Azure services for your apps by adding [Connected Services](#), such as:

- [Active Directory connected service](#), to use [Azure Active Directory](#) (Azure AD) accounts to connect to web apps
- [Azure Storage connected service](#) for blob storage, queues, and tables
- [Key Vault connected service](#) to manage secrets for web apps

The available **Connected Services** depend on your project type. Add a service by right-clicking the project in **Solution Explorer** and choosing **Add > Connected Service**.



On the **Connected Services** screen, select the link or the plus sign to **Add a service dependency**. On the **Add dependency** screen, select the service you want to add, and follow the screens to connect to your Azure subscription and service.



For more information, see [Move to the cloud With Visual Studio and Azure](#).

Create web apps

Visual Studio can help you write apps for the web. You can create web apps by using ASP.NET, Node.js, Python, JavaScript, and TypeScript. Visual Studio supports many web frameworks, such as Angular, jQuery, and Express.

[ASP.NET Core](#) and .NET Core run on Windows, Mac, and Linux operating systems. ASP.NET Core is a major update to MVC, WebAPI, and SignalR. ASP.NET Core is designed from the ground up to provide a lean and composable .NET stack for building modern cloud-based web apps and services.

For more information, see [Modern web tooling](#).

Build cross-platform apps and games

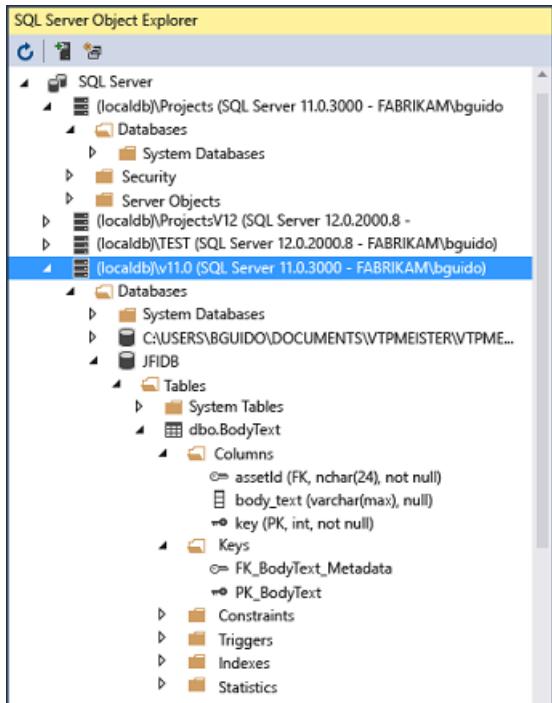
Visual Studio can build apps and games for macOS, Linux, and Windows, and for Android, iOS, and other [mobile devices](#). With Visual Studio, you can build:

- [.NET Core](#) apps that run on Windows, macOS, and Linux.
- Mobile apps for iOS, Android, and Windows in C# and F# by using [Xamarin](#).
- 2D and 3D games in C# by using [Visual Studio Tools for Unity](#).
- Native C++ apps for iOS, Android, and Windows devices. Share common code in iOS, Android, and Windows libraries by using [C++ for cross-platform development](#).

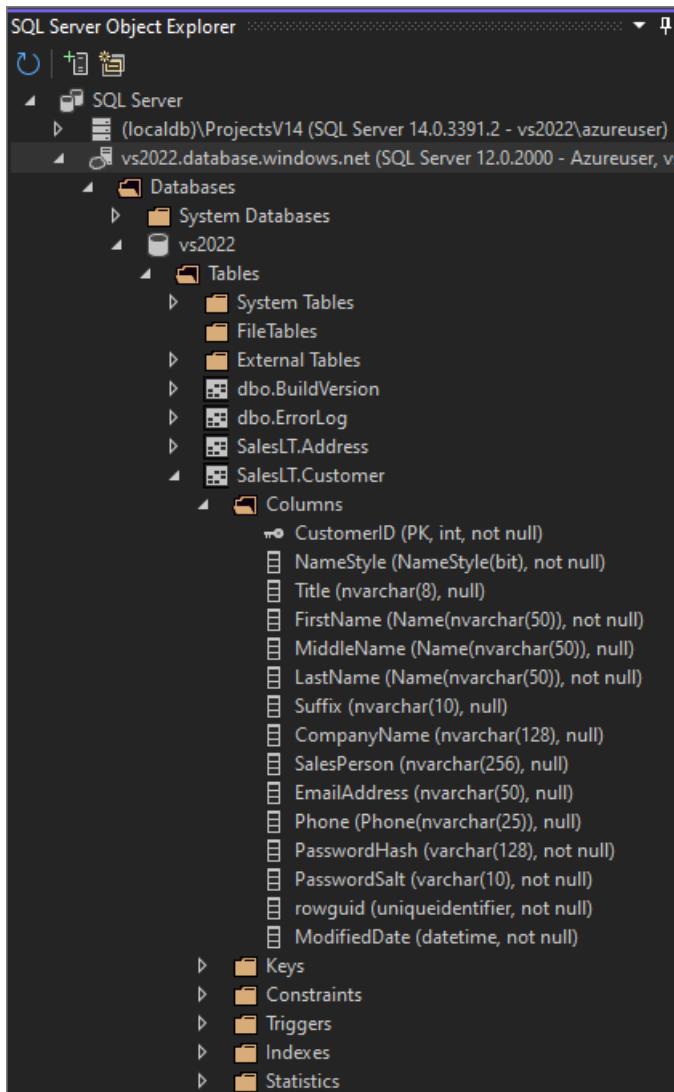
Connect to databases

[Server Explorer](#) helps you browse and manage server instances and assets locally, remotely, and on Azure, Microsoft 365, Salesforce.com, and websites. To open [Server Explorer](#), choose [View > Server Explorer](#). For more information on using Server Explorer, see [Add new connections](#).

SQL Server Object Explorer provides a view of your database objects, similar to SQL Server Management Studio. With SQL Server Object Explorer, you can do light-duty database administration and design work. Examples include editing table data, comparing schemas, and executing queries by using contextual menus.



To open **SQL Server Object Explorer**, select its icon at the top of the **Server Explorer** window, or select **View > SQL Server Object Explorer** from the Visual Studio top menu.



[SQL Server Data Tools \(SSDT\)](#) is a powerful development environment for SQL Server, Azure SQL Database, and Azure SQL Data Warehouse. With SSDT, you can build, debug, maintain, and refactor databases. You can work with a database project, or directly with a connected database instance on- or off-premises. To get SSDT, use the Visual Studio Installer to install the **Data storage and processing** workload.

Debug, test, and improve your code

When you write code, you should run it and test it for bugs and performance. With Visual Studio's debugging system, you can debug code running in your local project, on a remote device, or on a [device emulator](#). Step through code one statement at a time, and inspect variables as you go. Or set breakpoints that are only hit when a specified condition is true. You can manage debug options in the code editor itself, so you don't have to leave your code.

For more information about debugging in Visual Studio, see [First look at the debugger](#).

To improve app performance, check out the Visual Studio [profiling](#) feature.

Visual Studio offers [testing](#) options like unit testing, Live Unit Testing, IntelliTest, and load and performance testing. Visual Studio also has advanced [code analysis](#) capabilities to find design, security, and other flaws.

Deploy your finished application

Visual Studio has tools to deploy your app to users or customers through the Microsoft Store, a SharePoint site, or InstallShield or Windows Installer technologies. You can access all these options through the Visual Studio IDE. For more information, see [Deploy applications, services, and components](#).

Manage your source code and collaborate with others

In Visual Studio, you can manage your source code in Git repos hosted by any provider, including GitHub. You can also browse for an Azure DevOps Server to connect to, too.

For full details, see the [Git experience in Visual Studio](#) page and the [Visual Studio version control documentation](#) navigation page. And, for a step-by-step tutorial on how to connect to a Git or Azure DevOps repository by using Visual Studio, see the [Open a project from a repo](#) page.

TIP

We continue to build out the Git feature set and iterate on it based on your feedback. For more info about a recent feature update along with a link to survey where you can share your feedback on it, see the [Multi-repo support in Visual Studio](#) blog post.

How you open a project from a GitHub repo by using Visual Studio 2019 depends on which version you have. Specifically, if you've installed version [version 16.8](#) or later, there's a new, more fully integrated [Git experience in Visual Studio](#) available to you. For more information, see the [Visual Studio version control documentation](#) page.

And, for a step-by-step tutorial on how to connect to a Git or Azure DevOps repository by using Visual Studio, see the [Open a project from a repo](#) page.

To learn more about managing Git repos in Visual Studio by using [Team Explorer](#), see [Get started with Git and Azure Repos](#). To learn more the Visual Studio built-in source control features, see the [Git features in Visual Studio](#) blog post.

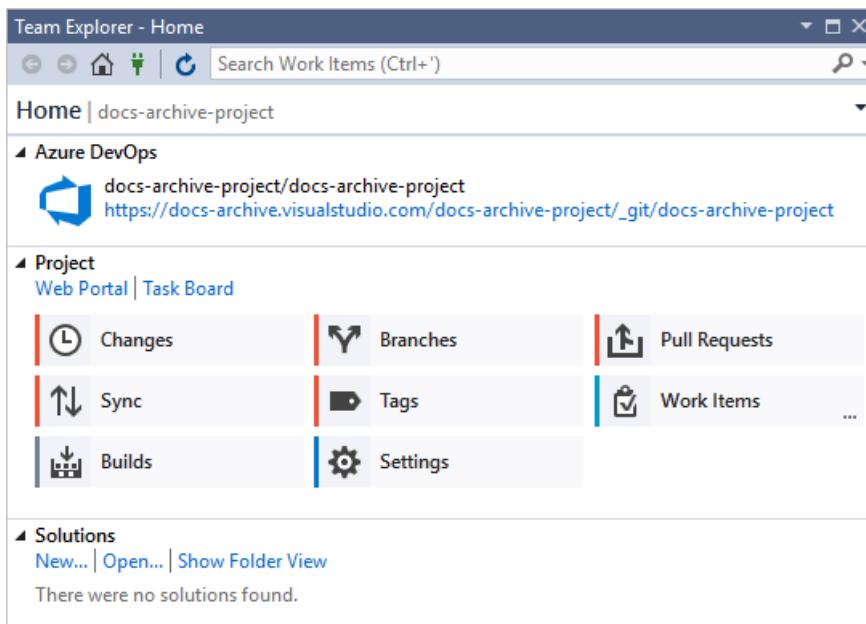
[Azure DevOps Services](#) is a suite of cloud-based services that plan, host, automate, and deploy software and promote team collaboration. DevOps Services supports both GitHub distributed version control and Team Foundation Version Control (TFVC) centralized version control. DevOps Services provides continuous build and

release (CI/CD) pipelines for code stored in version control systems. DevOps Services also supports Scrum, CMMI, and Agile development methodologies. You can use DevOps Services to manage code along with bugs and work items for your project.

Team Foundation Server (TFS) is the application lifecycle management hub for Visual Studio. It enables everyone involved with the development process to participate using a single solution. TFS is useful for managing heterogeneous teams and projects, too.

You can connect to an Azure DevOps organization or a Team Foundation Server on your network through the Visual Studio **Team Explorer** window. From the **Team Explorer** window, you can check code into or out of source control, manage work items, start builds, and access team rooms and workspaces. To open **Team Explorer**, use the search box, or select **View > Team Explorer**.

The following image shows the **Team Explorer** window for a solution that's hosted in Azure DevOps Services.



Azure DevOps is an application lifecycle management hub for Visual Studio. Azure DevOps enables everyone involved with the development process to participate using a single solution. Azure DevOps is also useful for managing heterogeneous teams and projects.

You can connect to an Azure DevOps organization or Azure DevOps Server on your network through the **Team Explorer** window in Visual Studio. From the **Team Explorer** window, you can check code into or out of source control, manage work items, start builds, and access team rooms and workspaces. To open **Team Explorer**, use the search box, or select **View > Team Explorer**.

You can also automate your build process to build code that developers check into version control. For example, you can build one or more projects nightly, or every time certain code is checked in. For more information, see [Azure Pipelines](#).

Next steps

- If Visual Studio doesn't have the exact functionality you need, you can add it. Personalize the IDE based on your workflow and style, add support for external tools that aren't integrated with Visual Studio, and modify existing functionality to increase your productivity. For the latest version of the Visual Studio Extensibility Tools (VS SDK), see [Visual Studio SDK](#).
- You can use the .NET Compiler Platform *Roslyn* to write your own code analyzers and code generators. Find everything you need at [Roslyn](#).
- Find [existing extensions](#) for Visual Studio created by Microsoft developers and the Visual Studio

development community.

- To learn more about extending Visual Studio, see [Extend Visual Studio IDE](#).

See also

- [Visual Studio IDE overview](#)
- [What's new in Visual Studio 2017](#)
- [What's new in Visual Studio 2019](#)
- [What's new in Visual Studio 2022](#)

Tutorial: Get started with Visual Basic in Visual Studio

11/13/2021 • 10 minutes to read • [Edit Online](#)

In this tutorial for Visual Basic (VB), you'll use Visual Studio to create and run a few different console apps and explore some features of the [Visual Studio integrated development environment \(IDE\)](#) while you do so.

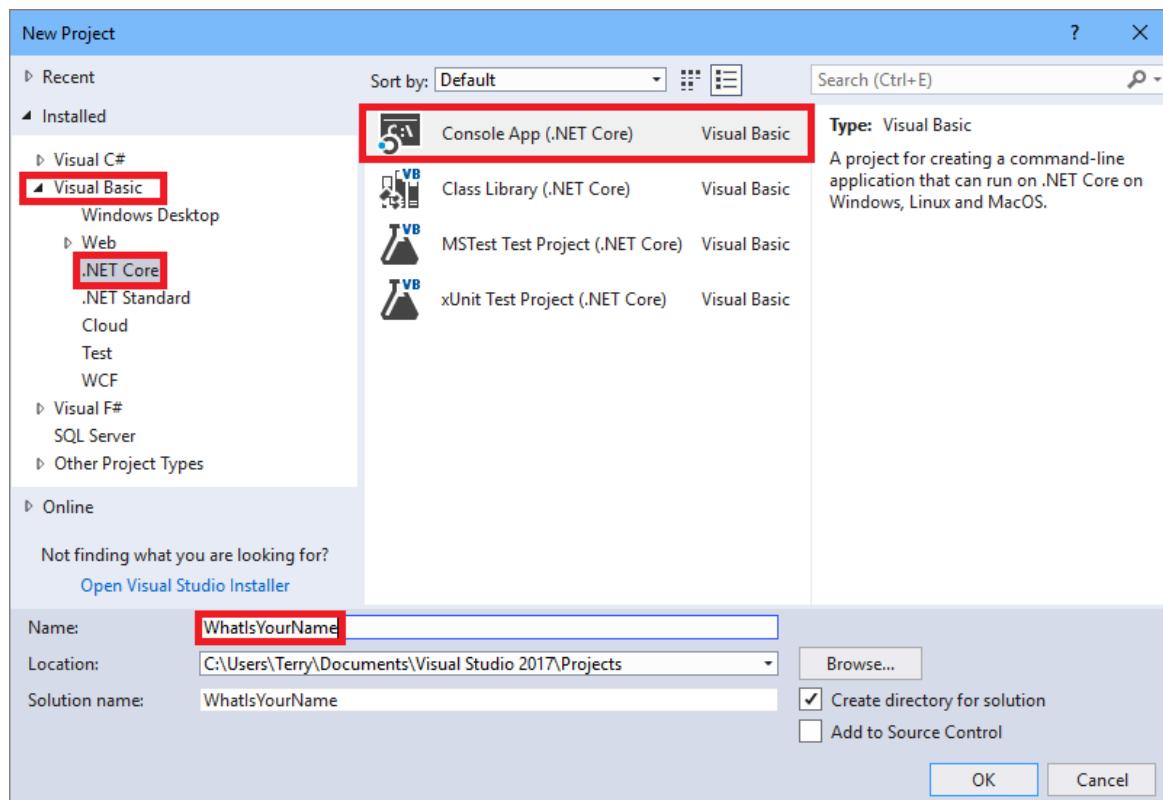
If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

Create a project

First, we'll create a Visual Basic application project. The project type comes with all the template files you'll need, before you've even added anything!

1. Open Visual Studio 2017.
2. From the top menu bar, choose **File > New > Project**.
3. In the **New Project** dialog box in the left pane, expand **Visual Basic**, and then choose **.NET Core**. In the middle pane, choose **Console App (.NET Core)**. Then name the project *What'sYourName*.

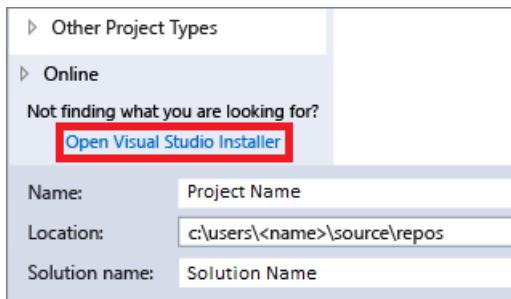


Add a workload (optional)

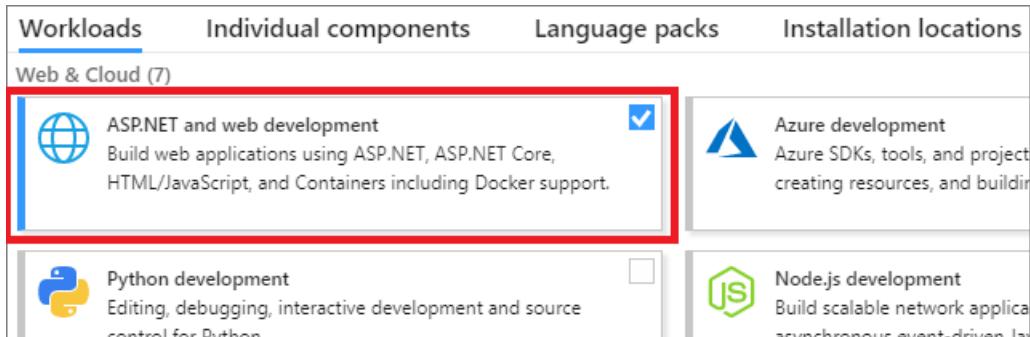
If you don't see the **Console App (.NET Core)** project template, you can get it by adding the **.NET Core cross-platform development** workload. You can add this workload in one of the two following ways, depending on which Visual Studio 2017 updates are installed on your machine.

Option 1: Use the New Project dialog box

1. Click the [Open Visual Studio Installer](#) link in the left pane of the **New Project** dialog box.



2. The Visual Studio Installer launches. Choose the **.NET Core cross-platform development** workload, and then choose **Modify**.



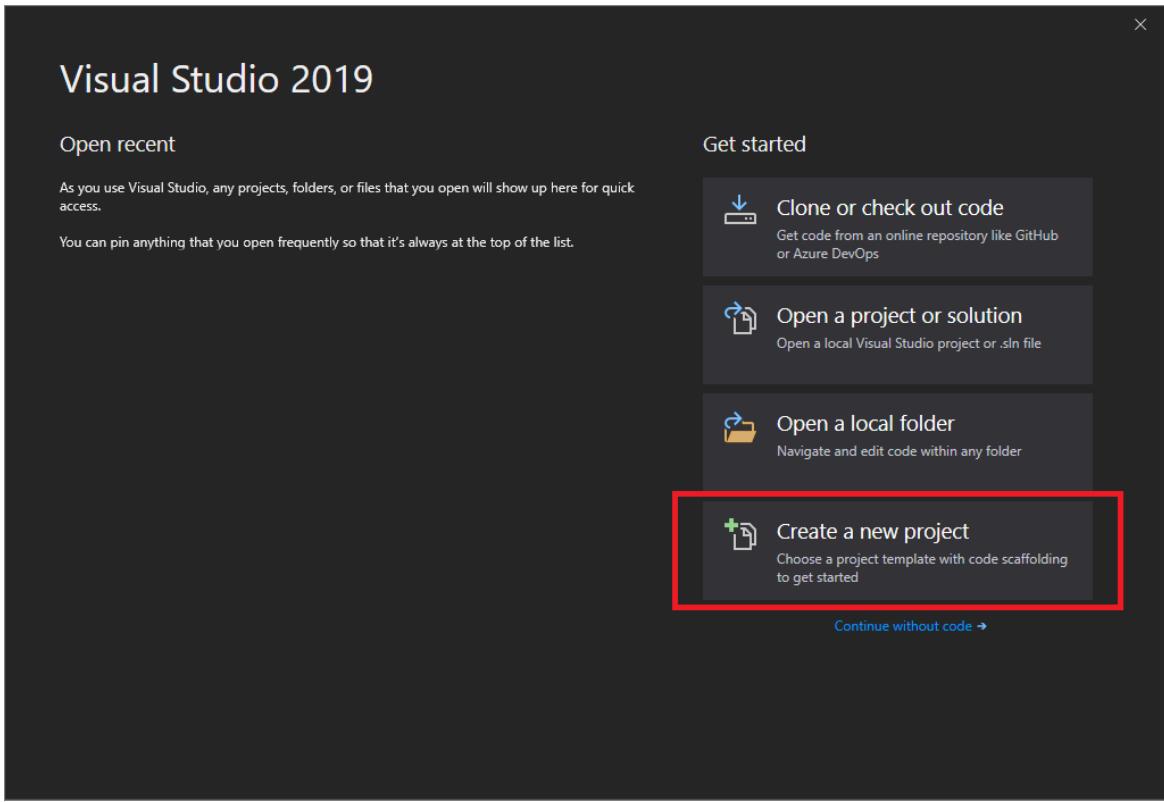
Option 2: Use the Tools menu bar

1. Cancel out of the **New Project** dialog box and from the top menu bar, choose **Tools > Get Tools and Features**.
2. The Visual Studio Installer launches. Choose the **.NET Core cross-platform development** workload, and then choose **Modify**.

NOTE

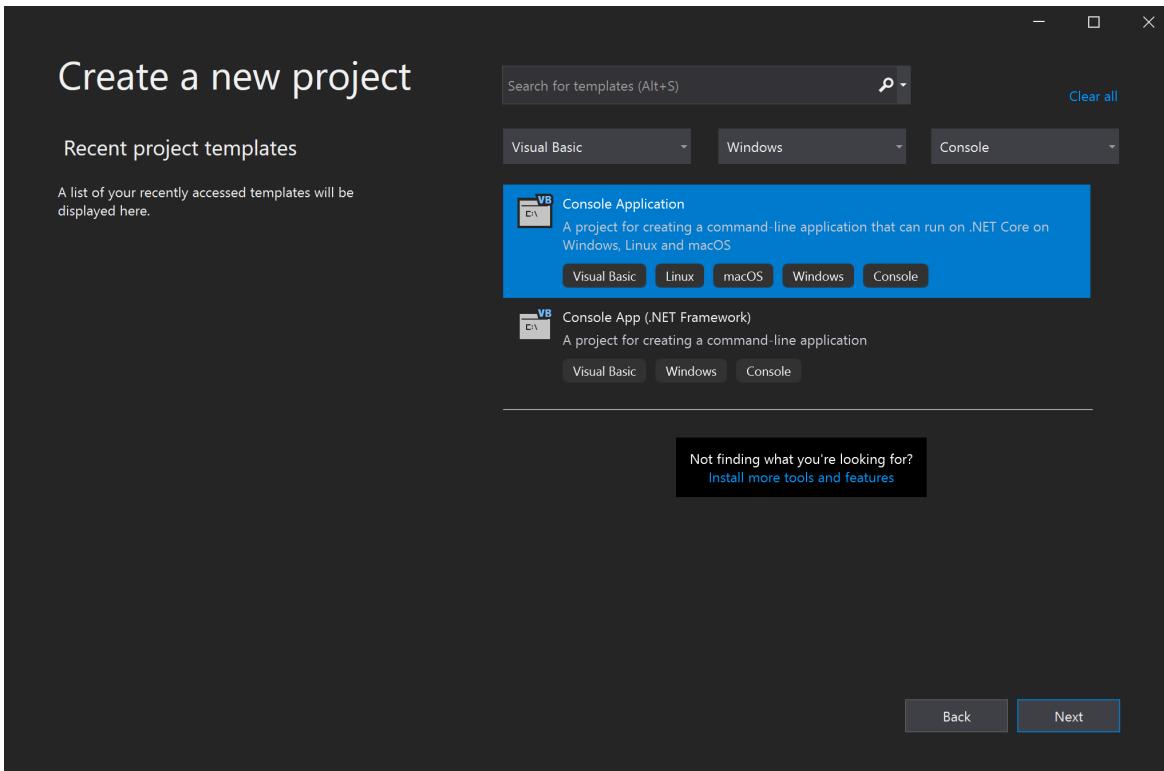
Some of the screenshots in this tutorial use the dark theme. If you aren't using the dark theme but would like to, see the [Personalize the Visual Studio IDE and Editor](#) page to learn how.

1. Open Visual Studio.
2. On the start window, choose **Create a new project**.



3. In the **Create a new project** window, choose **Visual Basic** from the Language list. Next, choose **Windows** from the Platform list and **Console** from the project types list.

After you apply the language, platform, and project type filters, choose the **Console Application** template, and then choose **Next**.

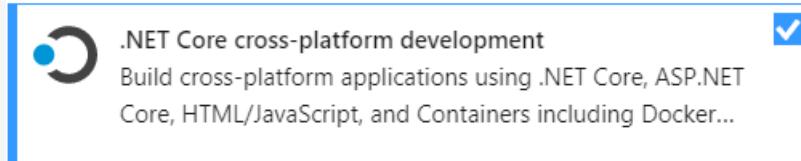


NOTE

If you do not see the **Console Application** template, you can install it from the **Create a new project** window. In the **Not finding what you're looking for?** message, choose the **Install more tools and features** link.

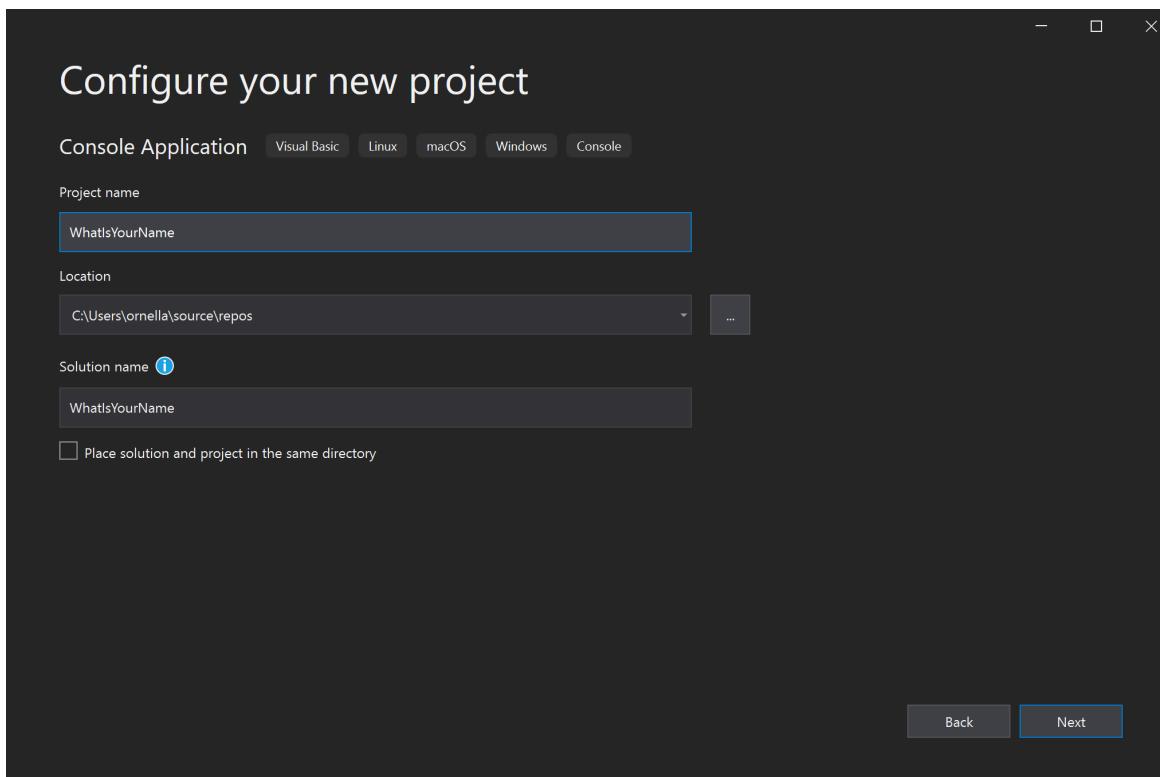
Not finding what you're looking for?
[Install more tools and features](#)

Then, in the Visual Studio Installer, choose the **.NET Core cross-platform development** workload.

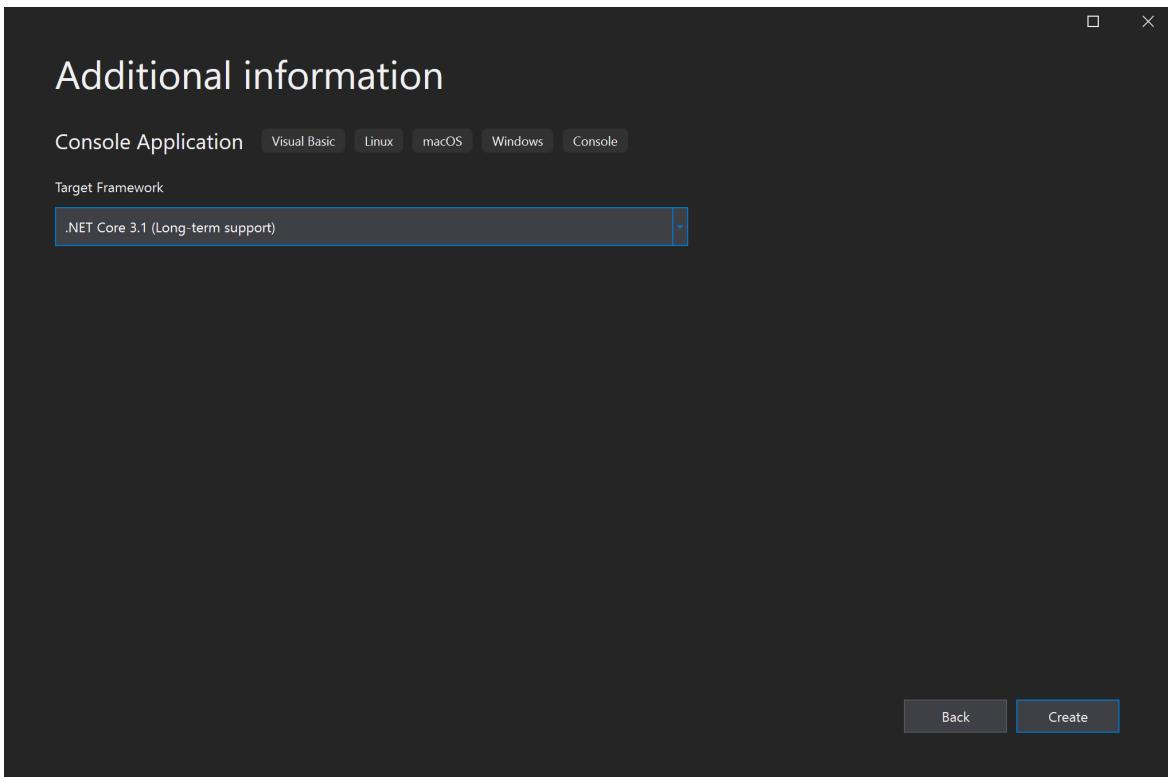


After that, choose the **Modify** button in the Visual Studio Installer. You might be prompted to save your work; if so, do so. Next, choose **Continue** to install the workload. Then, return to step 2 in this "[Create a project](#)" procedure.

4. In the **Configure your new project** window, type or enter *WhatIsYourName* in the **Project name** box. Then, choose **Next**.

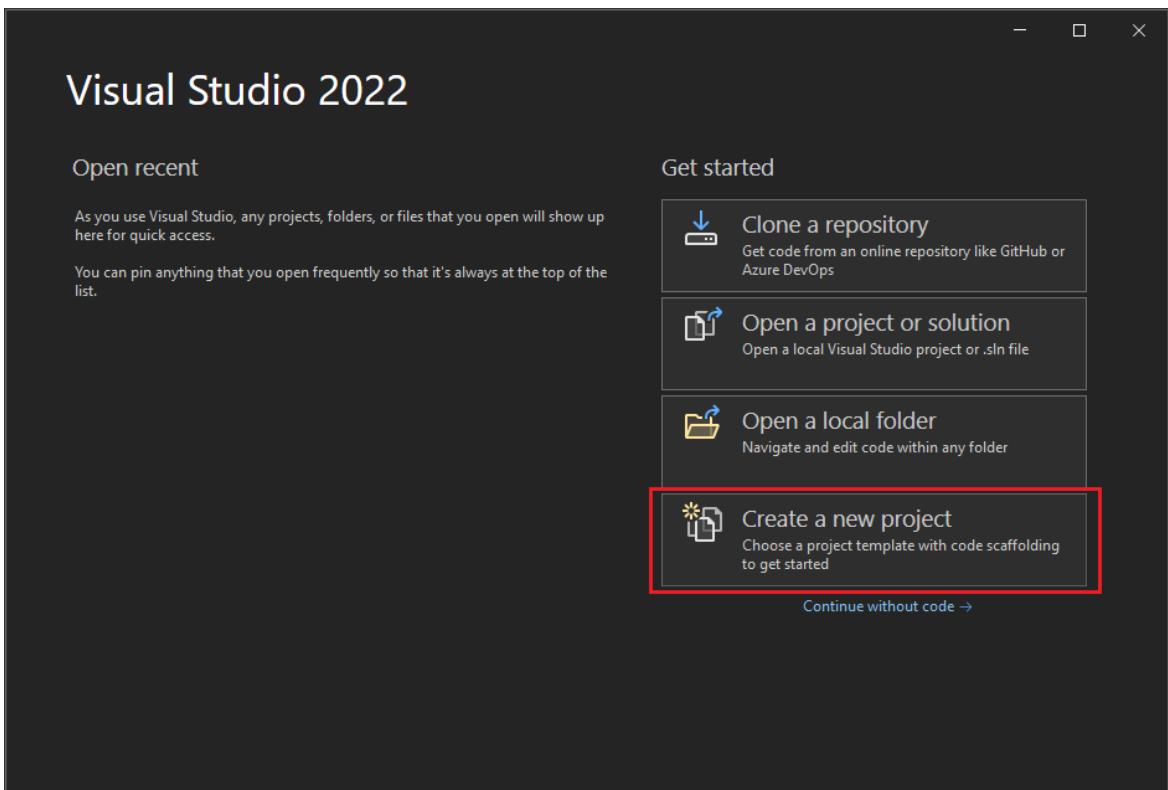


5. In the **Additional information** window, **.NET Core 3.1** should already be selected for your target framework. If not, select **.NET Core 3.1**. Then, choose **Create**.



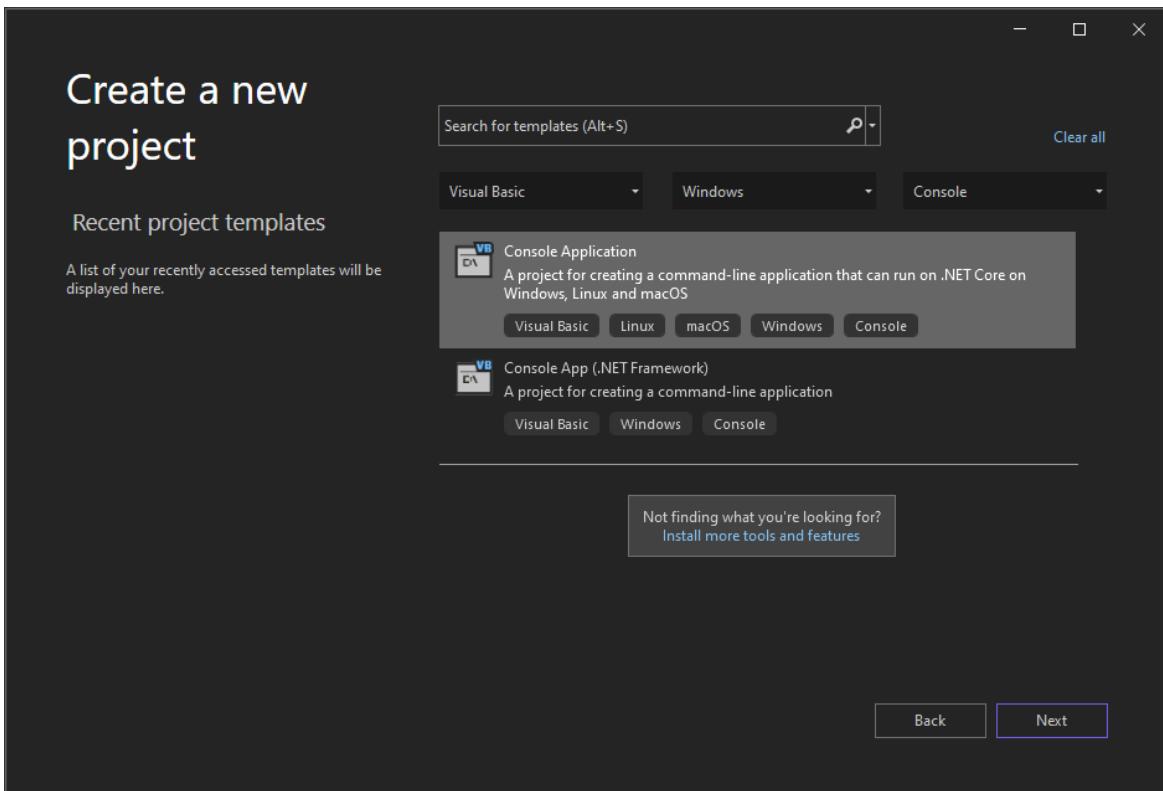
Visual Studio opens your new project.

1. Open Visual Studio.
2. On the start window, choose **Create a new project**.



3. In the **Create a new project** window, choose **Visual Basic** from the Language list. Next, choose **Windows** from the Platform list and **Console** from the Project types list.

After you apply the language, platform, and project type filters, choose the **Console Application** template, and then choose **Next**.

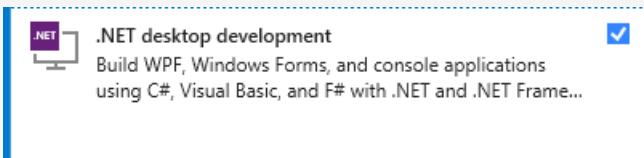


NOTE

If you do not see the **Console Application** template, you can install it from the **Create a new project** window. In the **Not finding what you're looking for?** message, choose the **Install more tools and features** link.

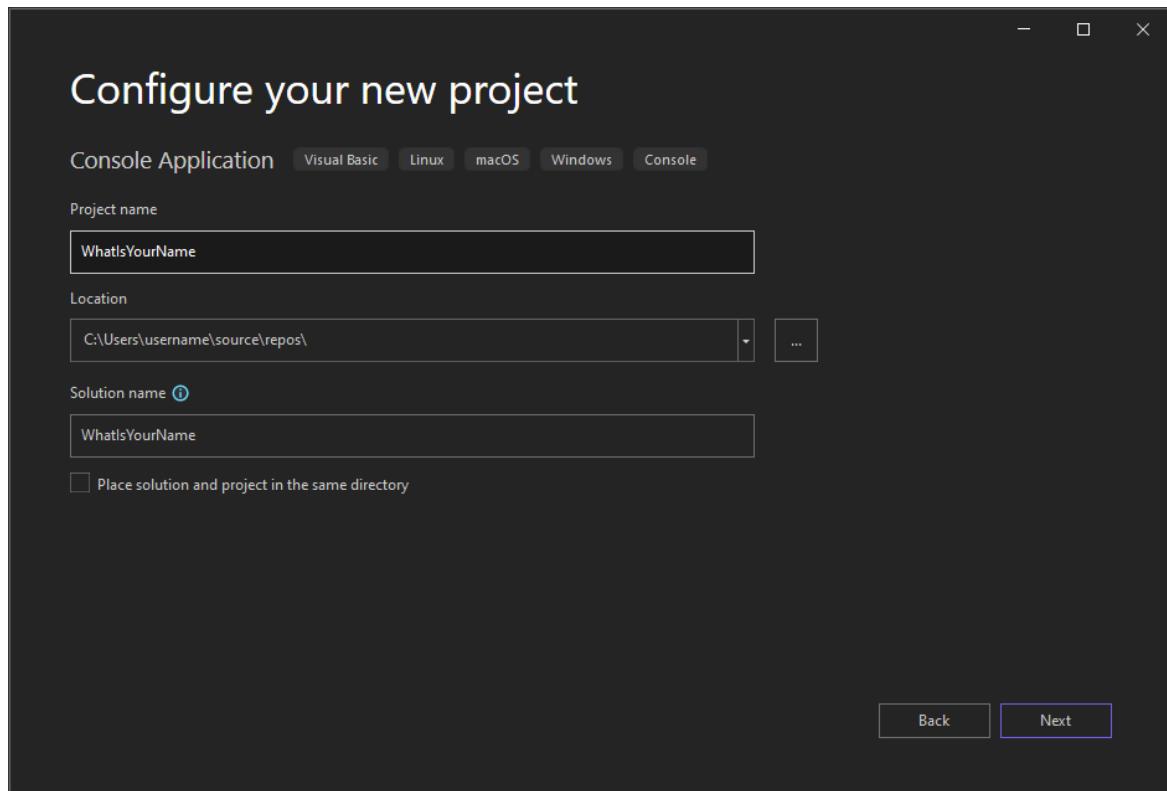
Not finding what you're looking for?
[Install more tools and features](#)

Then, in the Visual Studio Installer, choose the **.NET desktop development** workload.

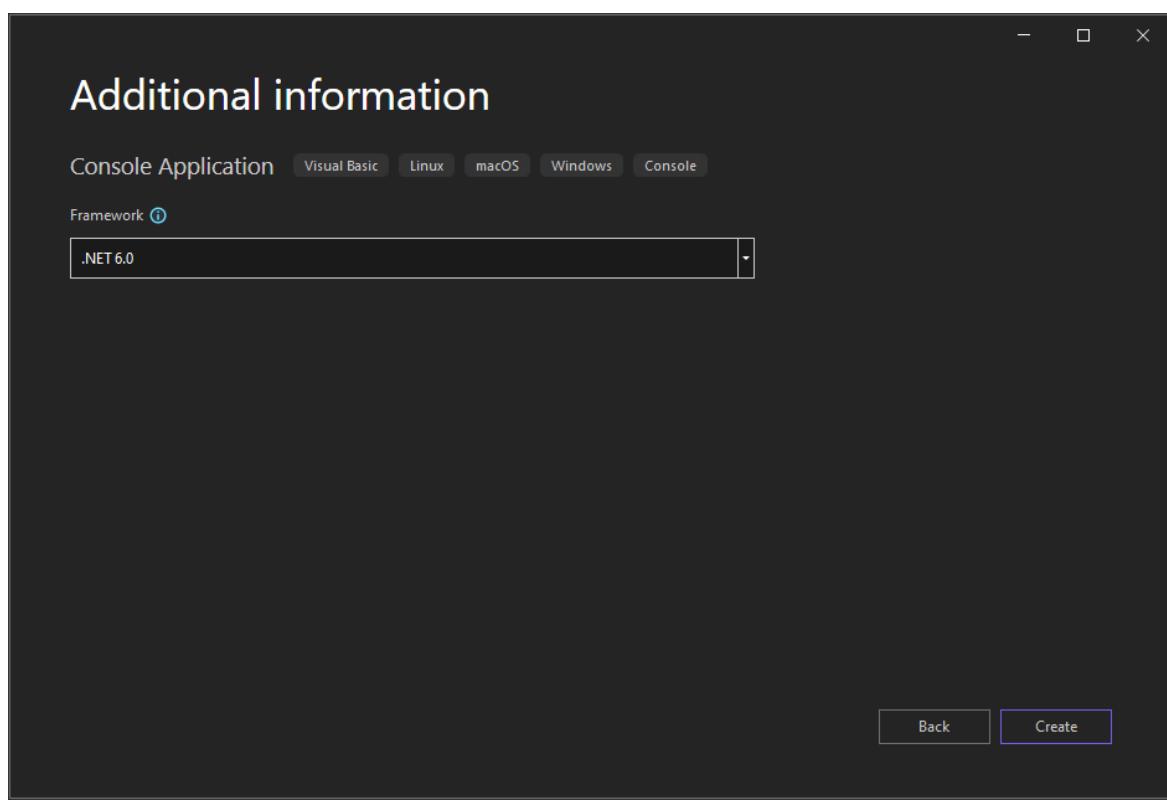


After that, choose the **Modify** button in the Visual Studio Installer. You might be prompted to save your work; if so, do so. Next, choose **Continue** to install the workload. Then, return to step 2 in this "Create a project" procedure.

4. In the **Configure your new project** window, type or enter *WhatIsYourName* in the **Project name** box. Then, choose **Next**.



5. In the **Additional information** window, .NET 6.0 should already be selected for your target framework. If not, select .NET 6.0. Then, choose **Create**.



Visual Studio opens your new project.

Create a "What Is Your Name" application

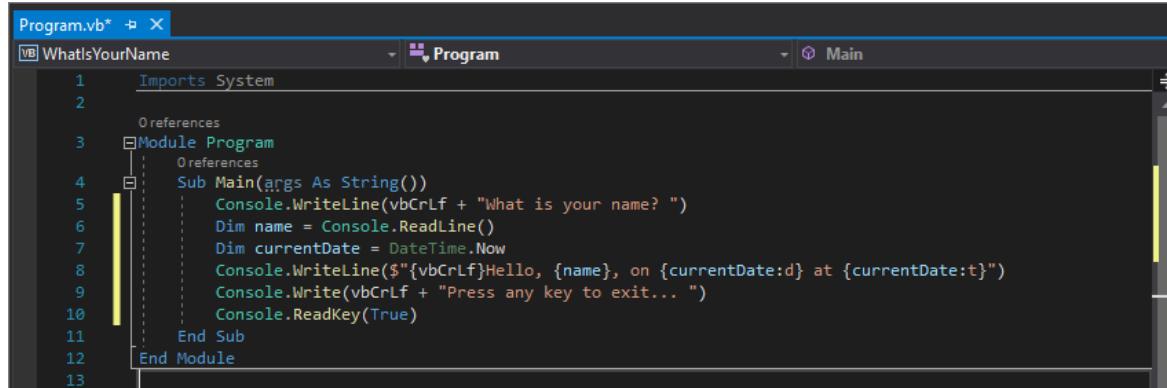
Let's create an app that prompts you for your name and then displays it along with the date and time. Here's how:

1. If it is not already open, then open your *WhatIsYourName* project.
2. Enter the following Visual Basic code immediately after the opening bracket that follows the

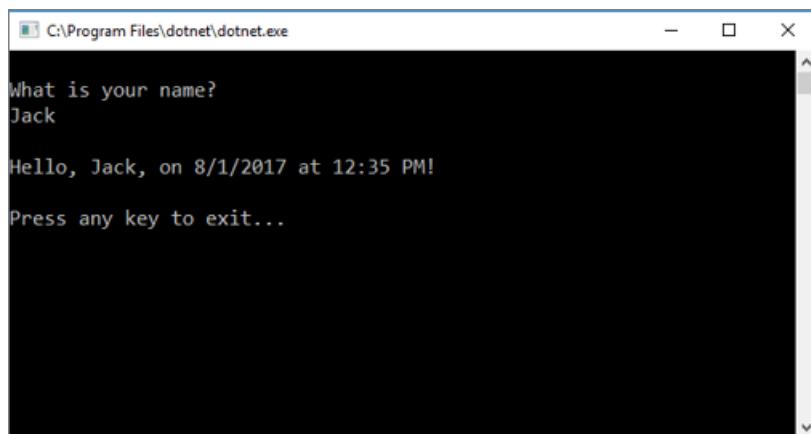
`Sub Main(args As String())` line and before the `End Sub` line:

```
Console.WriteLine(vbCrLf + "What is your name? ")
Dim name = Console.ReadLine()
Dim currentDate = DateTime.Now
Console.WriteLine($"{vbCrLf}Hello, {name}, on {currentDate:d} at {currentDate:t}")
Console.Write(vbCrLf + "Press any key to exit... ")
Console.ReadKey(True)
```

This code replaces the existing [WriteLine](#), [Write](#), and [ReadKey](#) statements.



3. Use the green **Start** button, or press **F5** to build and run your first app.
4. When the console window opens, enter your name. Your console window should look similar to the following screenshot:



5. Press any key to close the console window.

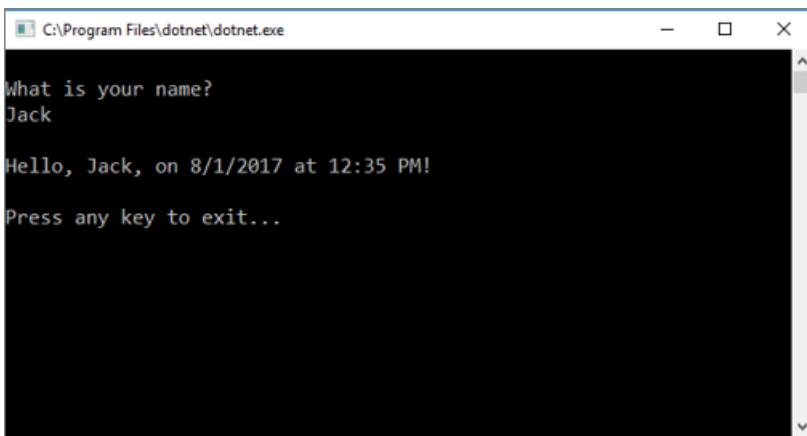
1. In the *WhatIsYourName* project, enter the following Visual Basic code immediately after the opening bracket that follows the `Sub Main(args As String())` line and before the `End Sub` line:

```
Console.WriteLine(vbCrLf + "What is your name? ")
Dim name = Console.ReadLine()
Dim currentDate = DateTime.Now
Console.WriteLine($"{vbCrLf}Hello, {name}, on {currentDate:d} at {currentDate:t}!")
Console.Write(vbCrLf + "Press any key to exit... ")
Console.ReadKey(True)
```

This code replaces the existing [WriteLine](#), [Write](#), and [ReadKey](#) statements.

```
VB WhatIsYourName    Program    Main
1 Imports System
2
3     References
4     Module Program
5         References
6             Sub Main(args As String())
7                 Console.WriteLine(vbCrLf + "What is your name? ")
8                 Dim name = Console.ReadLine()
9                 Dim currentDate = DateTime.Now
10                Console.WriteLine($"{vbCrLf}Hello, {name}, on {currentDate:d} at {currentDate:t}")
11                Console.Write(vbCrLf + "Press any key to exit... ")
12                Console.ReadKey(True)
13            End Sub
14        End Module
```

2. Use the green Start button, or press F5 to build and run your first app.
3. When the console window opens, enter your name. Your console window should look similar to the following screenshot:



4. Press any key to close the console window.

1. In the *WhatIsYourName* project, enter the following Visual Basic code in the *Program.vb* file immediately after the opening bracket that follows the `Sub Main(args As String())` line and before the `End Sub` line:

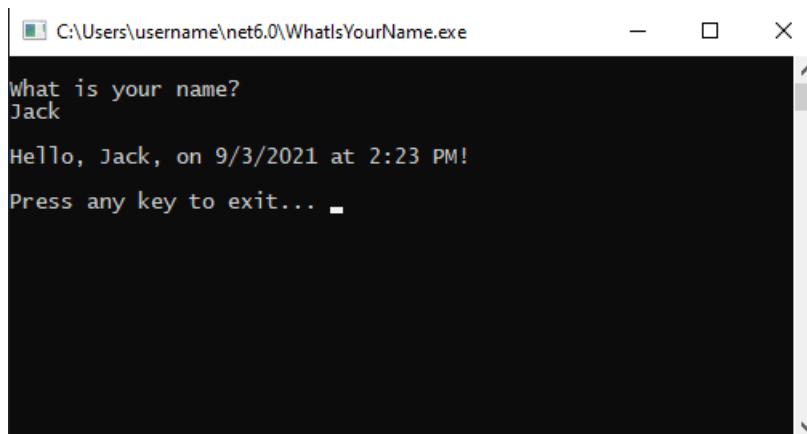
```
Console.WriteLine(vbCrLf + "What is your name? ")
Dim name = Console.ReadLine()
Dim currentDate = DateTime.Now
Console.WriteLine($"{vbCrLf}Hello, {name}, on {currentDate:d} at {currentDate:t}!")
Console.Write(vbCrLf + "Press any key to exit... ")
Console.ReadKey(True)
```

This code replaces the existing `WriteLine` statement.

```
Program.vb    Program    Main
VB WhatIsYourName
1 Imports System
2
3     References
4     Module Program
5         References
6             Sub Main(args As String())
7                 Console.WriteLine(vbCrLf + "What is your name? ")
8                 Dim name = Console.ReadLine()
9                 Dim currentDate = DateTime.Now
10                Console.WriteLine($"{vbCrLf}Hello, {name}, on {currentDate:d} at {currentDate:t}!")
11                Console.Write(vbCrLf + "Press any key to exit... ")
12                Console.ReadKey(True)
13            End Sub
14        End Module
```

2. Use the green Start button, or press F5 to build and run your first app.

3. When the console window opens, enter your name. Your console window should look similar to the following screenshot:



```
C:\Users\username\net6.0\WhatIsYourName.exe
What is your name?
Jack
Hello, Jack, on 9/3/2021 at 2:23 PM!
Press any key to exit...
```

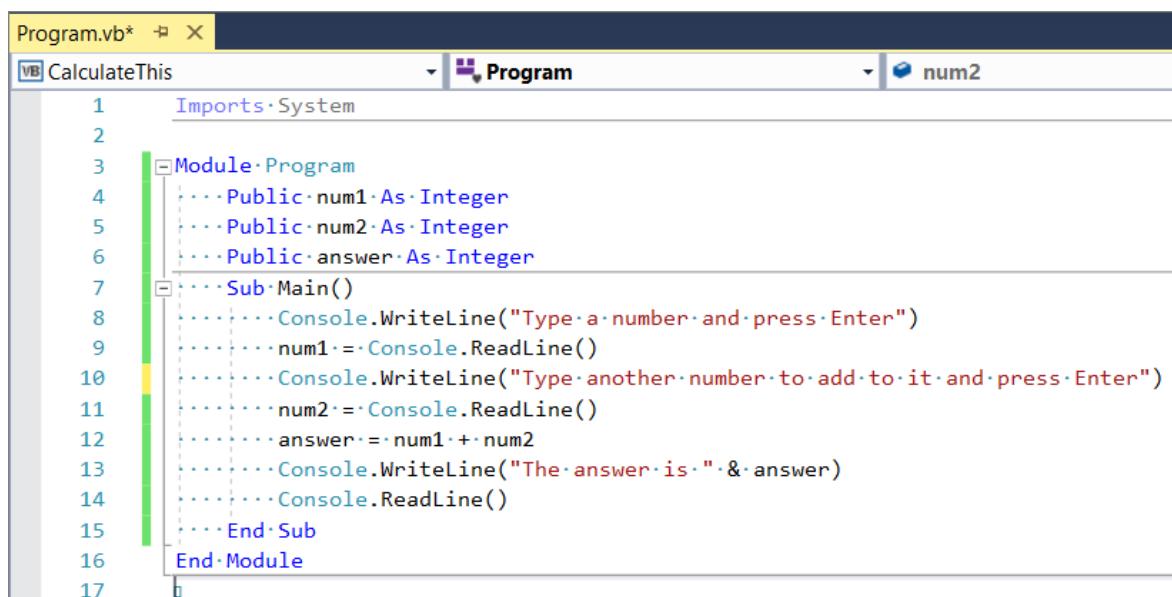
4. Press any key to close the console window.

Create a "Calculate This" application

1. Open Visual Studio 2017, and then from the top menu bar, choose **File > New > Project**.
2. In the **New Project** dialog box in the left pane, expand **Visual Basic**, and then choose **.NET Core**. In the middle pane, choose **Console App (.NET Core)**. Then name the file *CalculateThis*.
3. Enter the following code between the `Module Program` line and the `End Module` line:

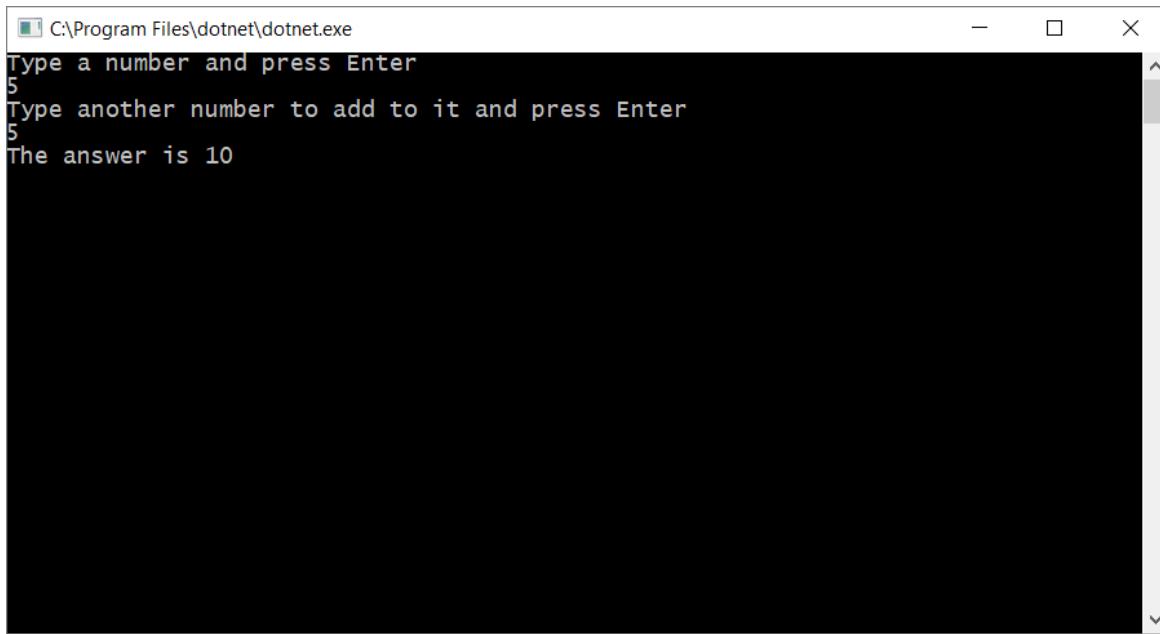
```
Public num1 As Integer
Public num2 As Integer
Public answer As Integer
Sub Main()
    Console.WriteLine("Type a number and press Enter")
    num1 = Console.ReadLine()
    Console.WriteLine("Type another number to add to it and press Enter")
    num2 = Console.ReadLine()
    answer = num1 + num2
    Console.WriteLine("The answer is " & answer)
    Console.ReadLine()
End Sub
```

Your code window should look like the following screenshot:



```
Program.vb* X
VB|CalculateThis Program num2
Imports System
Module Program
    Public num1 As Integer
    Public num2 As Integer
    Public answer As Integer
    Sub Main()
        Console.WriteLine("Type a number and press Enter")
        num1 = Console.ReadLine()
        Console.WriteLine("Type another number to add to it and press Enter")
        num2 = Console.ReadLine()
        answer = num1 + num2
        Console.WriteLine("The answer is " & answer)
        Console.ReadLine()
    End Sub
End Module
```

4. Click **CalculateThis** to run your program. Your console window should look similar to the following screenshot:



```
C:\Program Files\dotnet\dotnet.exe
Type a number and press Enter
5
Type another number to add to it and press Enter
5
The answer is 10
```

1. On the start window, choose **Create a new project**.
2. In the **Create a new project** window, choose **Visual Basic** from the Language list. Next, choose **Windows** from the Platform list and **Console** from the project types list.
3. After you apply the language, platform, and project type filters, choose the **Console Application** template, and then choose **Next**.

Then, in the **Configure your new project** window, type or enter *CalculateThis* in the **Project name** box. Then, choose **Next**.

4. In the **Additional information** window, **.NET Core 3.1** should already be selected for your target framework. If not, select **.NET Core 3.1**. Then, choose **Create**.
5. Enter the following code between the **Module Program** line and **End Module** line:

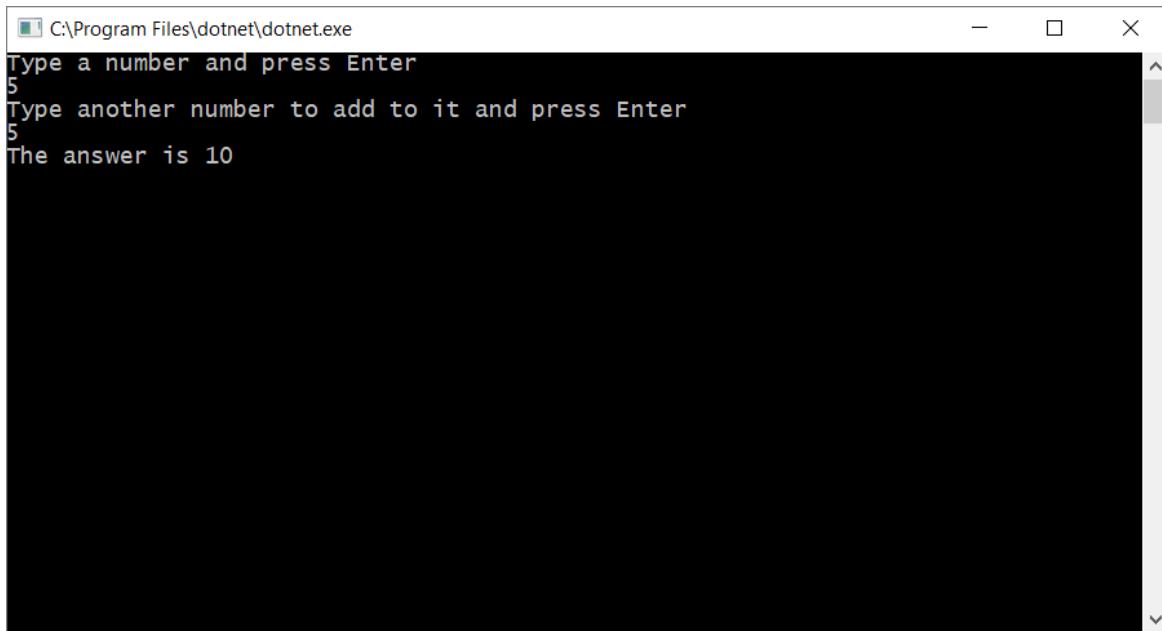
```
Public num1 As Integer
Public num2 As Integer
Public answer As Integer
Sub Main()
    Console.WriteLine("Type a number and press Enter")
    num1 = Console.ReadLine()
    Console.WriteLine("Type another number to add to it and press Enter")
    num2 = Console.ReadLine()
    answer = num1 + num2
    Console.WriteLine("The answer is " & answer)
    Console.ReadLine()
End Sub
```

Your code window should look like the following screenshot:

The screenshot shows the Visual Studio IDE with the code editor open. The file is named 'Program.vb'. The code is a simple VB.NET program that adds two numbers entered by the user. The code includes imports for System, defines a module named 'Program', and contains a Main() subroutine. It uses Console.WriteLine() to prompt the user for input and Console.ReadLine() to read the input. The answer is calculated and printed back to the console.

```
Imports System
Module Program
    Public num1 As Integer
    Public num2 As Integer
    Public answer As Integer
    Sub Main()
        Console.WriteLine("Type a number and press Enter")
        num1 = Console.ReadLine()
        Console.WriteLine("Type another number to add to it and press Enter")
        num2 = Console.ReadLine()
        answer = num1 + num2
        Console.WriteLine("The answer is " & answer)
        Console.ReadLine()
    End Sub
End Module
```

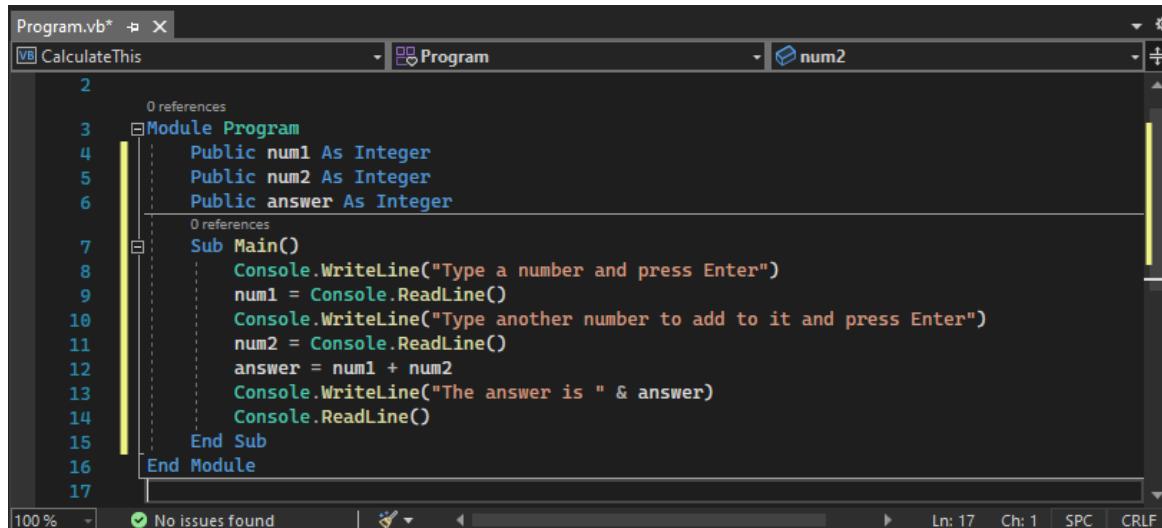
6. Click **CalculateThis** to run your program. Your console window should look similar to the following screenshot:



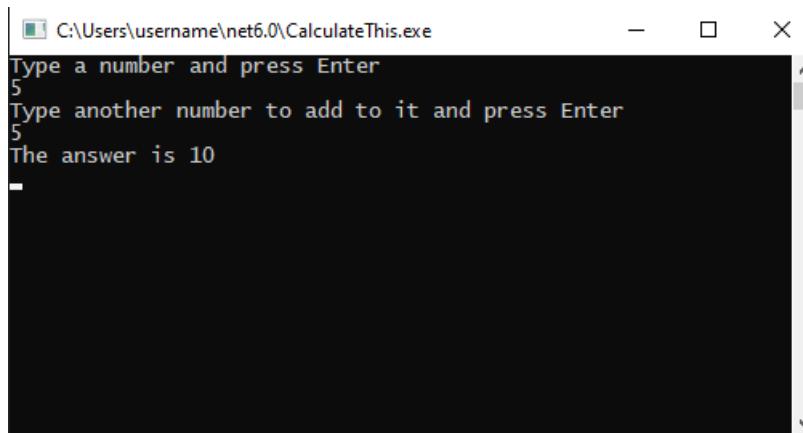
1. On the start window, choose **Create a new project**.
2. In the **Create a new project** window, choose **Visual Basic** from the Language list. Next, choose **Windows** from the Platform list and **Console** from the Project types list.
3. After you apply the language, platform, and project type filters, choose the **Console Application** template, and then choose **Next**.
Then, in the **Configure your new project** window, type or enter *CalculateThis* in the **Project name** box. Then, choose **Next**.
4. In the **Additional information** window, .NET 6.0 should already be selected for your target framework. If not, select .NET 6.0. Then, choose **Create**.
5. In *Program.vb*, enter the following code between the **Module Program** line and **End Module** line:

```
Public num1 As Integer
Public num2 As Integer
Public answer As Integer
Sub Main()
    Console.WriteLine("Type a number and press Enter")
    num1 = Console.ReadLine()
    Console.WriteLine("Type another number to add to it and press Enter")
    num2 = Console.ReadLine()
    answer = num1 + num2
    Console.WriteLine("The answer is " & answer)
    Console.ReadLine()
End Sub
```

Your code window should look like the following screenshot:



6. Select the green Start button next to **CalculateThis** to run your program. Your console window should look similar to the following screenshot:



Add Git source control

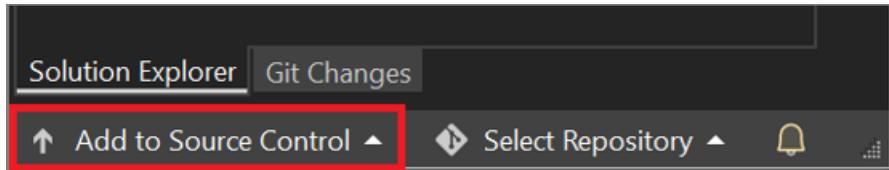
Now that you've created an app, you might want to add it to a Git repository. We've got you covered. Visual Studio makes that process easy with Git tools you can use directly from the IDE.

TIP

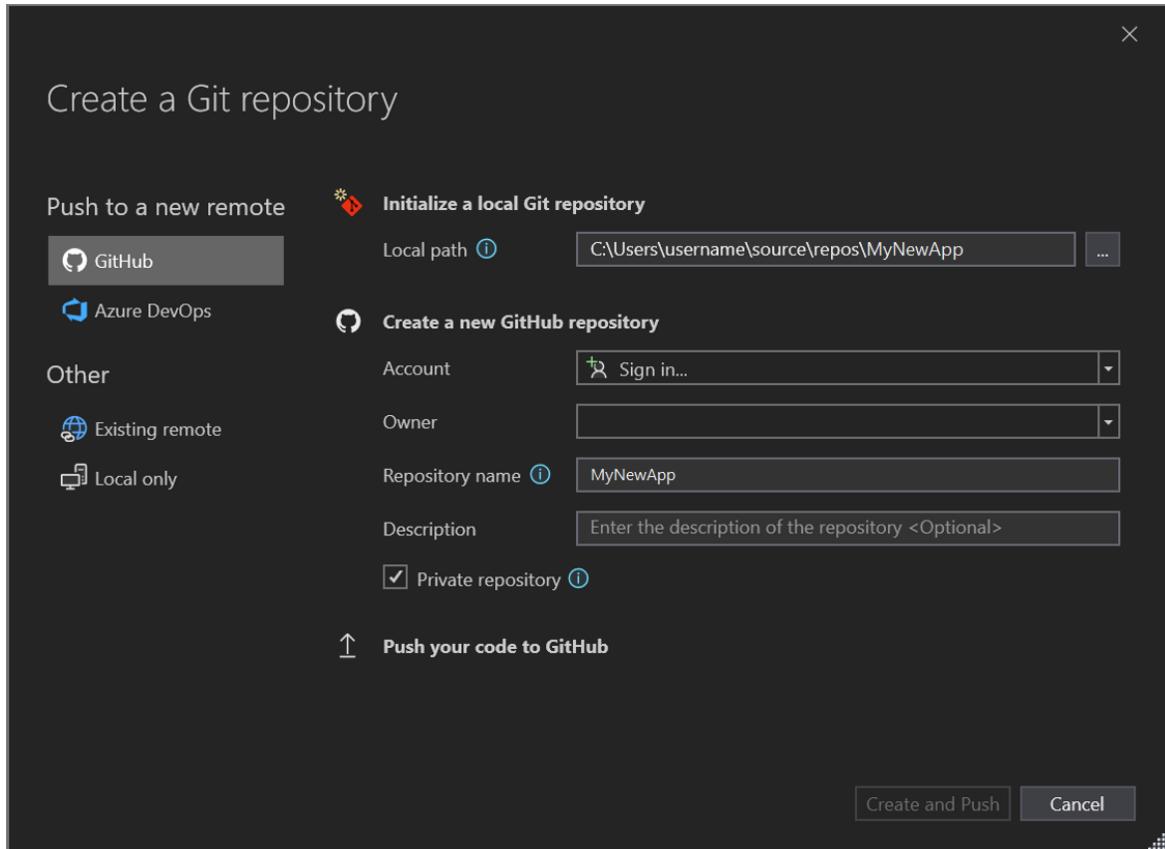
Git is the most widely used modern version control system, so whether you're a professional developer or you're learning how to code, Git can be very useful. If you're new to Git, the <https://git-scm.com/> website is a good place to start. There, you can find cheat sheets, a popular online book, and Git Basics videos.

To associate your code with Git, you start by creating a new Git repository where your code is located. Here's how:

1. In the status bar at the bottom-right corner of Visual Studio, select **Add to Source Control**, and then select **Git**.



2. In the **Create a Git repository** dialog box, sign in to GitHub.



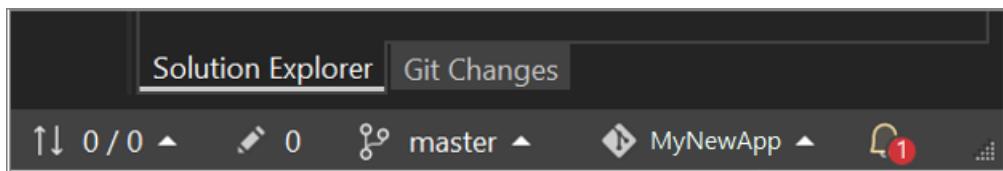
The repository name auto-populates based on your folder location. By default, your new repository is private, which means you're the only one who can access it.

TIP

Whether your repository is public or private, it's best to have a remote backup of your code stored securely on GitHub. Even if you aren't working with a team, a remote repository makes your code available to you from any computer.

3. Select **Create and Push**.

After you create your repository, you see status details in the status bar.



The first icon with the arrows shows how many outgoing/incoming commits are in your current branch.

You can use this icon to pull any incoming commits or push any outgoing commits. You can also choose to view these commits first. To do so, select the icon, and then select **View Outgoing/Incoming**.

The second icon with the pencil shows the number of uncommitted changes to your code. You can select this icon to view those changes in the **Git Changes** window.

To learn more about how to use Git with your app, see the [Visual Studio version control documentation](#).

Quick answers FAQ

Here's a quick FAQ to highlight some key concepts.

What is Visual Basic?

Visual Basic is a type-safe programming language that's designed to be easy to learn. It is derived from BASIC, which means "Beginner's All-purpose Symbolic Instruction Code".

What is Visual Studio?

Visual Studio is an integrated development suite of productivity tools for developers. Think of it as a program you can use to create programs and applications.

What is a console app?

A console app takes input and displays output in a command-line window, also known as a console.

What is .NET Core?

.NET Core is the evolutionary next step of the .NET Framework. Where the .NET Framework allowed you to share code across programming languages, .NET Core adds the ability to share code across platforms. Even better, it's open source. (Both the .NET Framework and .NET Core include libraries of prebuilt functionality and a common language runtime (CLR), which acts as a virtual machine in which to run your code.)

Next steps

Congratulations on completing this tutorial! To learn even more, see the following tutorial.

[Build a library with Visual Basic and the .NET Core SDK in Visual Studio](#)

See also

- [Visual Basic language walkthroughs](#)
- [Visual Basic language reference](#)
- [IntelliSense for Visual Basic code files](#)

Tutorial: Create a simple application with Visual Basic

11/13/2021 • 13 minutes to read • [Edit Online](#)

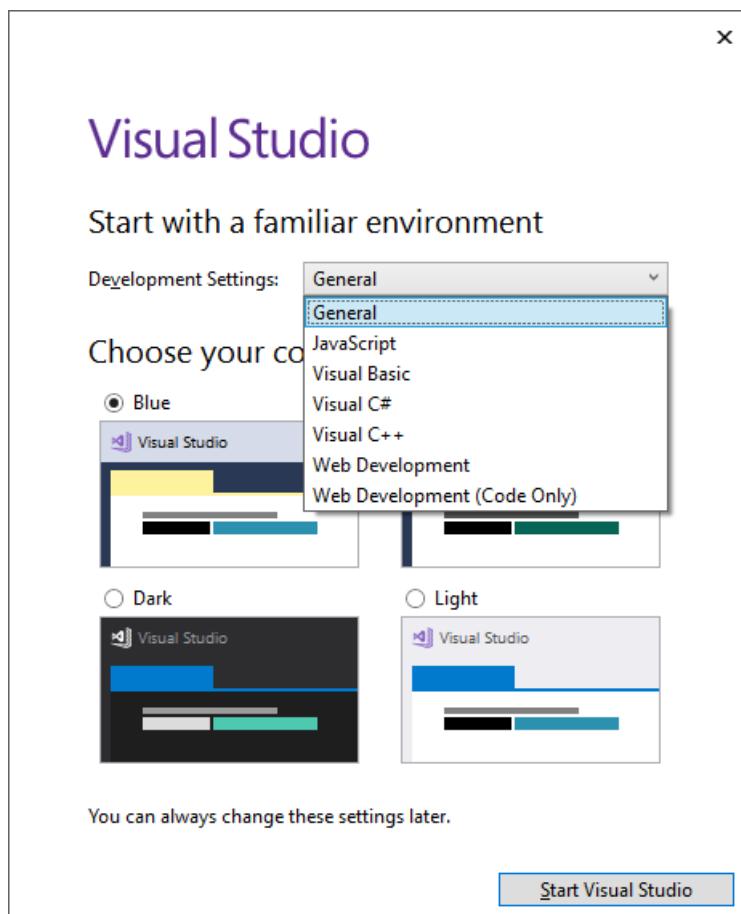
By completing this tutorial, you'll become familiar with many of the tools, dialog boxes, and designers that you can use when you develop applications with Visual Studio. You'll create a "Hello, World" application, design the UI, add code, and debug errors, while you learn about working in the integrated development environment (IDE).

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

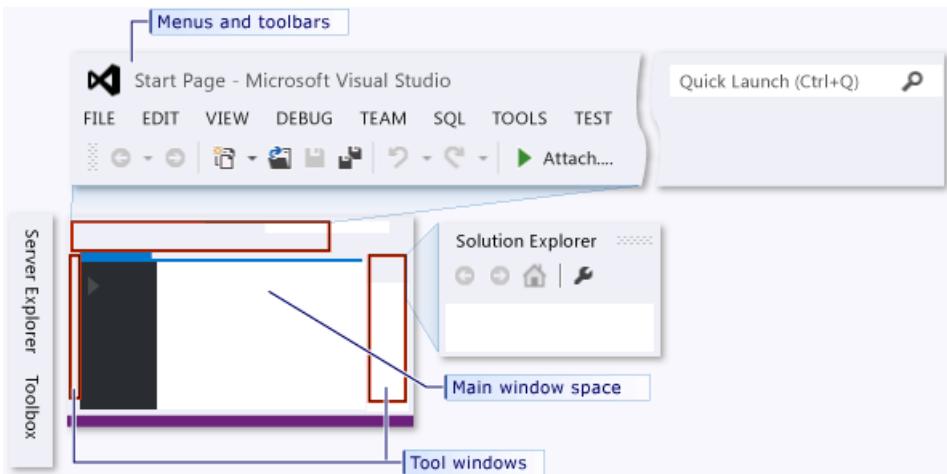
If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

Configure the IDE

When you open Visual Studio for the first time, you'll be prompted to sign in. This step is optional for this tutorial. Next you may be shown a dialog box that asks you to choose your development settings and color theme. Keep the defaults and choose **Start Visual Studio**.



After Visual Studio launches, you'll see tool windows, the menus and toolbars, and the main window space. Tool windows are docked on the left and right sides of the application window, with **Quick Launch**, the menu bar, and the standard toolbar at the top. In the center of the application window is the **Start Page**. When you load a solution or project, editors and designers appear in the space where the **Start Page** is. When you develop an application, you'll spend most of your time in this central area.

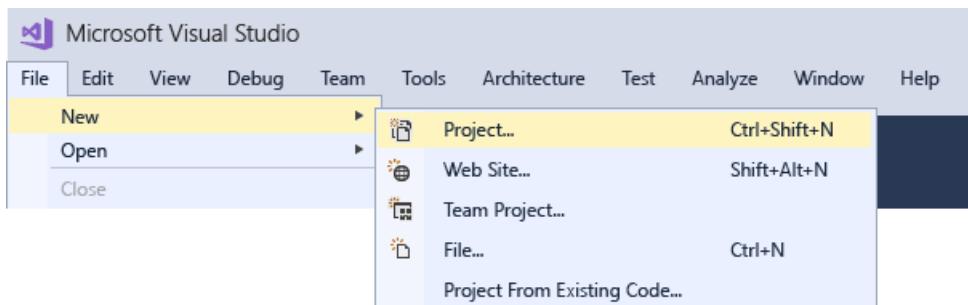


When you launch Visual Studio, the start window opens first. Select **Continue without code** to open the development environment. You'll see tool windows, the menus and toolbars, and the main window space. Tool windows are docked on the left and right sides of the application window. The search box, menu bar, and the standard toolbar are located at the top. When you load a solution or project, editors and designers appear in the central space of the application window. When you develop an application, you'll spend most of your time in this central area.

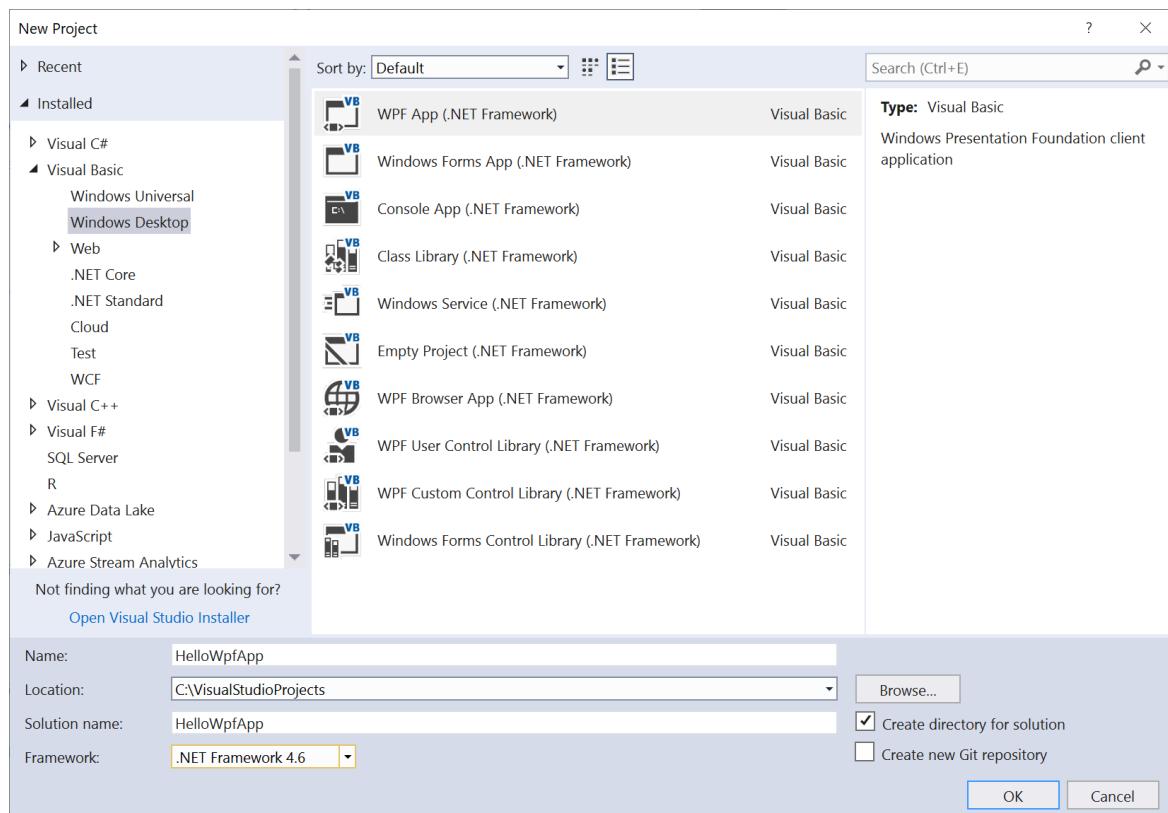
Create the project

When you create an application in Visual Studio, you first create a project and a solution. For this example, you'll create a Windows Presentation Foundation (WPF) project.

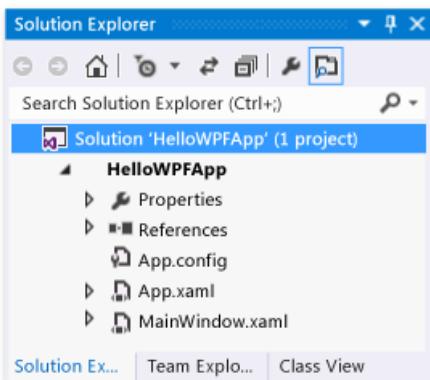
1. Create a new project. On the menu bar, select **File > New > Project**.



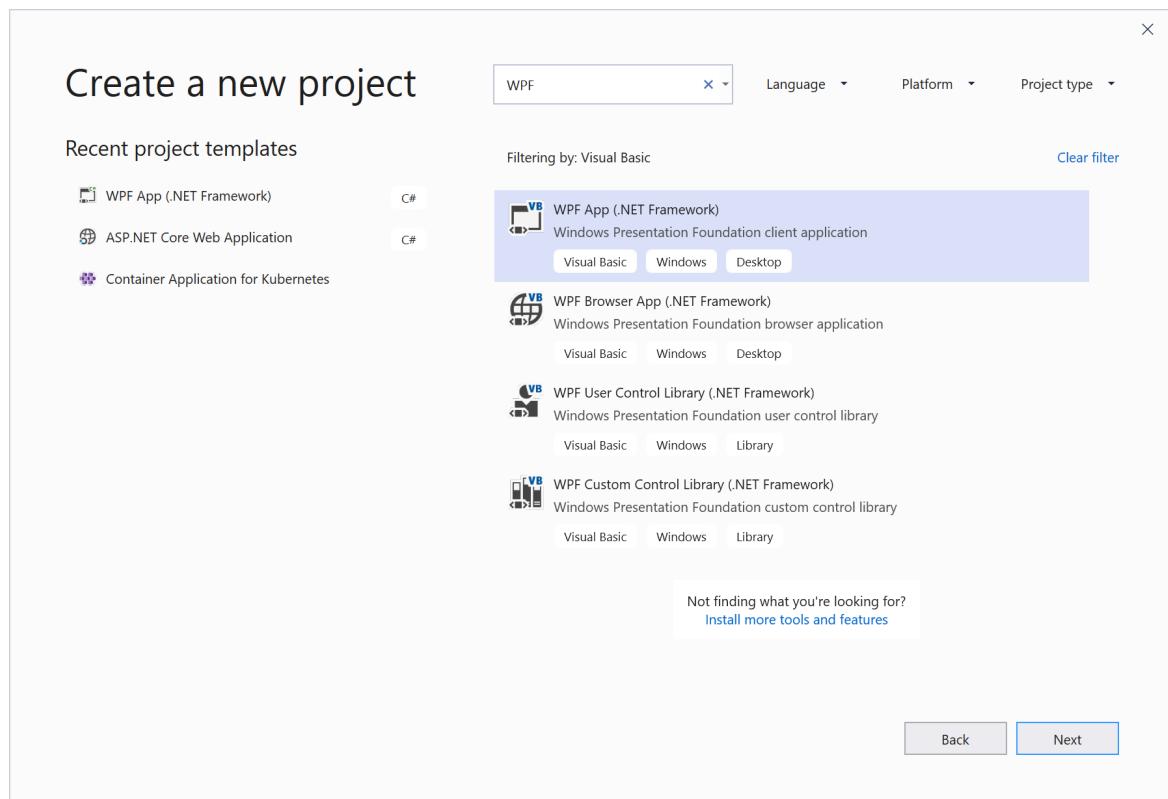
2. In the **New Project** dialog, select the **Installed > Visual Basic > Windows Desktop** category, and then select the **WPF App (.NET Framework)** template. Name the project **HelloWPFApp**, and select **OK**.



Visual Studio creates the HelloWpfApp project and solution, and **Solution Explorer** shows the various files. The **WPF Designer** shows a design view and a XAML view of *MainWindow.xaml* in a split view. You can slide the splitter to show more or less of either view. You can choose to see only the visual view or only the XAML view. The following items appear in **Solution Explorer**:

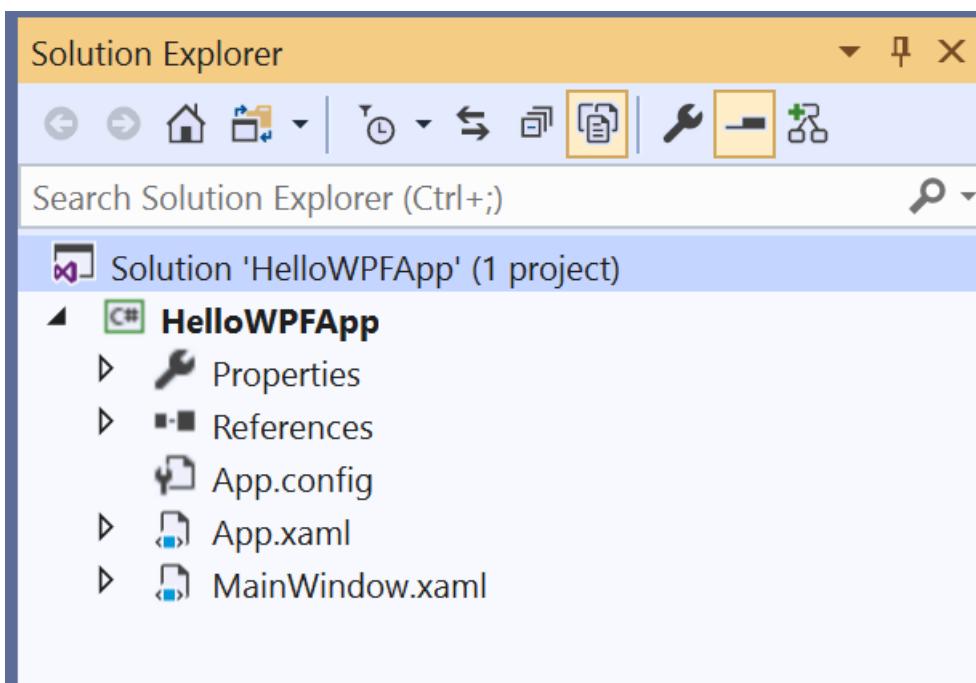


1. Open Visual Studio.
2. On the **Create a new project** screen, search for "WPF", and choose **WPF App (.NET Framework)**, and then choose **Next**.

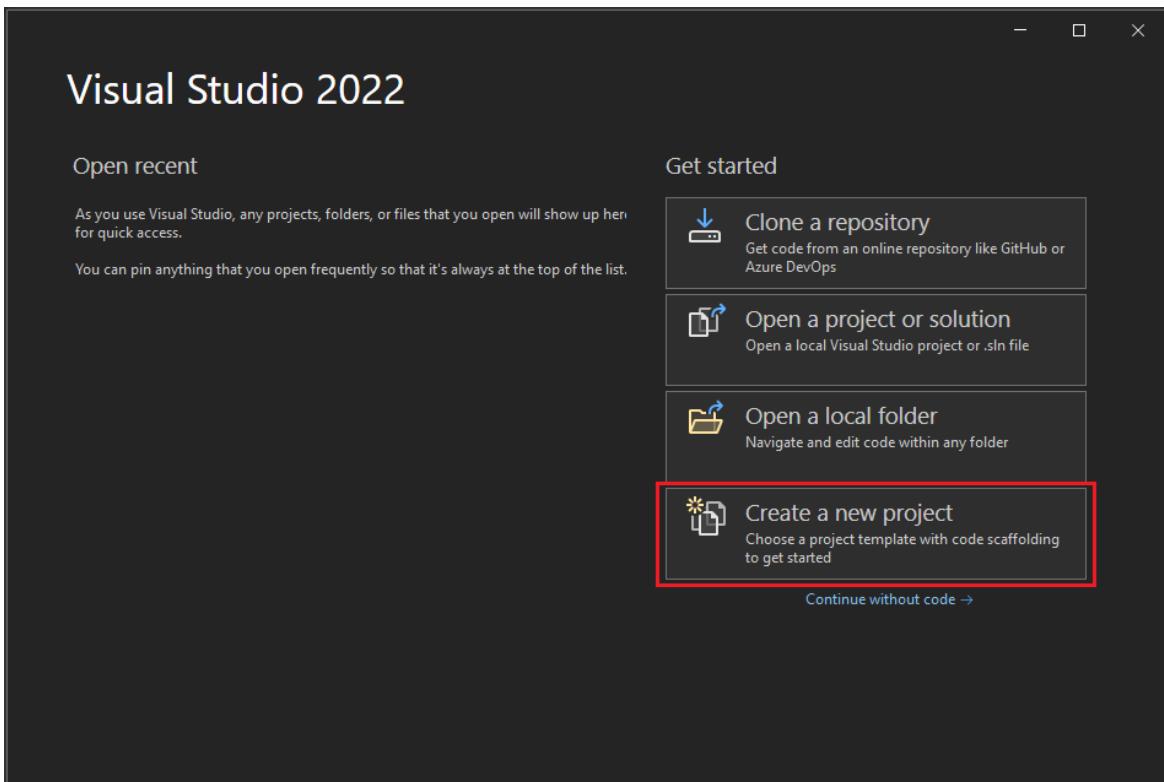


3. At the next screen, give the project a name, **HelloWPFApp**, and choose **Create**.

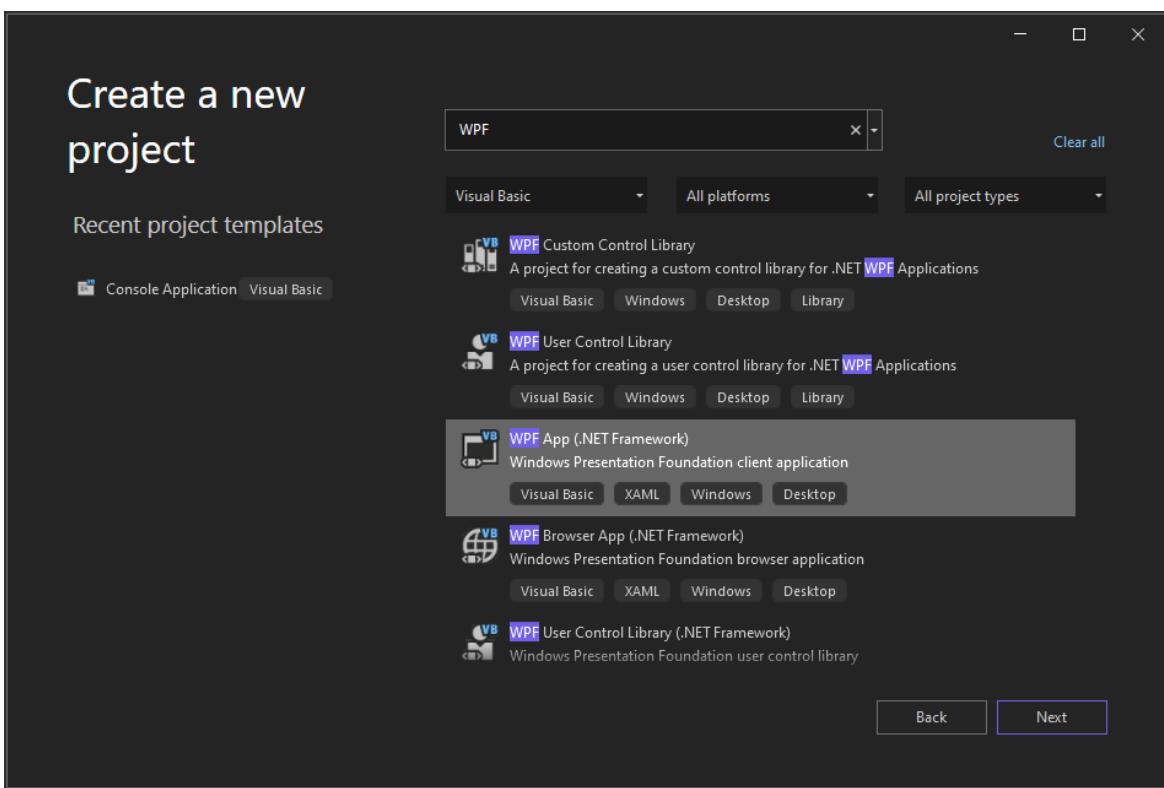
Visual Studio creates the HelloWPFApp project and solution, and **Solution Explorer** shows the various files. The **WPF Designer** shows a design view and a XAML view of *MainWindow.xaml* in a split view. You can slide the splitter to show more or less of either view. You can choose to see only the visual view or only the XAML view. The following items appear in **Solution Explorer**:



1. Open Visual Studio.
2. On the start window, choose **Create a new project**.

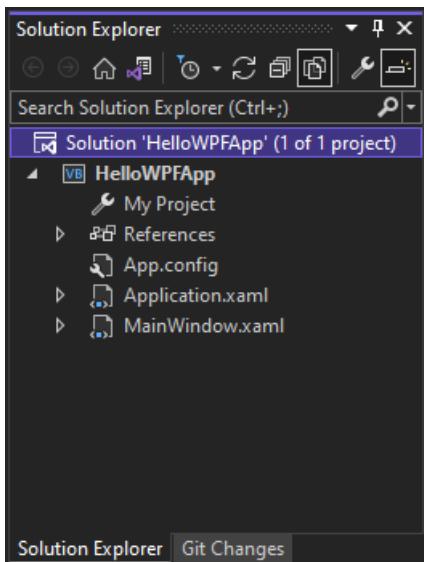


3. On the **Create a new project** screen, search for "WPF" and select **Visual Basic** in the **All languages** drop-down list. Choose **WPF App (.NET Framework)**, and then choose **Next**.



4. At the next screen, give the project a name, **HelloWPFApp**, and choose **Create**.

Visual Studio creates the HelloWPFApp project and solution, and **Solution Explorer** shows the various files. The **WPF Designer** shows a design view and a XAML view of *MainWindow.xaml* in a split view. You can slide the splitter to show more or less of either view. You can choose to see only the visual view or only the XAML view. The following items appear in **Solution Explorer**:



NOTE

For more information about XAML (eXtensible Application Markup Language), see the [XAML overview for WPF](#) page.

After you create the project, you can customize it. By using the **Properties** window (found on the **View** menu), you can display and change options for project items, controls, and other items in an application.

Change the name of `MainWindow.xaml`

Let's give `MainWindow` a more specific name. In **Solution Explorer**, right-click on `MainWindow.xaml` and choose **Rename**. Rename the file to `Greetings.xaml`.

As an optional step, it will avoid confusion to change the title of your application window to match this new name.

1. In **Solution Explorer**, open the `Greetings.xaml` file that you just renamed.
2. In the XAML view, change the value of the `Window.Title` property from `Title="MainWindow"` to `Title="Greetings"`, and save the changes.

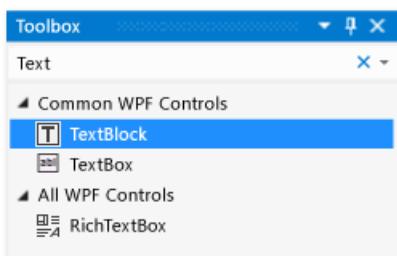
Design the user interface (UI)

If the designer is not open, select `Greetings.xaml` in **Solution Explorer**, and press **Shift+F7** to open the designer.

We will add three types of controls to this application: a **TextBlock** control, two **RadioButton** controls, and a **Button** control.

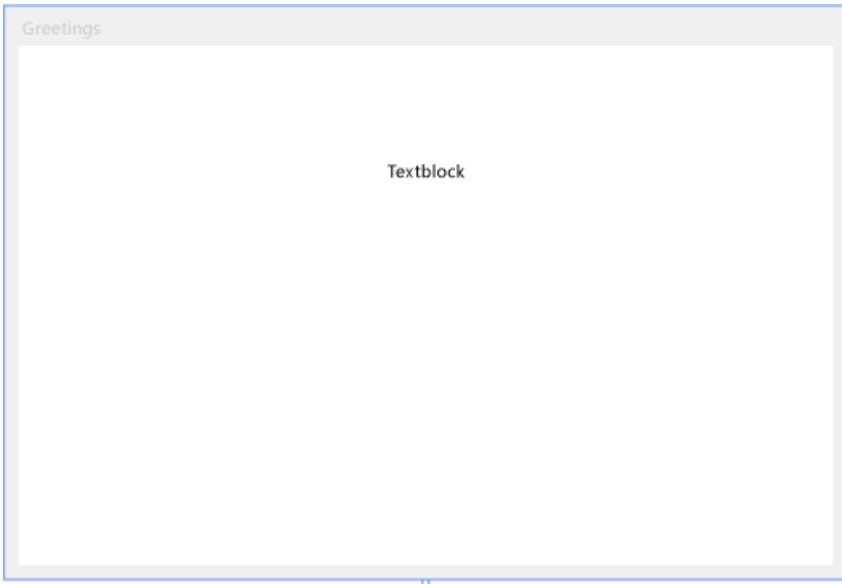
Add a **TextBlock** control

1. Press **Ctrl+Q** to activate the search box and type **Toolbox**. Choose **View > Toolbox** from the results list.
2. In the **Toolbox**, expand the **Common WPF Controls** node to see the **TextBlock** control.



3. Add a **TextBlock** control to the design surface by choosing the **TextBlock** item and dragging it to the window on the design surface. Center the control near the top of the window. In Visual Studio 2019 and later, you can use the red guidelines to center the control.

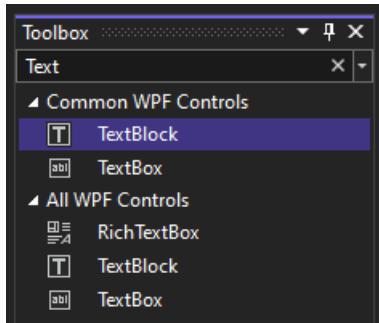
Your window should resemble the following illustration:



The XAML markup should look something like the following example:

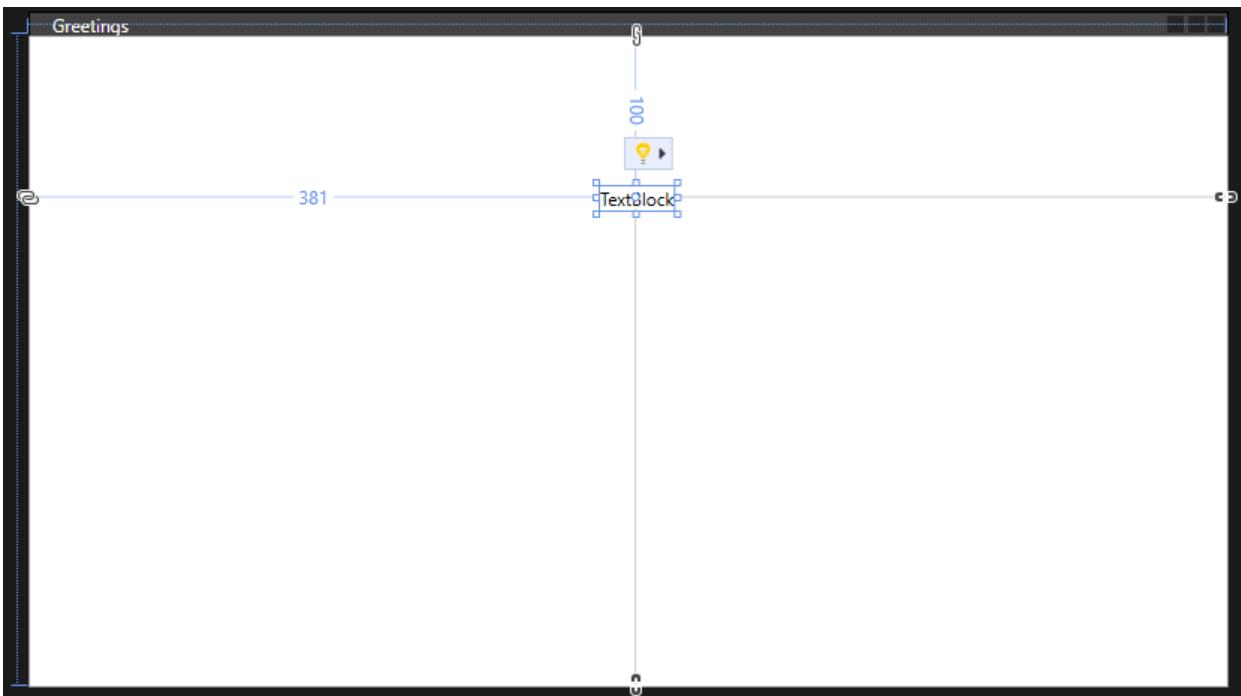
```
<TextBlock HorizontalAlignment="Left" Margin="381,100,0,0" TextWrapping="Wrap" Text="TextBlock" VerticalAlignment="Top"/>
```

1. Press **Ctrl+Q** to activate the search box and type **Toolbox**. Choose **View > Toolbox** from the results list.
2. In the **Toolbox**, expand the **Common WPF Controls** node to see the **TextBlock** control.



3. Add a **TextBlock** control to the design surface by choosing the **TextBlock** item and dragging it to the window on the design surface. Center the control near the top of the window. You can use the guidelines to center the control.

Your window should resemble the following image:



The XAML markup should look something like the following example:

```
<TextBlock HorizontalAlignment="Left" Margin="381,100,0,0" TextWrapping="Wrap" Text="TextBlock" VerticalAlignment="Top"/>
```

Customize the text in the text block

1. In the XAML view, locate the markup for TextBlock and change the Text attribute:

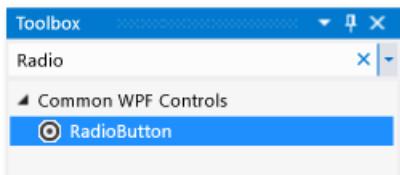
```
Text="Select a message option and then choose the Display button."
```

2. Center the TextBlock again if necessary, and save your changes by pressing Ctrl+S or using the File menu item.

Next, you'll add two [RadioButton](#) controls to the form.

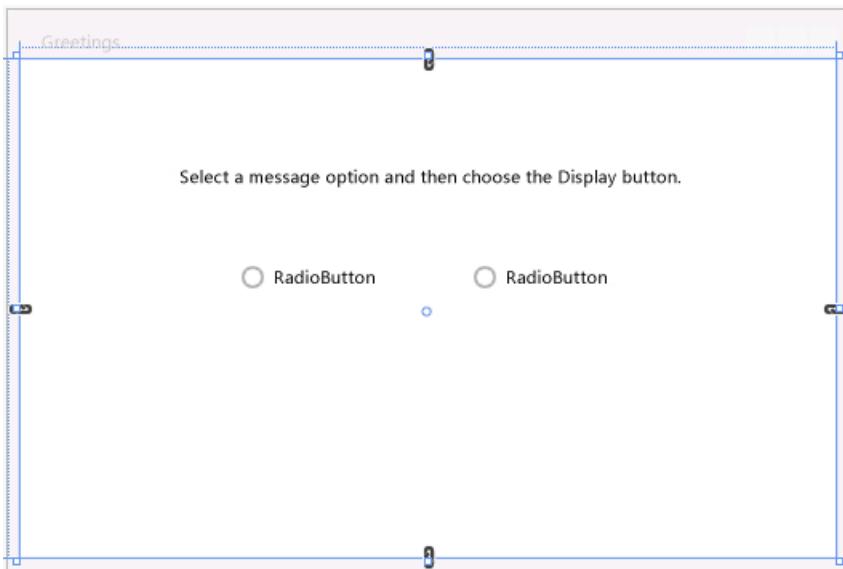
Add radio buttons

1. In the [Toolbox](#), find the [RadioButton](#) control.

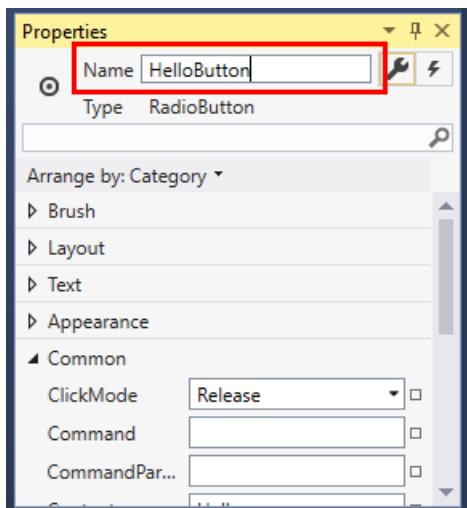


2. Add two RadioButton controls to the design surface by choosing the [RadioButton](#) item and dragging it to the window on the design surface. Move the buttons (by selecting them and using the arrow keys) so that the buttons appear side by side under the TextBlock control. Use the red guidelines to align the controls.

Your window should look like this:



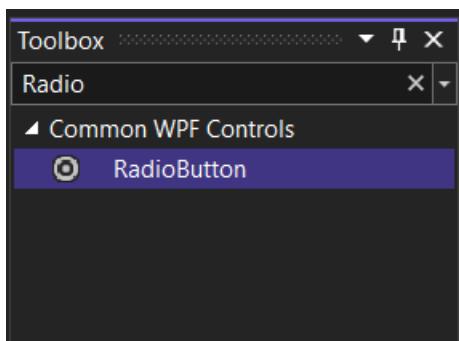
3. In the **Properties** window for the left RadioButton control, change the **Name** property (the property at the top of the **Properties** window) to `HelloButton`.



4. In the **Properties** window for the right RadioButton control, change the **Name** property to `GoodbyeButton`, and then save your changes.

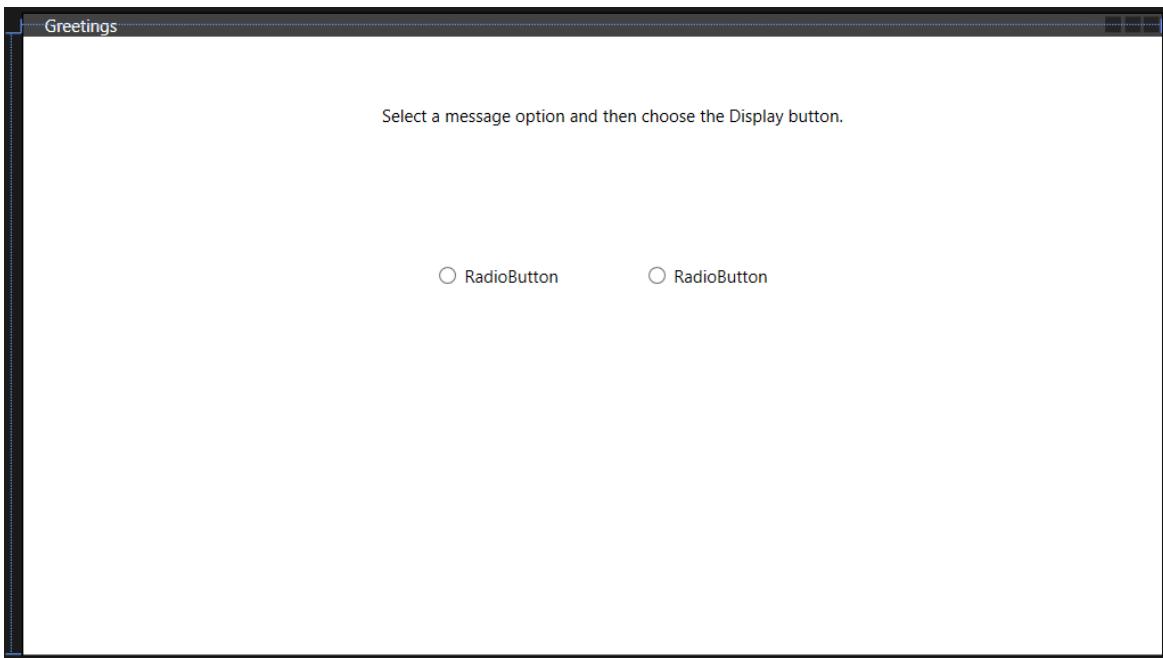
You can now add display text for each RadioButton control. The following procedure updates the **Content** property for a RadioButton control.

1. In the **Toolbox**, find the **RadioButton** control.

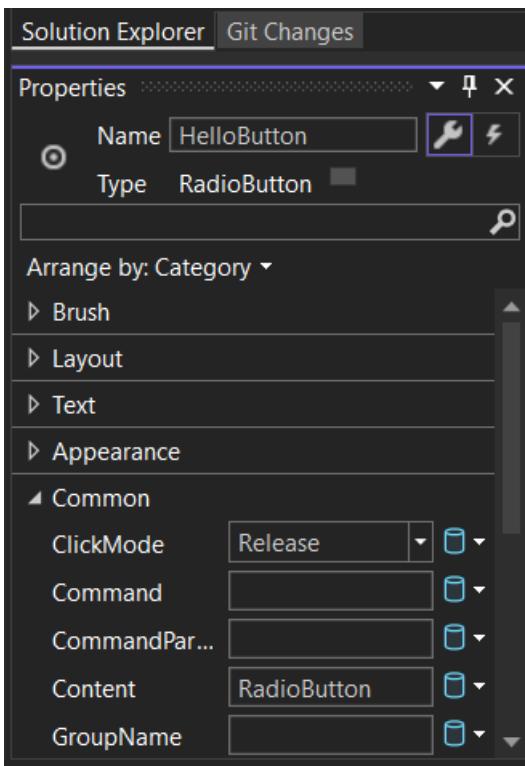


2. Add two RadioButton controls to the design surface by choosing the **RadioButton** item and dragging it to the window on the design surface. Move the buttons (by selecting them and using the arrow keys) so that the buttons appear side by side under the TextBlock control. Use the guidelines to align the controls.

Your window should look like this:



3. In the **Properties** window for the left RadioButton control, change the **Name** property (the property at the top of the **Properties** window) to `HelloButton`.



4. In the **Properties** window for the right RadioButton control, change the **Name** property to `GoodbyeButton`, and then save your changes.

You can now add display text for each RadioButton control. The following procedure updates the **Content** property for a RadioButton control.

Add display text for each radio button

Update the **Content** attribute for the `HelloButton` and `GoodbyeButton` to `"Hello"` and `"Goodbye"` in the XAML. The XAML markup should now look similar to the following example:

```

<Grid>
    <TextBlock HorizontalAlignment="Left" Margin="252,47,0,0" TextWrapping="Wrap" Text="Select a message option and then choose the Display button." VerticalAlignment="Top"/>
    <RadioButton x:Name="HelloButton" Content="Hello" HorizontalAlignment="Left" Margin="297,161,0,0" VerticalAlignment="Top"/>
    <RadioButton x:Name="GoodbyeButton" Content="Goodbye" HorizontalAlignment="Left" Margin="488,161,0,0" VerticalAlignment="Top"/>
</Grid>

```

Set a radio button to be checked by default

In this step, we'll set HelloButton to be checked by default so that one of the two radio buttons is always selected.

In the XAML view, locate the markup for HelloButton and add an **IsChecked** attribute:

```
IsChecked="True"
```

The final UI element that you'll add is a [Button](#) control.

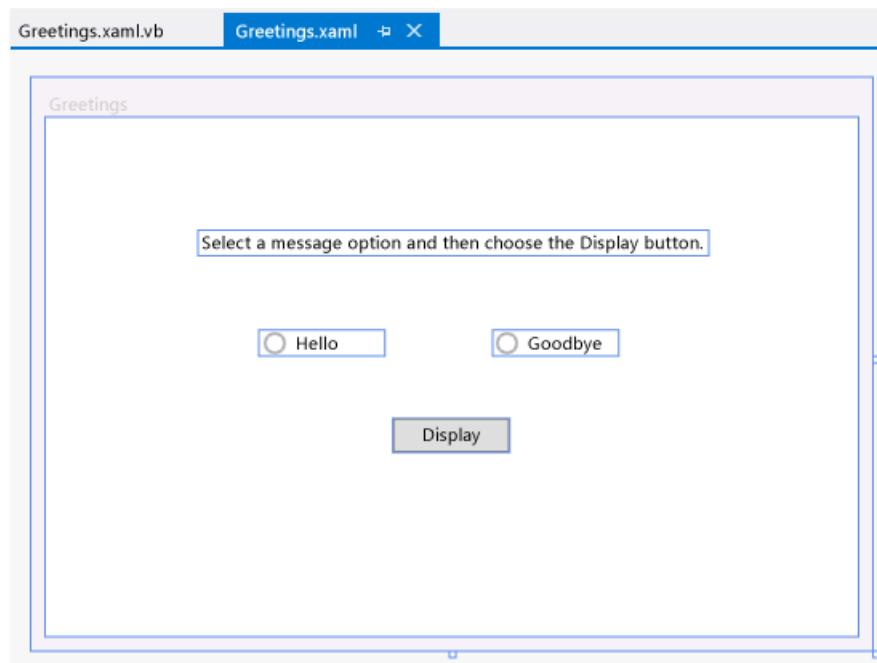
Add the button control

1. In the **Toolbox**, find the **Button** control, and then add it to the design surface under the RadioButton controls by dragging it to the form in the design view. The guidelines can help you center the control.
2. In the XAML view, change the value of **Content** for the Button control from `Content="Button"` to `Content="Display"`, and then save the changes.

The markup should resemble the following example:

```
<Button Content="Display" HorizontalAlignment="Left" VerticalAlignment="Top" Width="75" Margin="215,204,0,0"/>
```

Your window should resemble the following illustration.

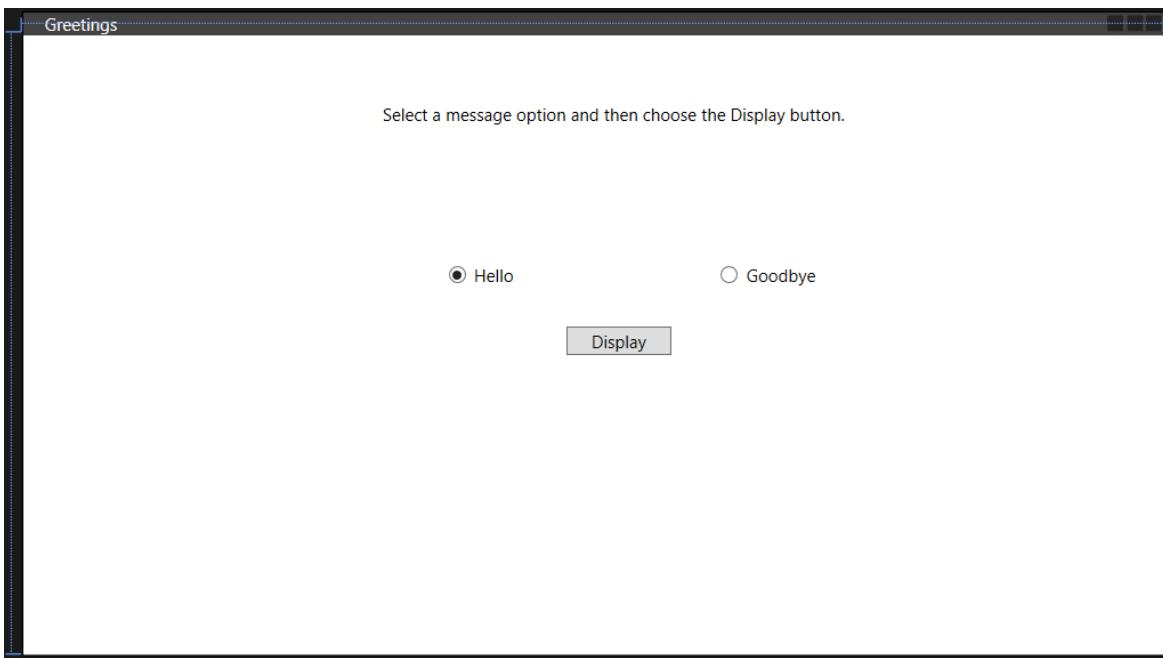


1. In the **Toolbox**, find the **Button** control, and then add it to the design surface under the RadioButton controls by dragging it to the form in the design view. The guidelines can help you center the control.
2. In the XAML view, change the value of **Content** for the Button control from `Content="Button"` to `Content="Display"`, and then save the changes.

The markup should resemble the following example:

```
<Button Content="Display" HorizontalAlignment="Left" VerticalAlignment="Top" Width="75"  
Margin="215,204,0,0"/>
```

Your window should resemble the following image.



Add code to the display button

When this application runs, a message box appears after a user chooses a radio button and then chooses the **Display** button. One message box will appear for Hello, and another will appear for Goodbye. To create this behavior, you'll add code to the `Button_Click` event in *Greetings.xaml.vb* or *Greetings.xaml.cs*.

1. On the design surface, double-click the **Display** button.

Greetings.xaml.vb opens, with the cursor in the `Button_Click` event.

```
Private Sub Button_Click(sender As Object, e As RoutedEventArgs)  
  
End Sub
```

2. Enter the following code:

```
If HelloButton.IsChecked = True Then  
    MessageBox.Show("Hello.")  
ElseIf GoodbyeButton.IsChecked = True Then  
    MessageBox.Show("Goodbye.")  
End If
```

3. Save the application.

Debug and test the application

Next, you'll debug the application to look for errors and test that both message boxes appear correctly. The following instructions tell you how to build and launch the debugger, but later you might read [Build a WPF application \(WPF\)](#) and [Debug WPF](#) for more information.

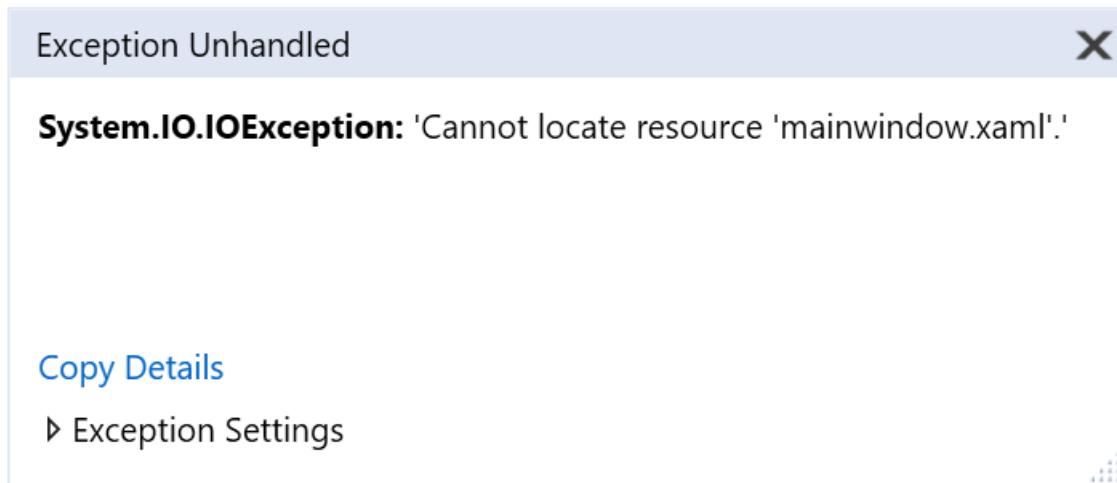
Find and fix errors

In this step, you'll find the error that we caused earlier by changing the name of the *MainWindow.xaml* file.

Start debugging and find the error

1. Start the debugger by pressing F5 or selecting Debug, then Start Debugging.

A Break Mode window appears, and the Output window indicates that an IOException has occurred:
Cannot locate resource 'mainwindow.xaml'.

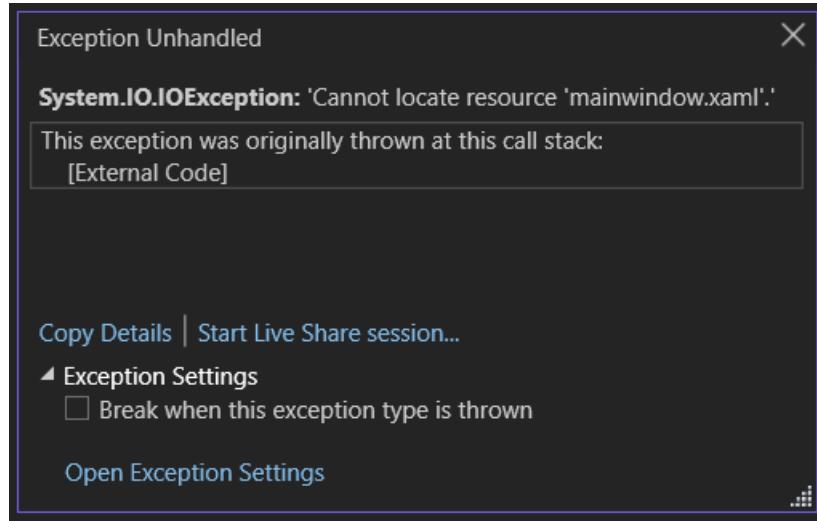


2. Stop the debugger by choosing Debug > Stop Debugging.

We renamed *MainWindow.xaml* to *Greetings.xaml* at the start of this tutorial, but the code still refers to *MainWindow.xaml* as the startup URI for the application, so the project can't start.

1. Start the debugger by pressing F5 or selecting Debug, then Start Debugging.

A Break Mode window appears, and the Output window indicates that an IOException has occurred:
Cannot locate resource 'mainwindow.xaml'.



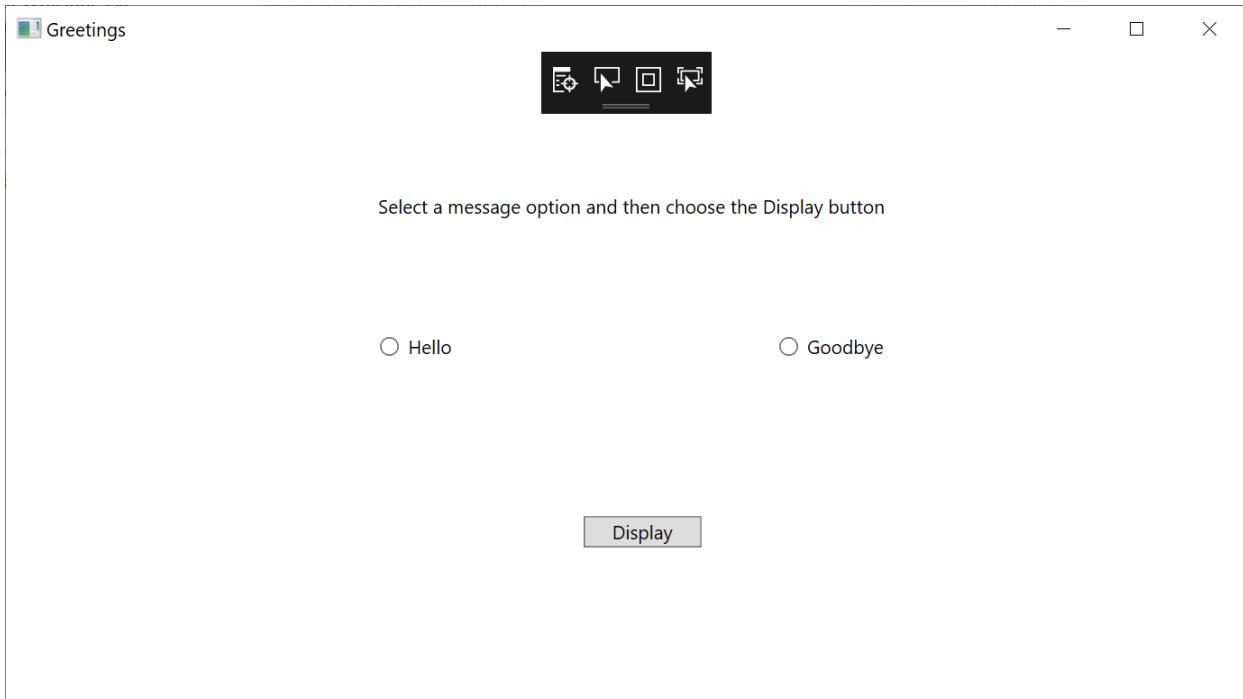
2. Stop the debugger by choosing Debug > Stop Debugging.

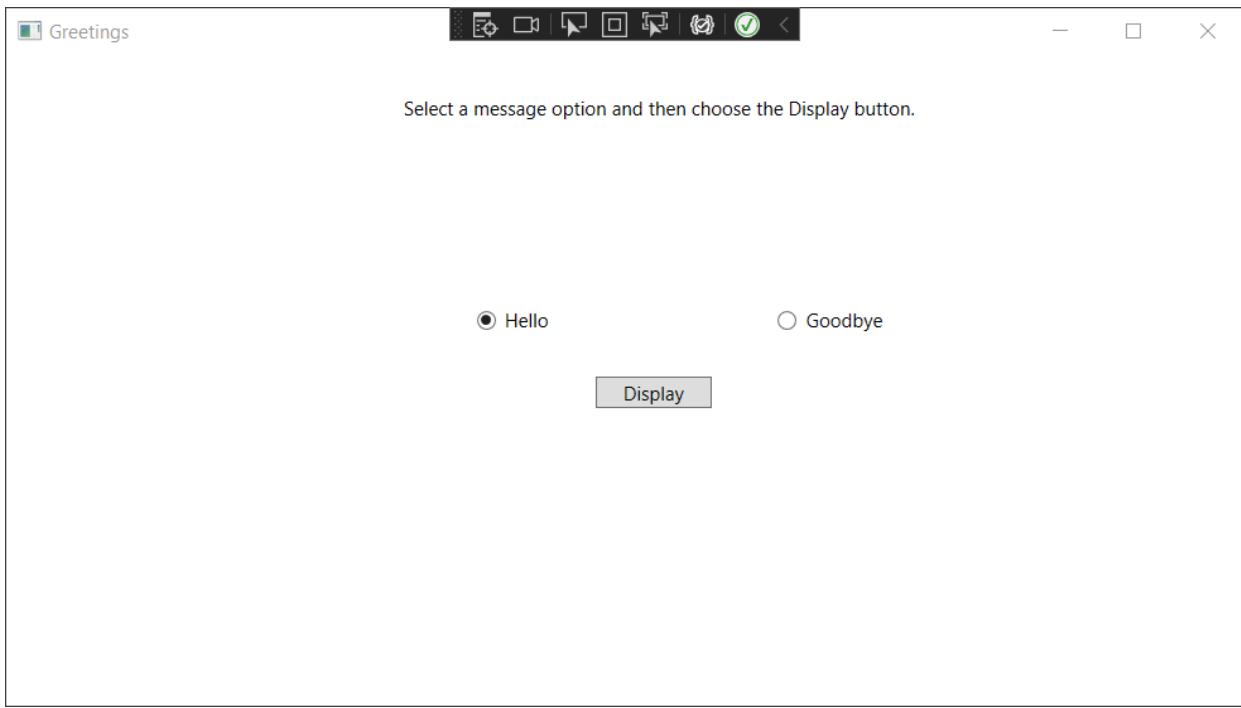
We renamed *MainWindow.xaml* to *Greetings.xaml* at the start of this tutorial, but the code still refers to *MainWindow.xaml* as the startup URI for the application, so the project can't start.

Specify *Greetings.xaml* as the startup URI

1. In Solution Explorer, open the *Application.xaml* file.
2. Change `StartupUri="MainWindow.xaml"` to `StartupUri="Greetings.xaml"`, and save the changes.

Start the debugger again (press F5). You should now see the **Greetings** window of your application.





Now close the application window to stop debugging.

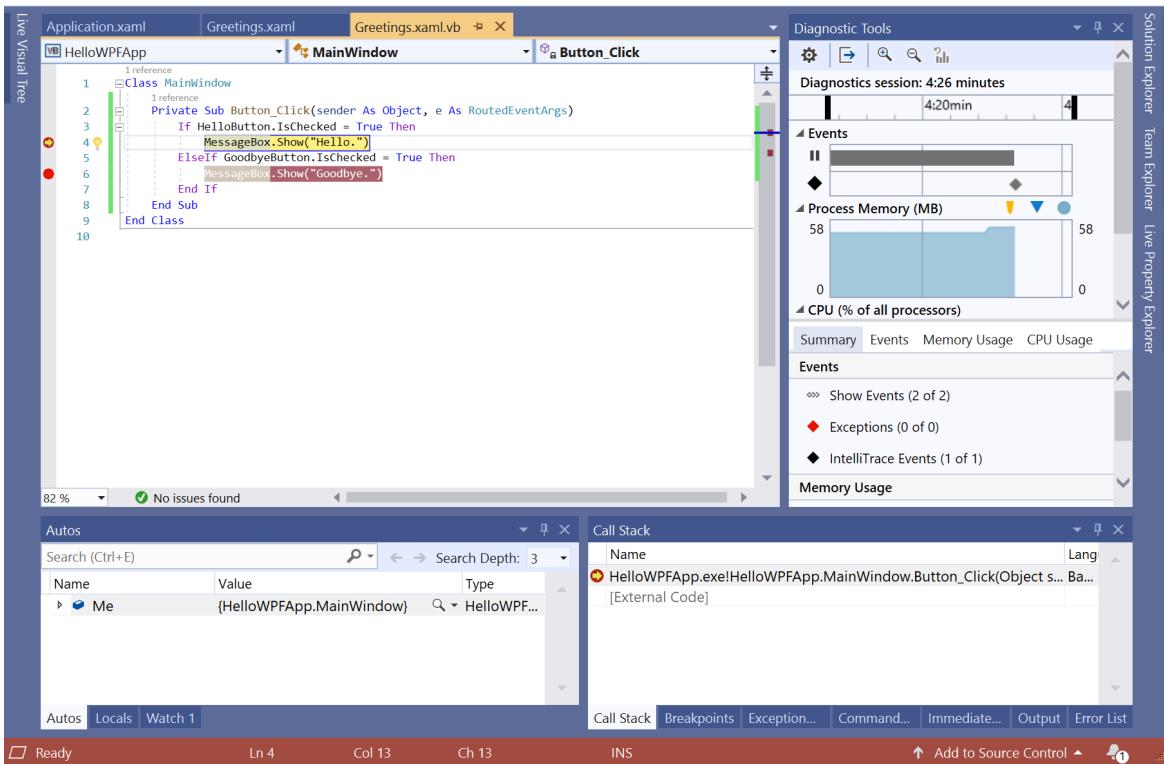
Debug with breakpoints

You can test the code during debugging by adding some breakpoints. You can add breakpoints by choosing **Debug > Toggle Breakpoint**, by clicking in the left margin of the editor next to the line of code where you want the break to occur, or by pressing **F9**.

Add breakpoints

1. Open *Greetings.xaml.vb*, and select the following line: `MessageBox.Show("Hello.")`
2. Add a breakpoint by pressing **F9** or from the menu by selecting **Debug**, then **Toggle Breakpoint**.
A red circle appears next to the line of code in the far left margin of the editor window.
3. Select the following line: `MessageBox.Show("Goodbye.")`.
4. Press the **F9** key to add a breakpoint, and then press **F5** to start debugging.
5. In the **Greetings** window, choose the **Hello** radio button, and then choose the **Display** button.

The line `MessageBox.Show("Hello.")` is highlighted in yellow. At the bottom of the IDE, the Autos, Locals, and Watch windows are docked together on the left side, and the Call Stack, Breakpoints, Exception Settings, Command, Immediate, and Output windows are docked together on the right side.



6. On the menu bar, choose Debug > Step Out.

The application resumes execution, and a message box with the word "Hello" appears.

7. Choose the OK button on the message box to close it.

8. In the **Greetings** window, choose the **Goodbye** radio button, and then choose the **Display** button.

The line `MessageBox.Show("Goodbye.")` is highlighted in yellow.

9. Choose the F5 key to continue debugging. When the message box appears, choose the OK button on the message box to close it.

10. Close the application window to stop debugging.

11. On the menu bar, choose Debug > Disable All Breakpoints.

1. Open *Greetings.xaml.vb*, and select the following line: `MessageBox.Show("Hello.")`

2. Add a breakpoint by pressing F9 or from the menu by selecting Debug, then Toggle Breakpoint.

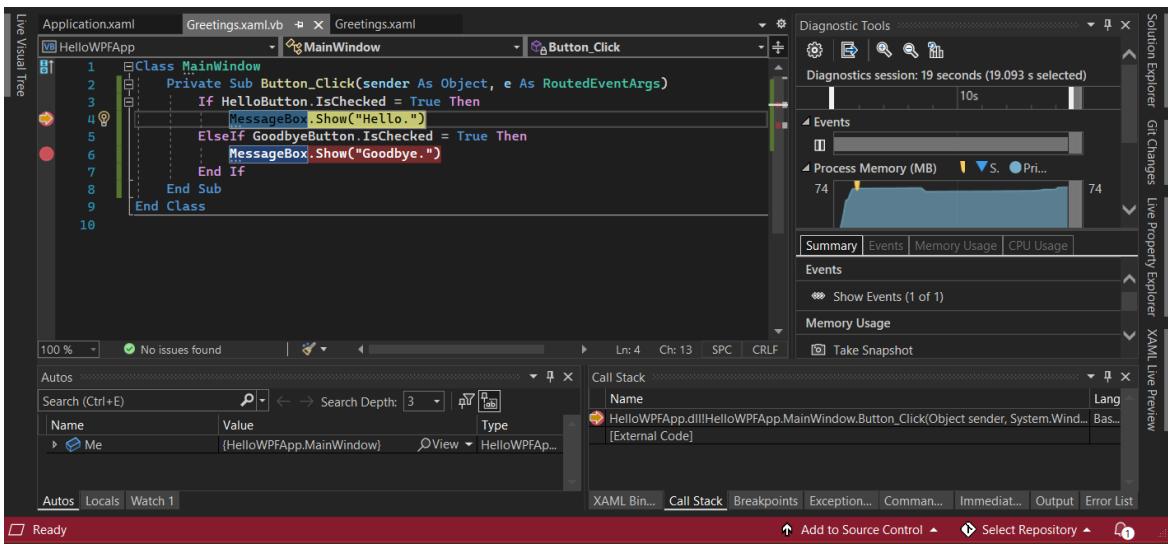
A red circle appears next to the line of code in the far left margin or gutter of the editor window.

3. Select the following line: `MessageBox.Show("Goodbye.")`.

4. Press the F9 key to add a breakpoint, and then press F5 to start debugging.

5. In the **Greetings** window, choose the **Hello** radio button, and then choose the **Display** button.

The line `MessageBox.Show("Hello.")` is highlighted in yellow. At the bottom of the IDE, the Autos, Locals, and Watch windows are docked together on the left side, and the Call Stack, Breakpoints, Exception Settings, Command, Immediate, and Output windows are docked together on the right side.



6. On the menu bar, choose **Debug > Step Out**.

The application resumes execution, and a message box with the word "Hello" appears.

7. Choose the **OK** button on the message box to close it.

8. In the **Greetings** window, choose the **Goodbye** radio button, and then choose the **Display** button.

The line `MessageBox.Show("Goodbye.")` is highlighted in yellow.

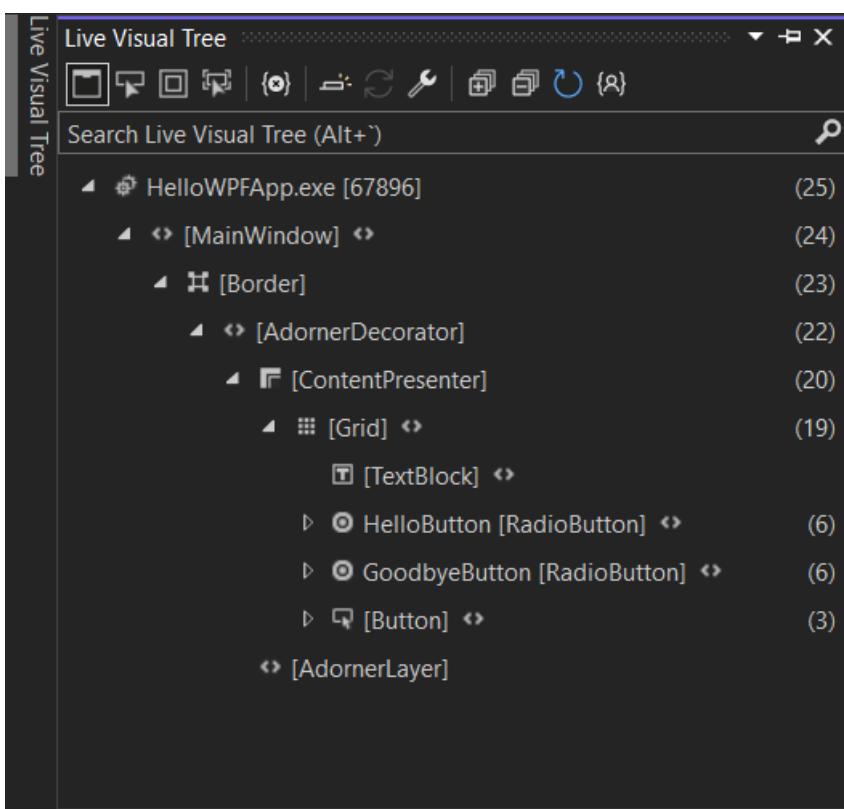
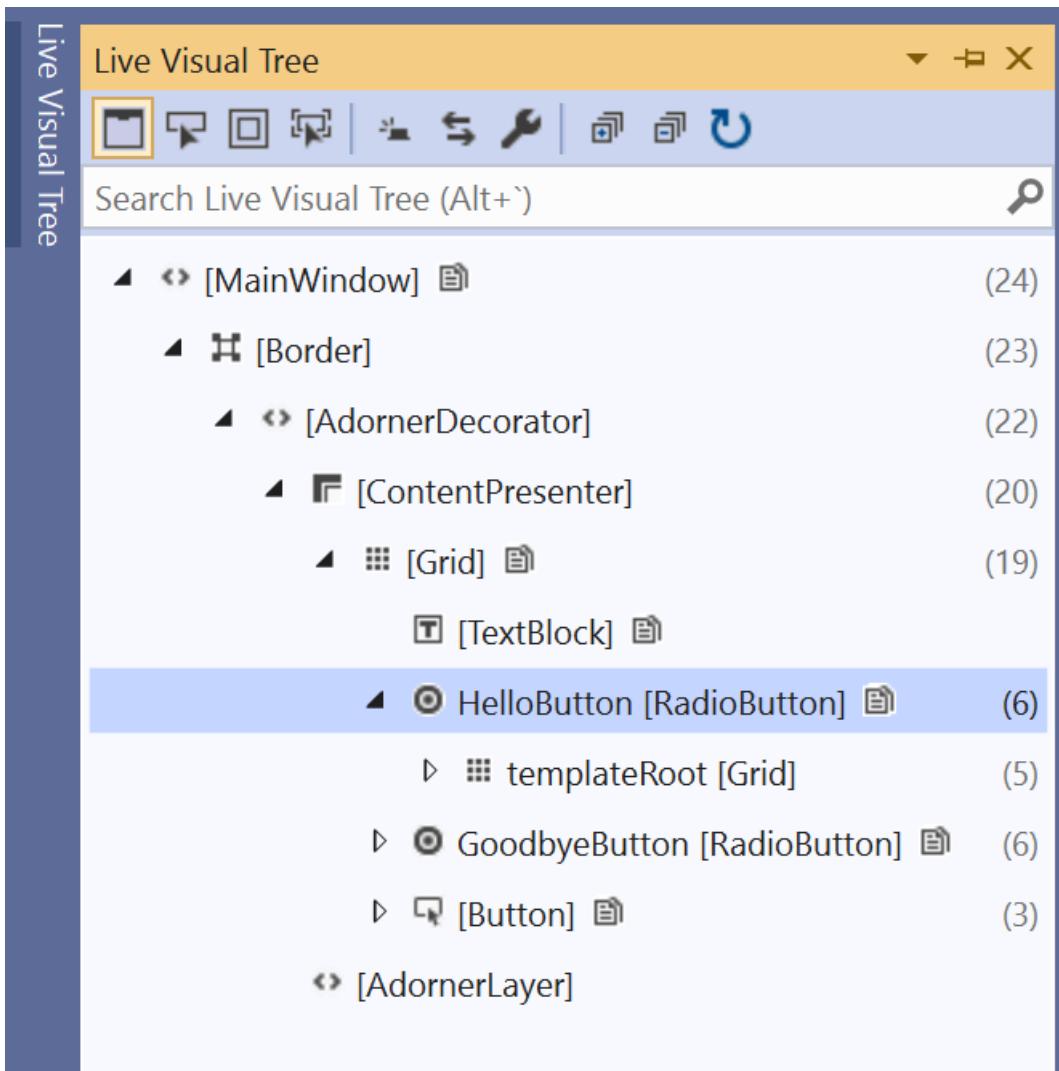
9. Choose the **F5** key to continue debugging. When the message box appears, choose the **OK** button on the message box to close it.

10. Close the application window to stop debugging.

11. On the menu bar, choose **Debug > Disable All Breakpoints**.

View a representation of the UI elements

In the running app, you should see a widget that appears at the top of your window. This is a runtime helper that provides quick access to some helpful debugging features. Click on the first button, **Go to Live Visual Tree**. You should see a window with a tree that contains all the visual elements of your page. Expand the nodes to find the buttons you added.



Build a release version of the application

Now that you've verified that everything works, you can prepare a release build of the application.

1. On the main menu, select **Build > Clean solution** to delete intermediate files and output files that were

created during previous builds. This is not necessary, but it cleans up the debug build outputs.

2. Change the build configuration for HelloWPFApp from **Debug** to **Release** by using the dropdown control on the toolbar (it says "Debug" currently).
3. Build the solution by choosing **Build > Build Solution**.

Congratulations on completing this tutorial! You can find the *.exe* you built under your solution and project directory (...|HelloWPFApp>HelloWPFApp\bin\Release).

See also

- [What's new in Visual Studio 2017](#)
- [Productivity tips](#)
- [What's new in Visual Studio 2019](#)
- [Productivity tips](#)
- [What's new in Visual Studio 2022](#)
- [Productivity tips](#)

Create a Windows Forms app in Visual Studio with Visual Basic

11/13/2021 • 4 minutes to read • [Edit Online](#)

In this short introduction to the Visual Studio integrated development environment (IDE), you'll create a simple Visual Basic application that has a Windows-based user interface (UI).

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

NOTE

Some of the screenshots in this tutorial use the dark theme. If you aren't using the dark theme but would like to, see the [Personalize the Visual Studio IDE and Editor](#) page to learn how.

If you haven't already installed Visual Studio, go to the [Visual Studio 2022 downloads](#) page to install it for free.

NOTE

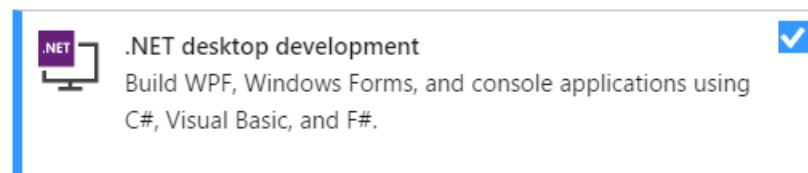
Some of the screenshots in this tutorial use the dark theme. If you aren't using the dark theme but would like to, see the [Personalize the Visual Studio IDE and Editor](#) page to learn how.

Create a project

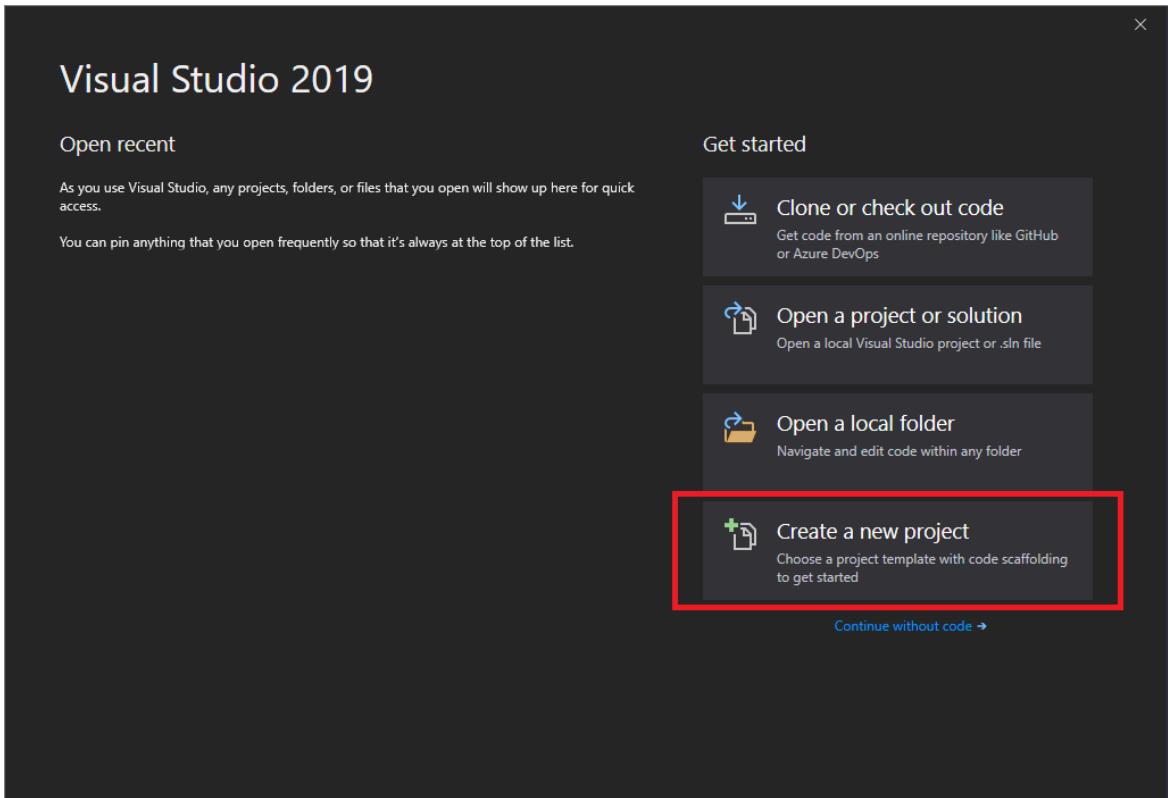
First, you'll create a Visual Basic application project. The project type comes with all the template files you'll need, before you've even added anything.

1. Open Visual Studio 2017.
2. From the top menu bar, choose **File > New > Project**.
3. In the **New Project** dialog box in the left pane, expand **Visual Basic**, and then choose **Windows Desktop**. In the middle pane, choose **Windows Forms App (.NET Framework)**. Then name the file `HelloWorld`.

If you don't see the **Windows Forms App (.NET Framework)** project template, cancel out of the **New Project** dialog box and from the top menu bar, choose **Tools > Get Tools and Features**. The Visual Studio Installer launches. Choose the **.NET desktop development** workload, then choose **Modify**.

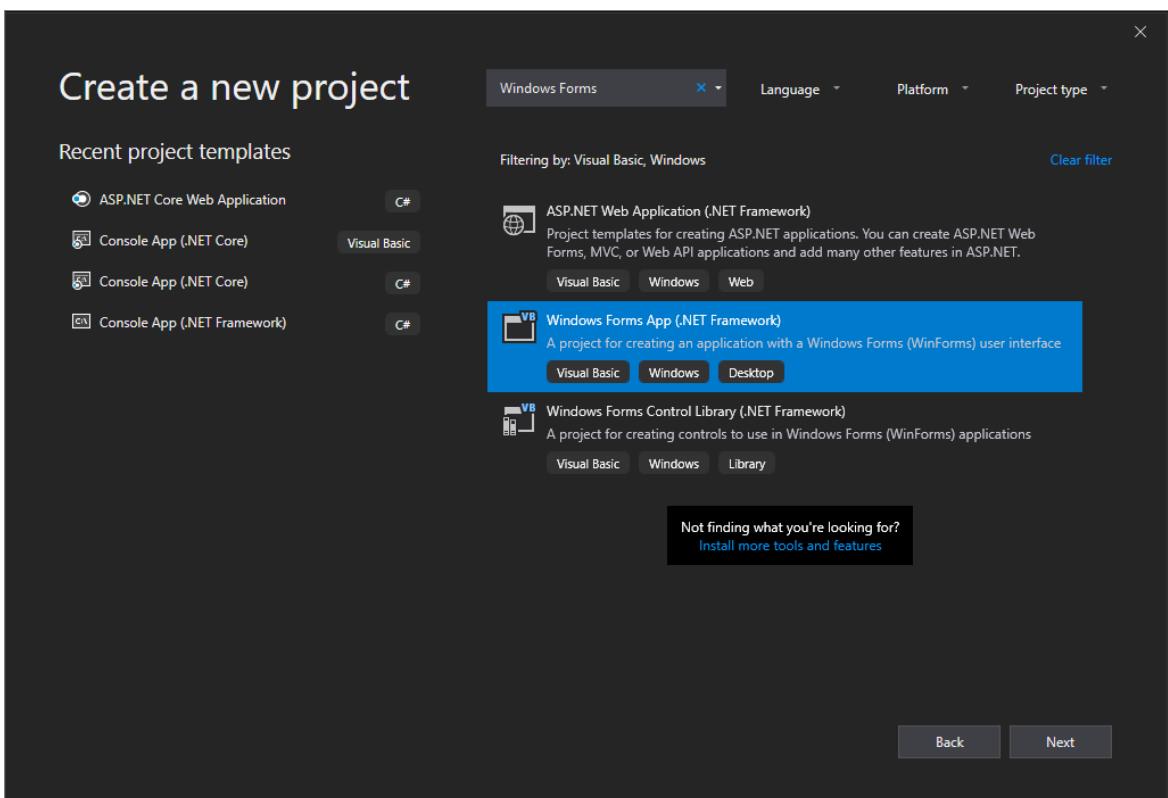


1. Open Visual Studio.
2. On the start window, choose **Create a new project**.



3. On the **Create a new project** window, choose the **Windows Forms App (.NET Framework)** template for Visual Basic.

(If you prefer, you can refine your search to quickly get to the template you want. For example, enter or type *Windows Forms App* in the search box. Next, choose **Visual Basic** from the Language list, and then choose **Windows** from the Platform list.)



NOTE

If you do not see the **Windows Forms App (.NET Framework)** template, you can install it from the Create a new project window. In the Not finding what you're looking for? message, choose the **Install more tools and features** link.

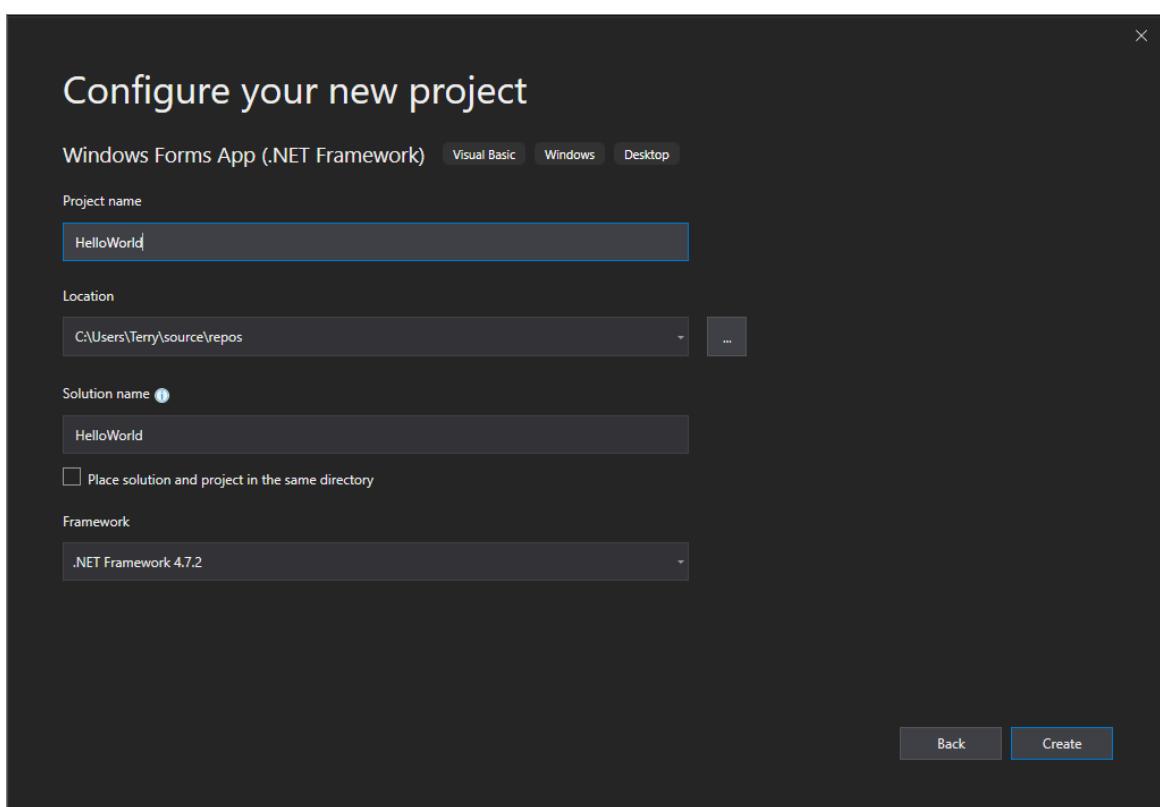
Not finding what you're looking for?
[Install more tools and features](#)

Next, in the Visual Studio Installer, choose the **.NET desktop development** workload.



After that, choose the **Modify** button in the Visual Studio Installer. You might be prompted to save your work; if so, do so. Next, choose **Continue** to install the workload. Then, return to step 2 in this "[Create a project](#)" procedure.

4. In the **Configure your new project** window, type or enter *HelloWorld* in the **Project name** box. Then, choose **Create**.



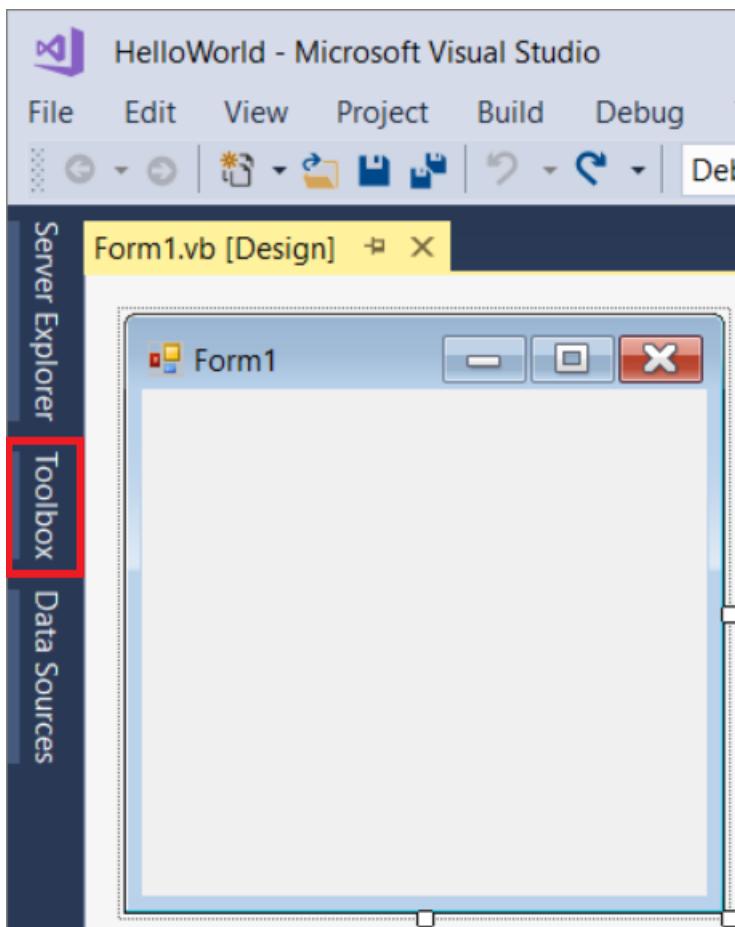
Visual Studio opens your new project.

Create the application

After you select your Visual Basic project template and name your file, Visual Studio opens a form for you. A form is a Windows user interface. We'll create a "Hello World" application by adding controls to the form, and then we'll run the app.

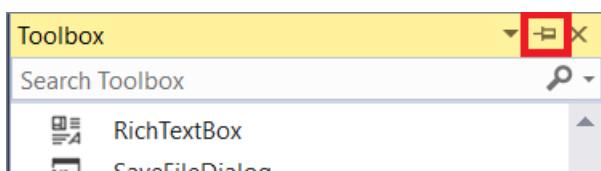
Add a button to the form

1. Click **Toolbox** to open the Toolbox fly-out window.

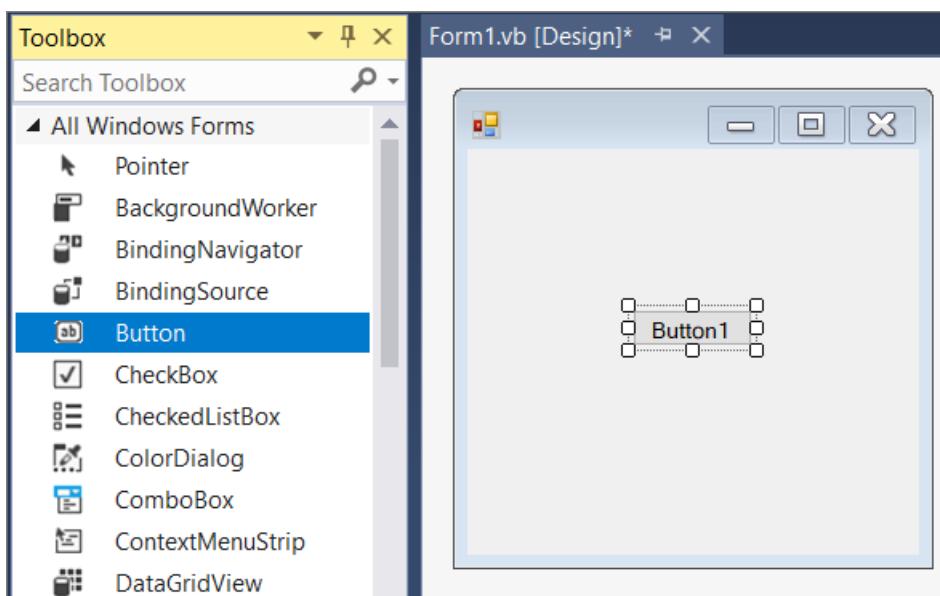


(If you don't see the **Toolbox** fly-out option, you can open it from the menu bar. To do so, **View > Toolbox**. Or, press **Ctrl+Alt+X**.)

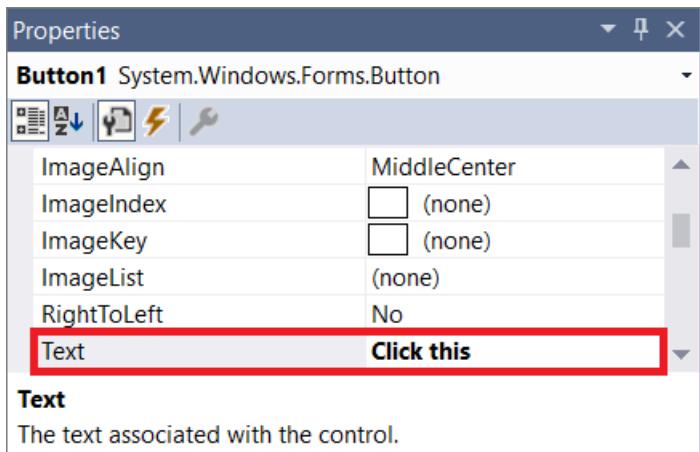
2. Click the **Pin** icon to dock the **Toolbox** window.



3. Click the **Button** control and then drag it onto the form.

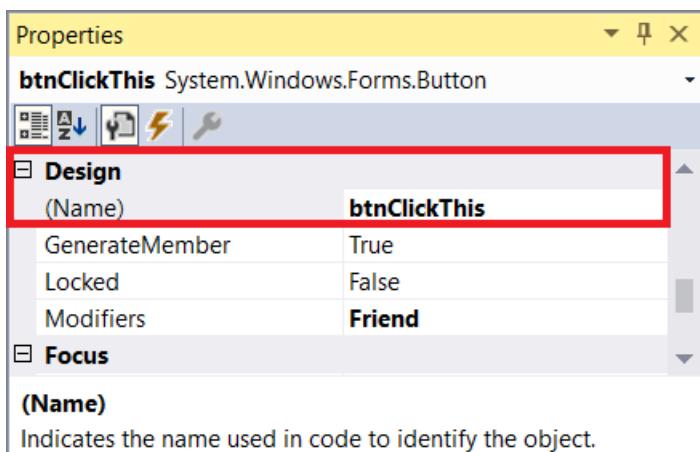


4. In the **Appearance** section (or the **Fonts** section) of the **Properties** window, type **Click this**, and then press **Enter**.



(If you don't see the **Properties** window, you can open it from the menu bar. To do so, click **View > Properties Window**. Or, press **F4**.)

5. In the **Design** section of the **Properties** window, change the name from **Button1** to `btnClickThis`, and then press **Enter**.



NOTE

If you've alphabetized the list in the **Properties** window, **Button1** appears in the **(DataBindings)** section, instead.

Add a label to the form

Now that we've added a button control to create an action, let's add a label control to send text to.

1. Select the **Label** control from the **Toolbox** window, and then drag it onto the form and drop it beneath the **Click this** button.
2. In either the **Design** section or the **(DataBindings)** section of the **Properties** window, change the name of **Label1** to `lblHelloWorld`, and then press **Enter**.

Add code to the form

1. In the **Form1.vb [Design]** window, double-click the **Click this** button to open the **Form1.vb** window.

(Alternatively, you can expand **Form1.vb** in **Solution Explorer**, and then click **Form1**.)

2. In the **Form1.vb** window, between the **Private Sub** and **End Sub** lines, type or enter

`lblHelloWorld.Text = "Hello World!"` as shown in the following screenshot:

```
Form1.vb*  Form1.vb [Design]*  
WindowsApp1  btnClickThis  Click  
1  Public Class Form1  
2  Private Sub btnClickThis_Click(sender As Object, e As EventArgs)  
3      Handles btnClickThis.Click  
4          lblHelloWorld.Text = "Hello World!"  
5      End Sub  
6  End Class
```

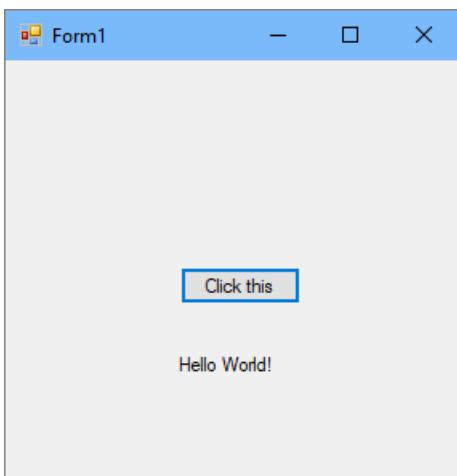
Run the application

1. Click the **Start** button to run the application.



Several things will happen. In the Visual Studio IDE, the **Diagnostics Tools** window will open, and an **Output** window will open, too. But outside of the IDE, a **Form1** dialog box appears. It will include your **Click this** button and text that says **Label1**.

2. Click the **Click this** button in the **Form1** dialog box. Notice that the **Label1** text changes to **Hello World!**.



3. Close the **Form1** dialog box to stop running the app.

Next steps

To learn more, continue with the following tutorial:

[Tutorial: Create a picture viewer](#)

See also

- [More Visual Basic tutorials](#)
- [C# tutorials](#)
- [C++ tutorials](#)

Tutorial: Open a project from a repo

11/13/2021 • 10 minutes to read • [Edit Online](#)

In this tutorial, you'll use Visual Studio to connect to a repository for the first time and then open a project from it.

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

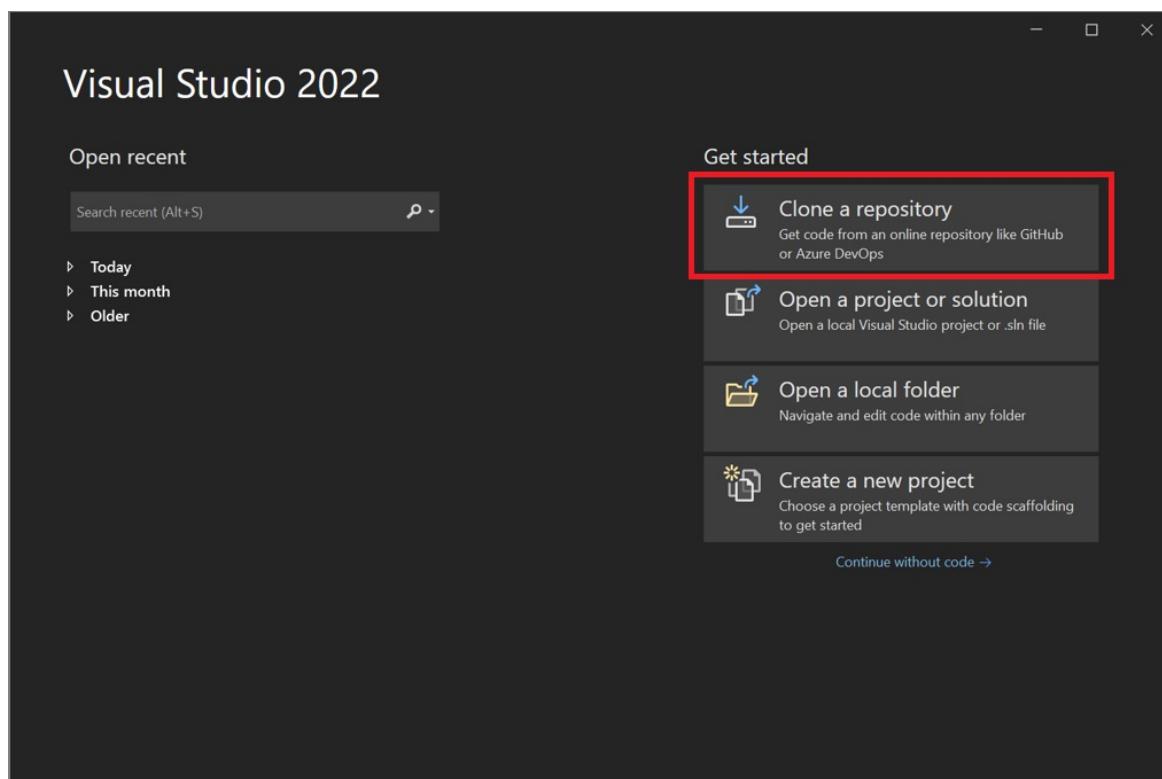
Open a project from a GitHub repo

Visual Studio makes it easy to open a project from a repo. You can do so when you start Visual Studio, or you can do so directly from within the [Visual Studio IDE](#).

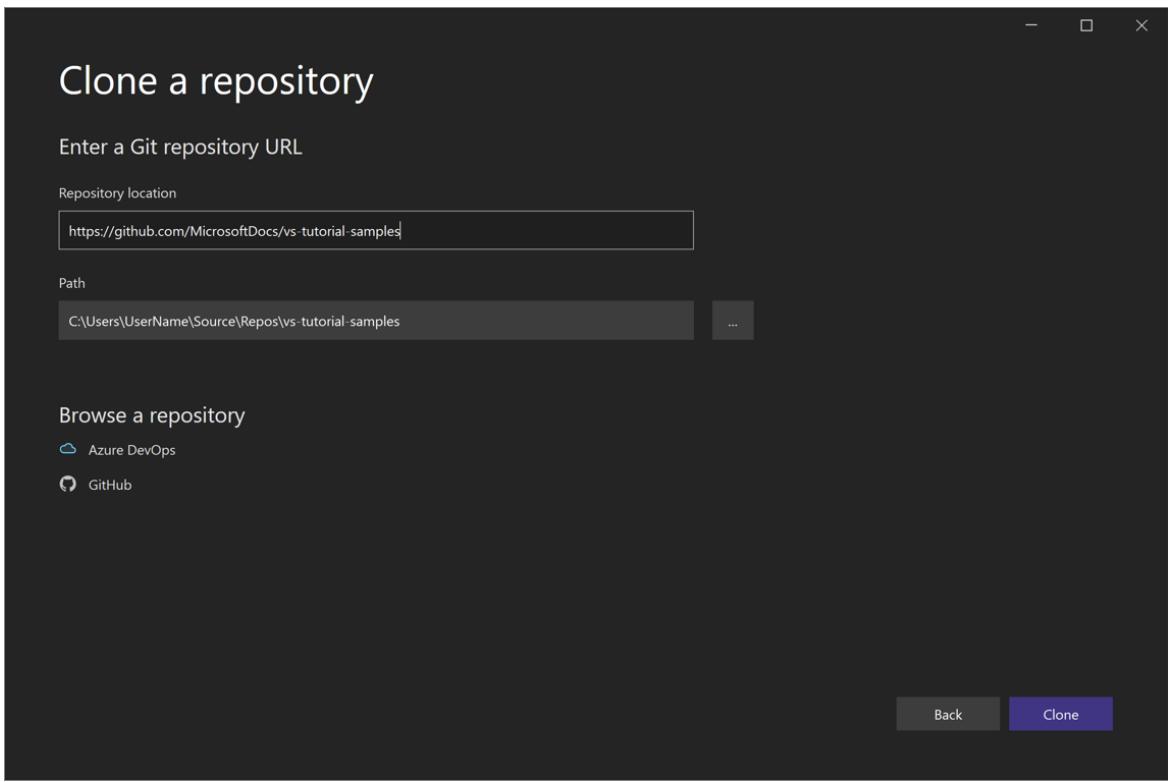
Here's how.

Use the start window

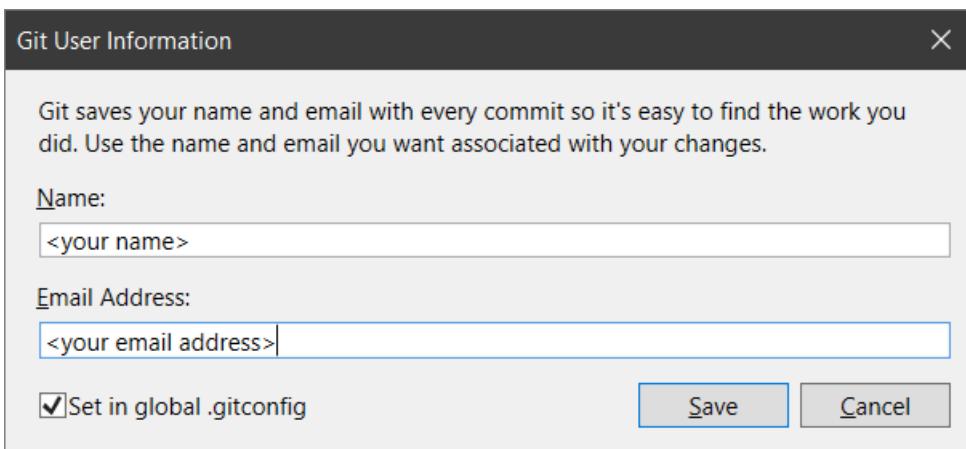
1. Open Visual Studio.
2. On the start window, select **Clone a repository**.



3. Enter or type the repository location, and then select the **Clone** button.



4. You might be asked for your user sign-in information in the **Git User Information** dialog box. You can either add your information or edit the default information it provides.



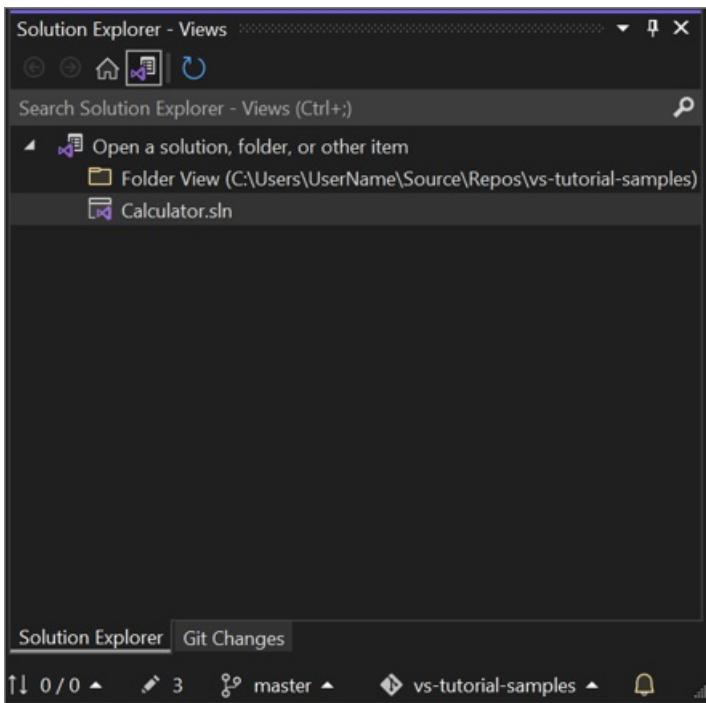
Select **Save** to add the info to your global `.gitconfig` file. (Or, you can choose to do this later by selecting **Cancel**.)

TIP

For more information about signing in to Visual Studio, see the [Sign in to Visual Studio](#) page. For specific information about how to use your GitHub account to sign in, see the [Work with GitHub accounts in Visual Studio](#) page. And if you receive a trust notification and want to know more about it, see the [Configure trust settings for files and folders](#) page.

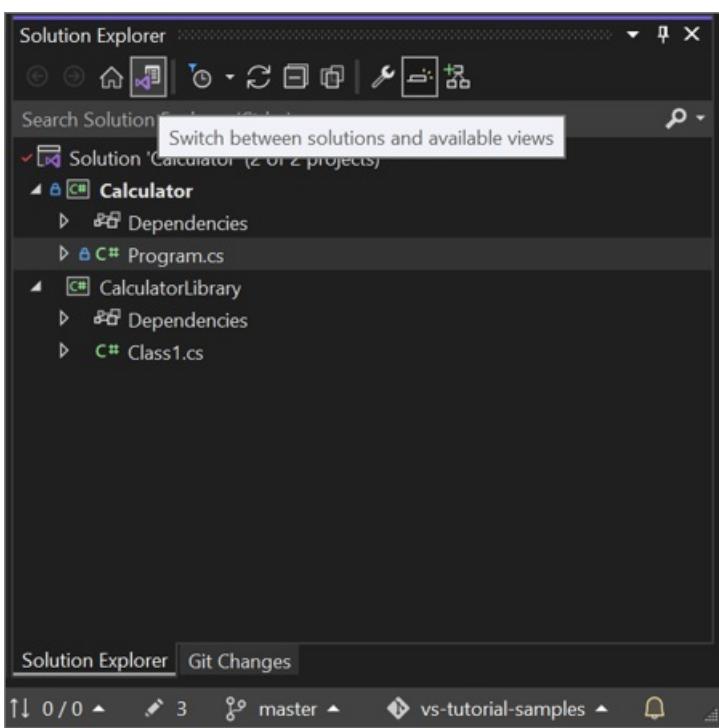
View files in Solution Explorer

1. Next, Visual Studio loads the solution(s) from the repository by using the **Folder View** in [Solution Explorer](#).



You can view a solution in **Solution View** by double-clicking its .sln file.

Or, you can select the **Switch Views** button, and then select **Program.cs** to view a solution's code.



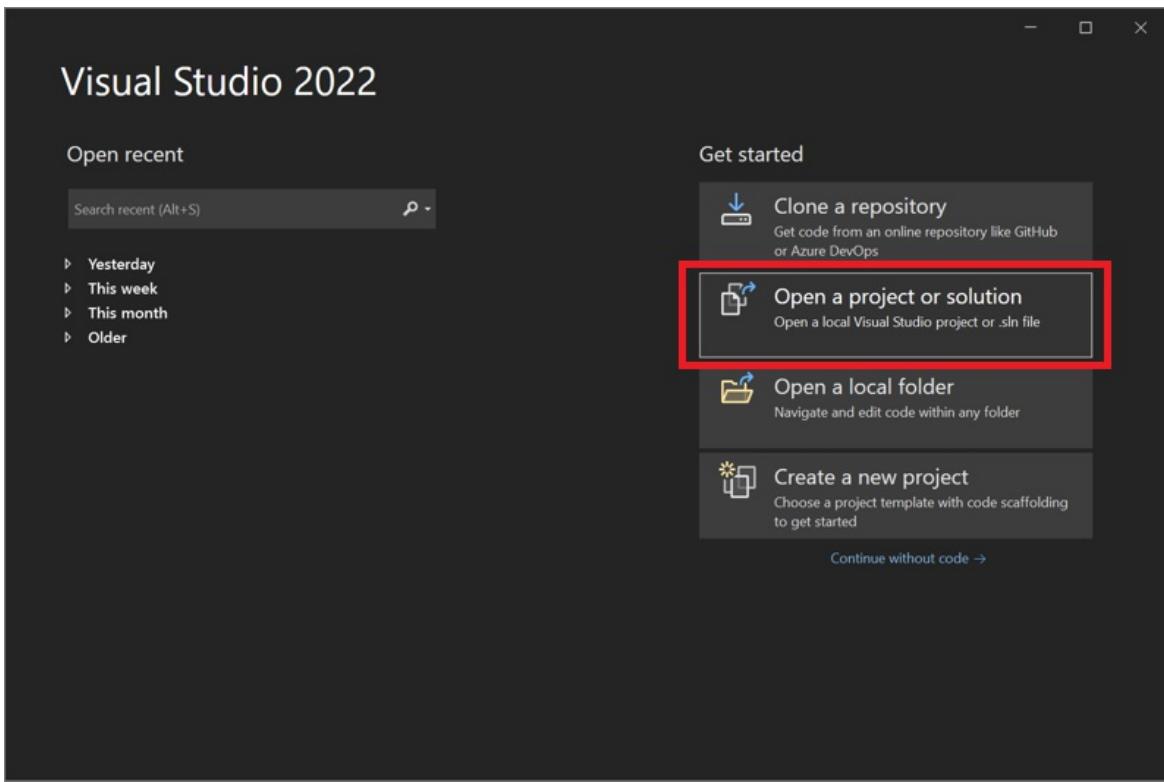
TIP

The default view is set to Folder View. You can change it to Solution View from the **Git** menu. Select **Settings > Source Control > Git Global Settings > Automatically load the solution when opening a Git repository** to do so.

Open a project locally from a previously cloned GitHub repo

1. Open Visual Studio.
2. On the start window, select **Open a project or solution**.

Visual Studio opens an instance of File Explorer, where you can browse to your solution or project, and then select it to open it.



TIP

If you've opened the project or solution recently, select it from the **Open recent** section to quickly open it again.

Start coding!

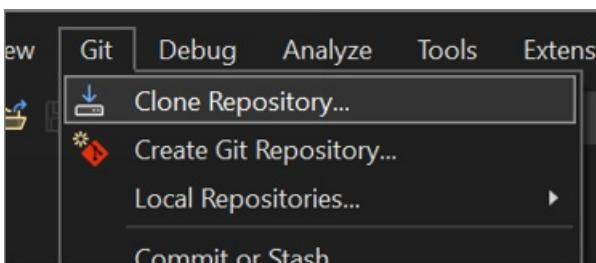
Use the IDE

You can also use the **Git** menu or the **Select Repository** control in the Visual Studio IDE to interact with a repository's folders and files.

Here's how.

To clone a repo and open a project

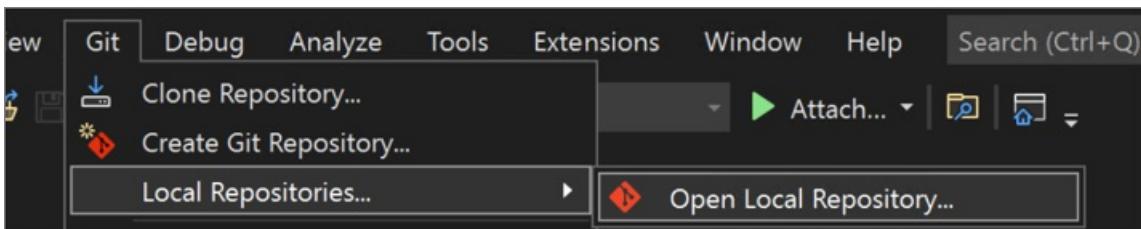
1. In the Visual Studio IDE, select the **Git** menu, and then select **Clone Repository**.



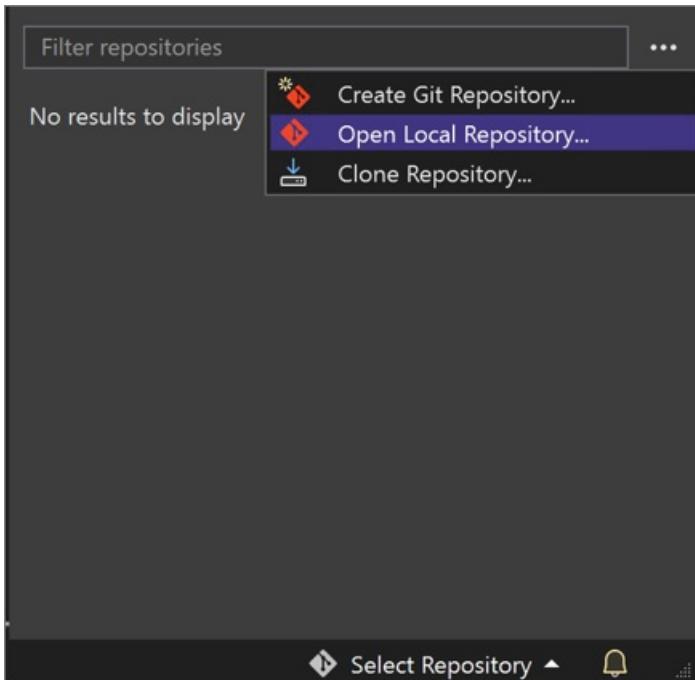
2. Follow the prompts to connect to the Git repository that includes the files you're looking for.

To open local folders and files

1. In the Visual Studio IDE, select the **Git** menu, select **Local Repositories**, and then select **Open Local Repository**.



Alternatively, you can perform the same task from **Solution Explorer**. To do so, choose the **Select Repository** control, select the ellipsis icon that's next to the **Filter repositories** box, and then select **Open Local Repository**.

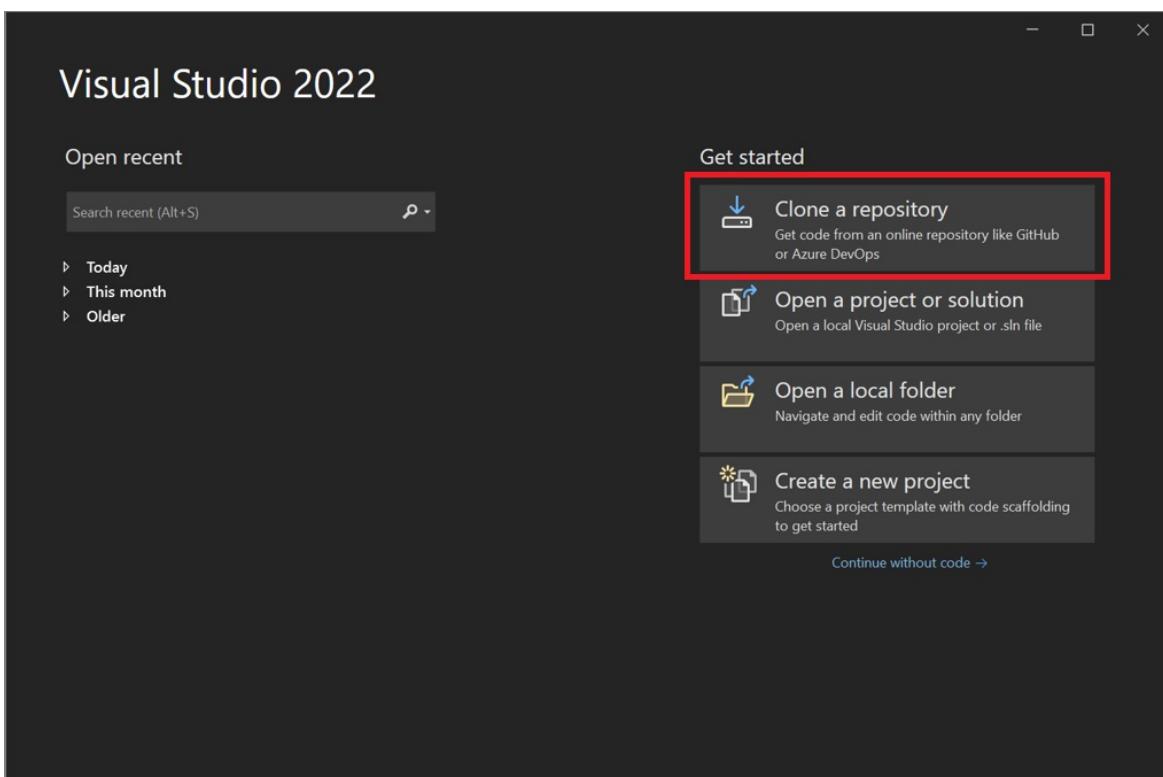


2. Follow the prompts to connect to the Git repository that has the files you're looking for.

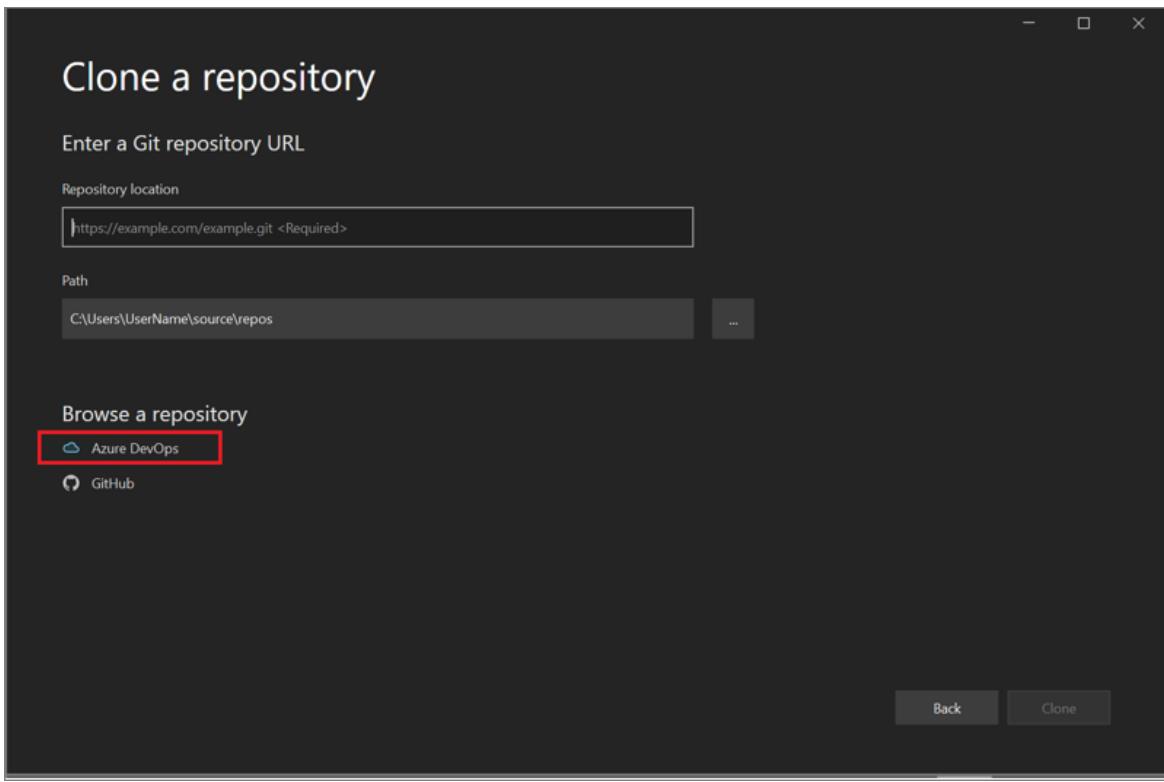
Browse to an Azure DevOps repo

Here's how to browse to and clone an Azure DevOps repo by using Visual Studio.

1. Open Visual Studio.
2. On the start window, select **Clone a repository**.



3. In the **Browse a repository** section, select **Azure DevOps**.



4. Follow the prompts to clone an Azure DevOps repo that includes the files you're looking for, and then open your project.

Open a project from a GitHub repo with Visual Studio 2019

How you open a project from a GitHub repo by using Visual Studio depends on which version you have. Specifically, if you've installed version Visual Studio 2019 [version 16.8](#) or later, there's a new, more fully integrated [Git experience in Visual Studio](#) available to you.

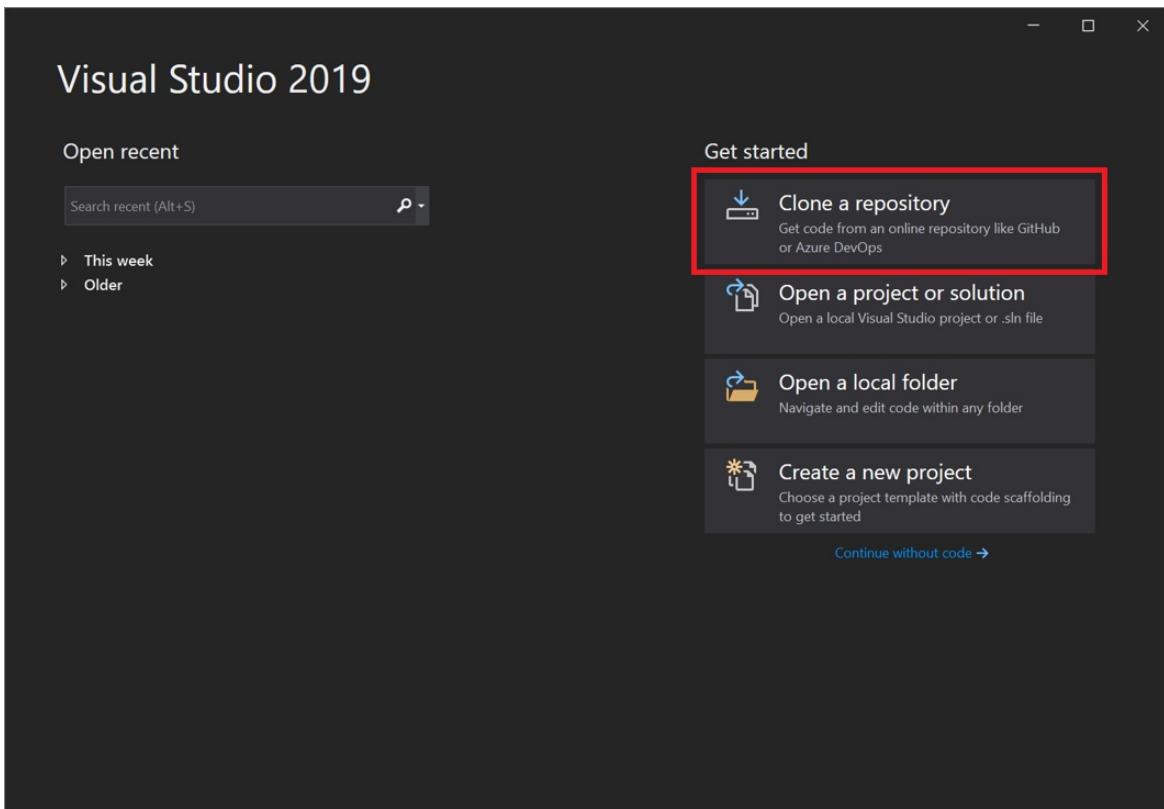
But no matter which version you've installed, you can always open a project from a GitHub repo with Visual Studio.

Visual Studio 2019 version 16.8 and later

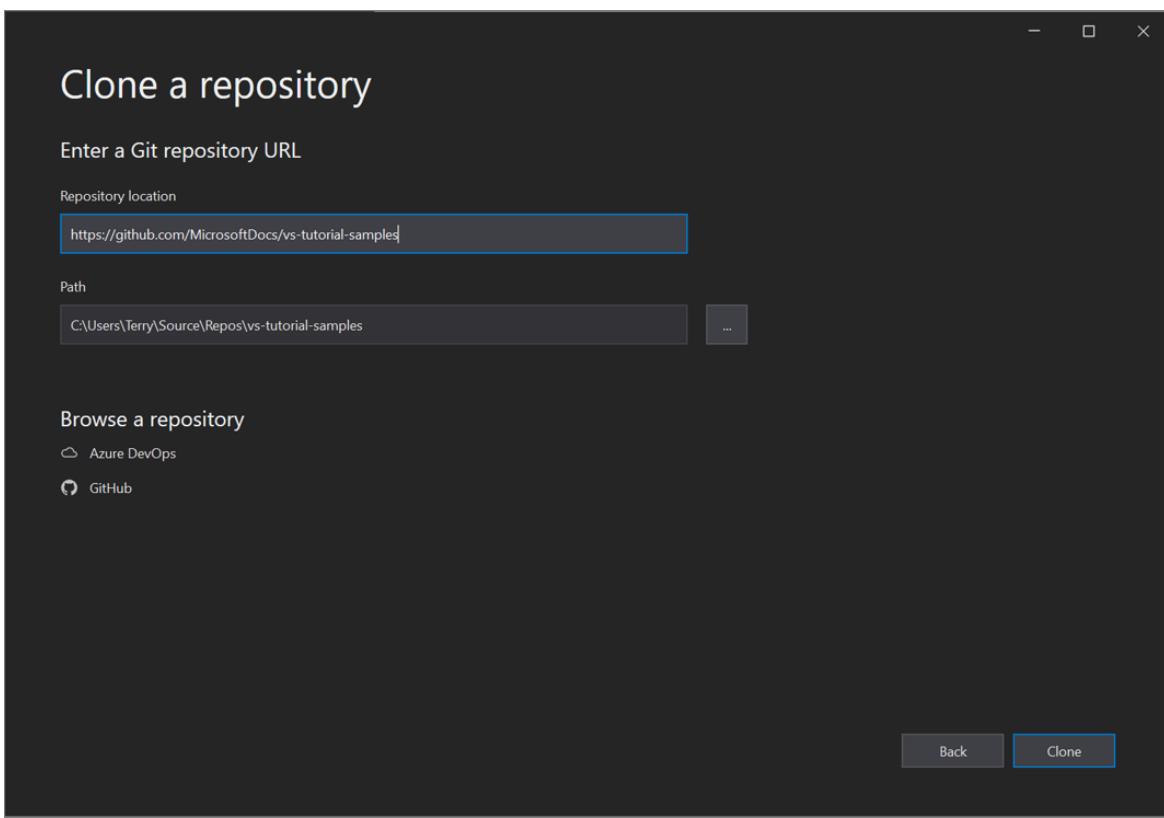
Here's how to use Git in Visual Studio 2019 [version 16.8](#) or later.

Clone a GitHub repo and then open a project

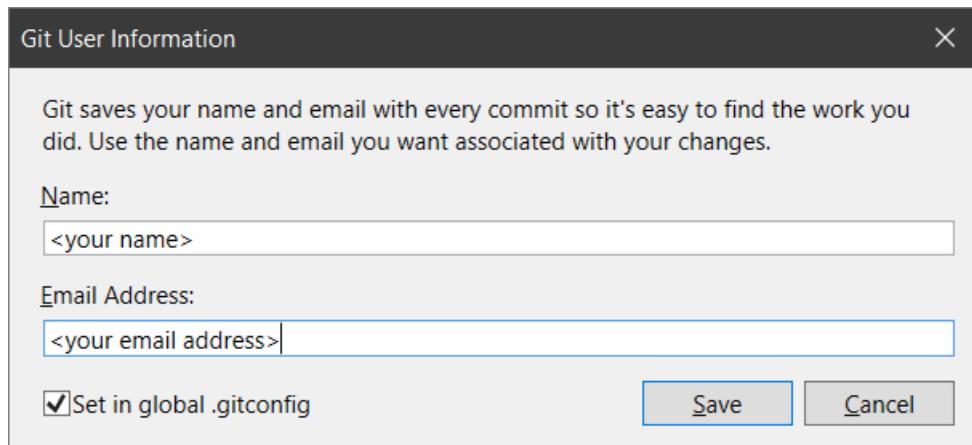
1. Open Visual Studio 2019.
2. On the start window, select **Clone a repository**.



3. Enter or type the repository location, and then select **Clone**.



4. You might be asked for your user sign-in information in the **Git User Information** dialog box. You can either add your information or edit the default information it provides.

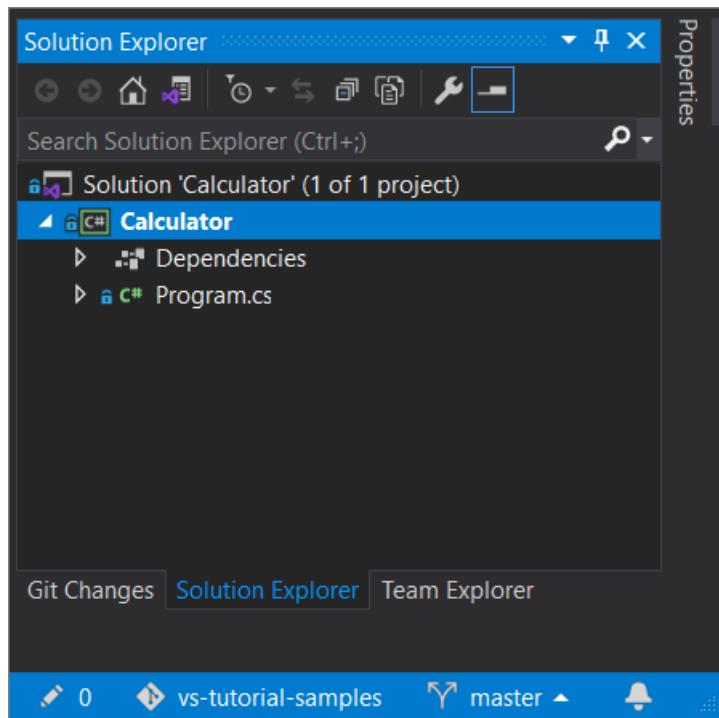


Select **Save** to add the info to your global `.gitconfig` file. (Or, you can choose to do this later by selecting **Cancel**.)

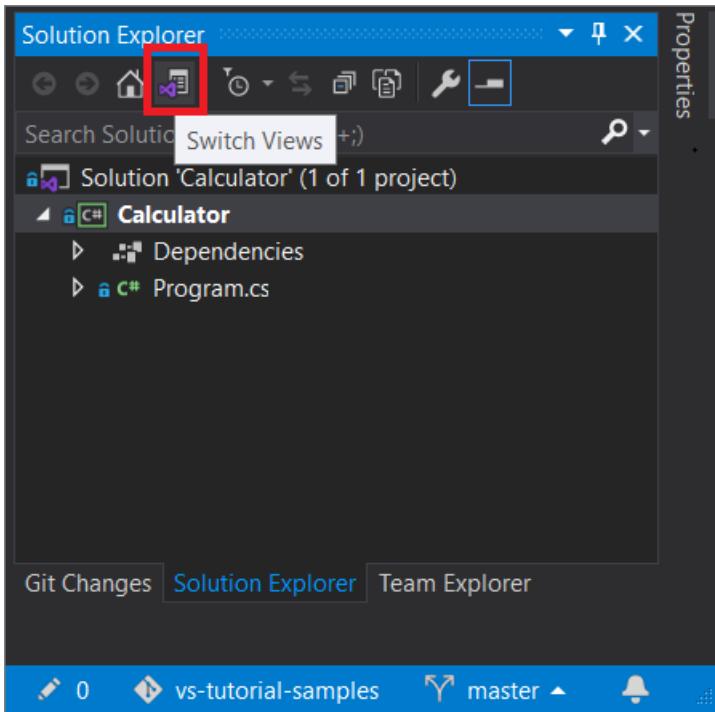
TIP

For more information about signing in to Visual Studio, see the [Sign in to Visual Studio](#) page. And for specific information about how to use your GitHub account to sign in, see the [Work with GitHub accounts in Visual Studio](#) page.

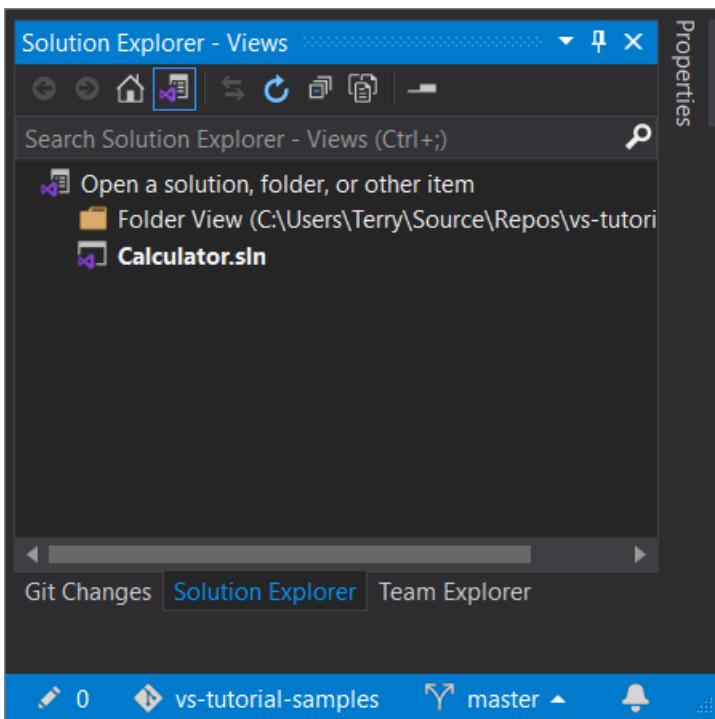
Next, Visual Studio automatically loads and opens the solution from the repository.



5. If your repository contains multiple solutions, you will see them in Solution Explorer. You can view the list of solutions by selecting the **Switch Views** button in Solution Explorer.



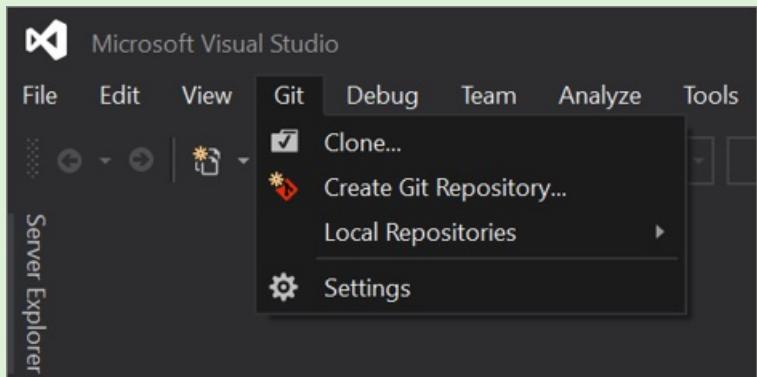
Solution Explorer then gives you the option to open the root folder in **Folder View** or to select a solution file to open.



To toggle the view, select the **Switch Views** button again.

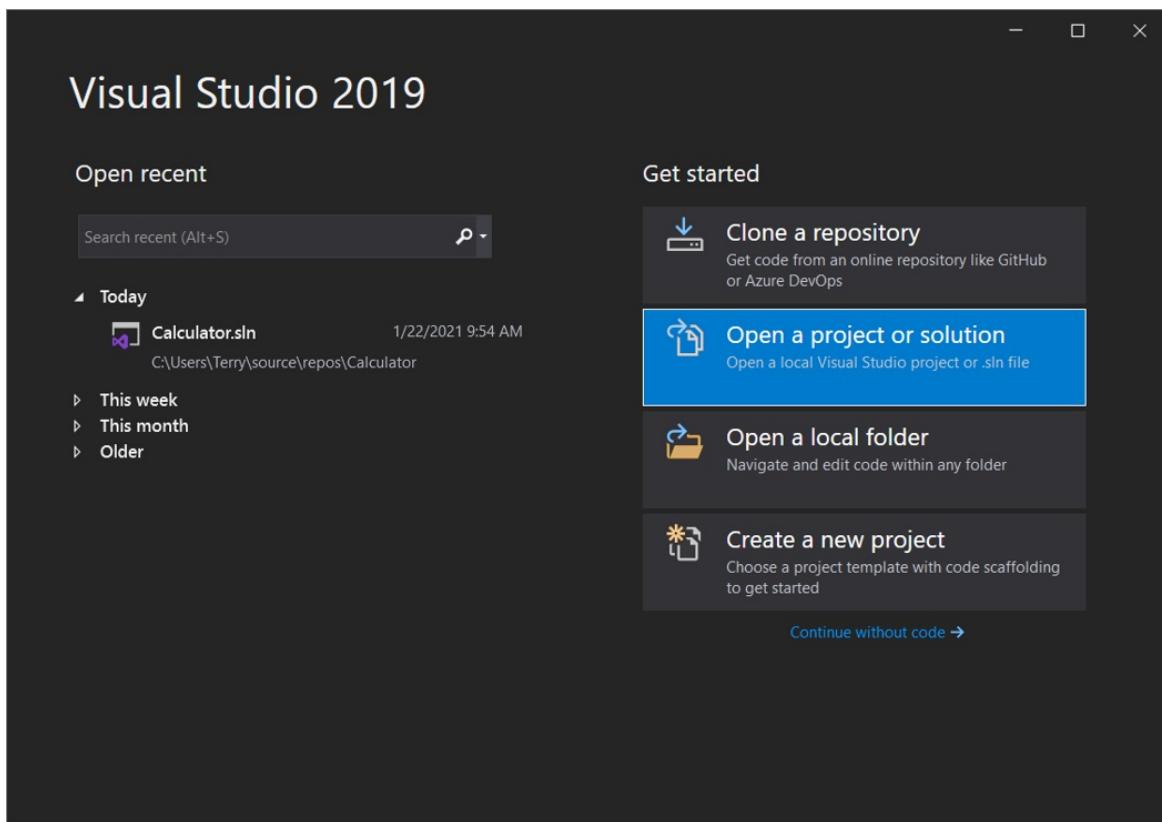
TIP

You can also use the **Git** menu in the Visual Studio IDE to clone a repo and open a project.

**Open a project locally from a previously cloned GitHub repo**

1. Open Visual Studio 2019 version 16.8 or later.
2. On the start window, select **Open a project or solution**.

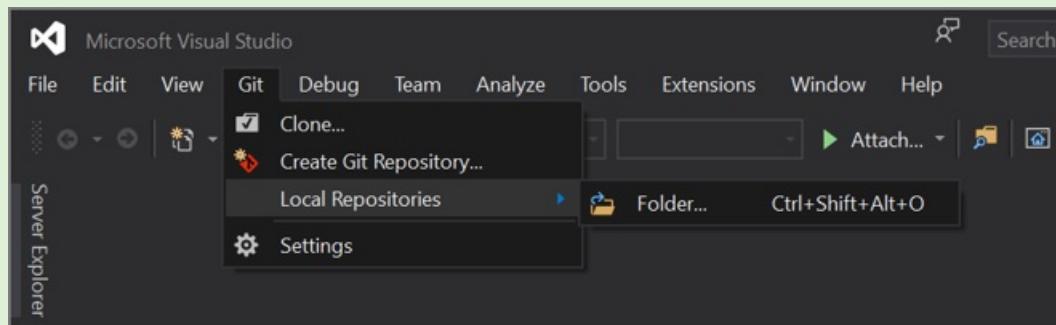
Visual Studio opens an instance of File Explorer, where you can browse to your solution or project, and then select it to open it.



If you've opened the project or solution recently, select it from the **Open recent** section to quickly open it again.

TIP

You can also use the **Git** menu in the Visual Studio IDE to open local folders and files from a repo that you've previously cloned.



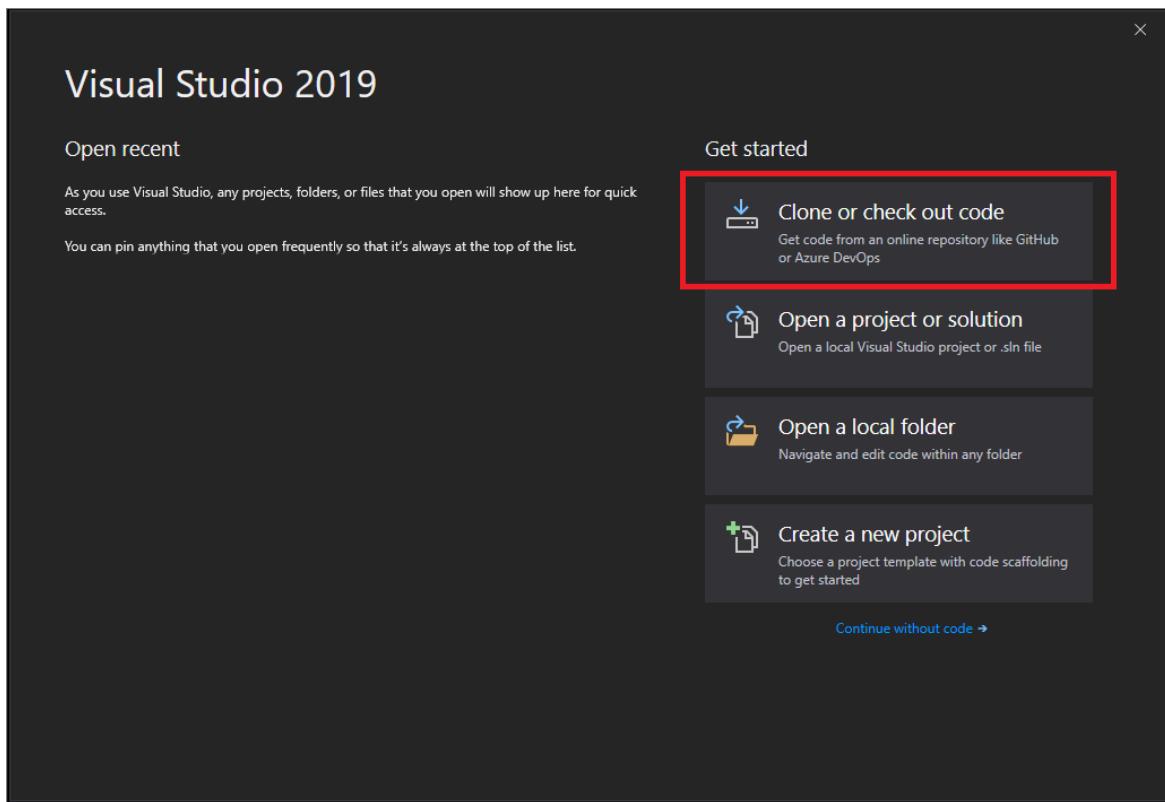
Start coding!

Visual Studio 2019 version 16.7 and earlier

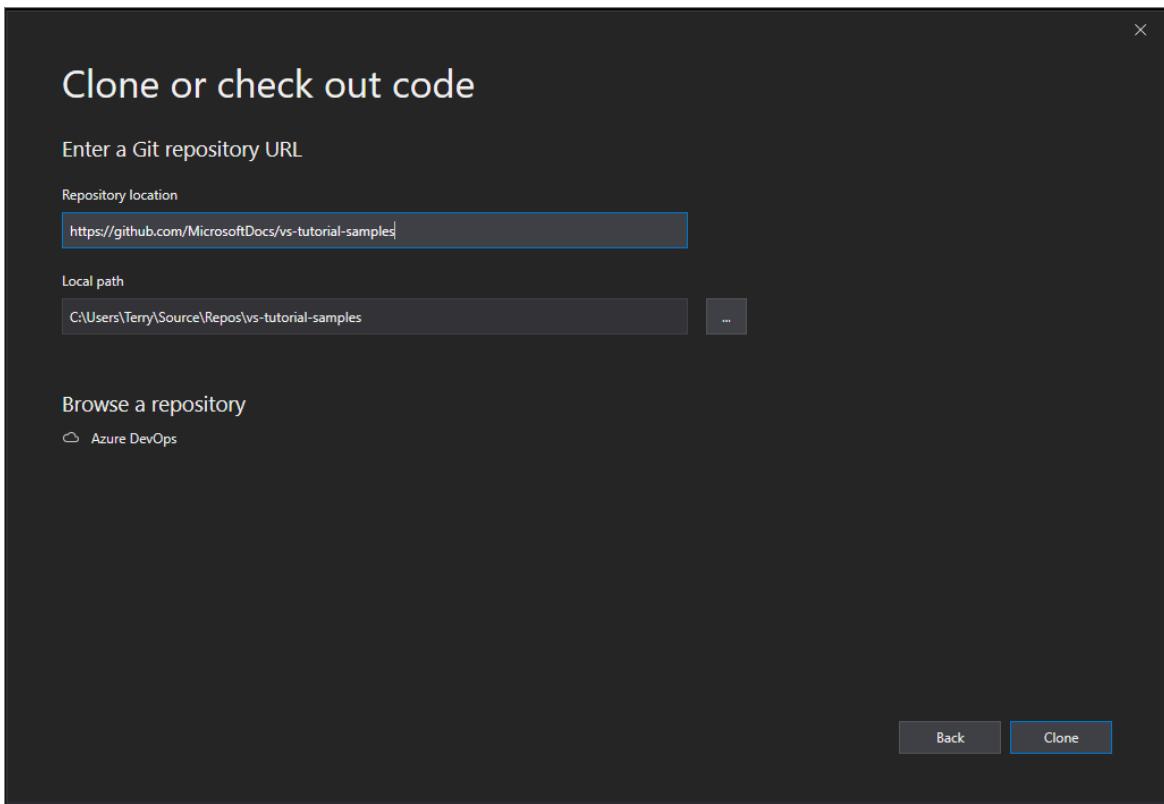
Here's how to use Git in Visual Studio 2019 **version 16.7** or earlier.

Clone a GitHub repo and then open a project

1. Open Visual Studio 2019 version 16.7 or earlier.
2. On the start window, select **Clone or check out code**.

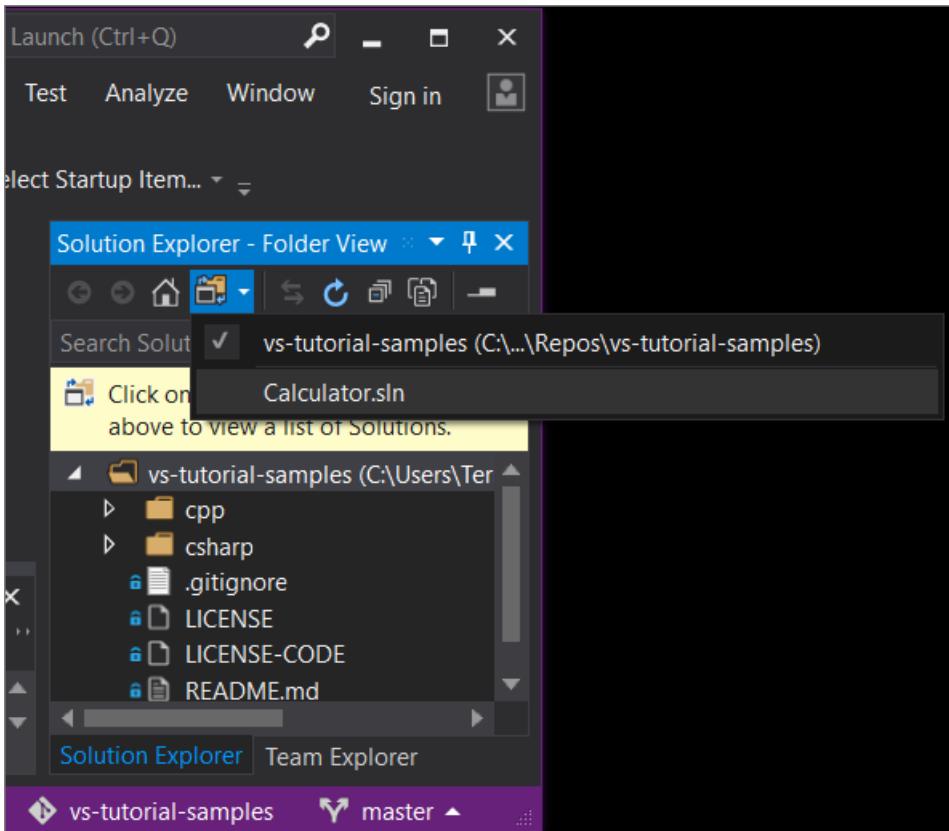


3. Enter or type the repository location, and then select **Clone**.



Visual Studio opens the project from the repo.

4. If you have a solution file available, it will appear in the "Solutions and Folders" fly-out menu. Select it, and Visual Studio opens your solution.



If you do not have a solution file (specifically, an .sln file) in your repo, the fly-out menu says "No Solutions Found." However, you can double-click any file from the folder menu to open it in the Visual Studio code editor.

Start coding!

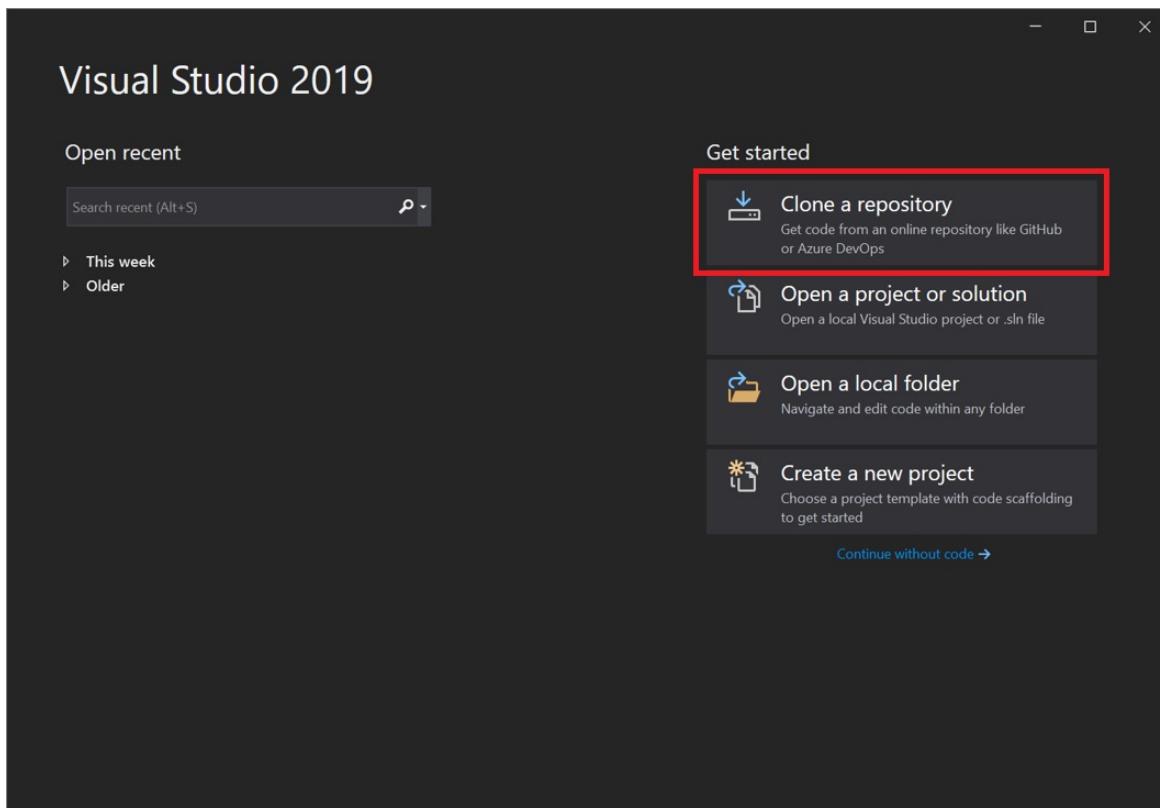
Browse to an Azure DevOps repo with Visual Studio 2019

What you see when you browse to and clone an Azure DevOps repository by using Visual Studio 2019 depends on which version you have. Specifically, if you've installed version [version 16.8](#) or later, we've changed the UI to accommodate a new, more fully integrated [Git experience in Visual Studio](#) in Visual Studio.

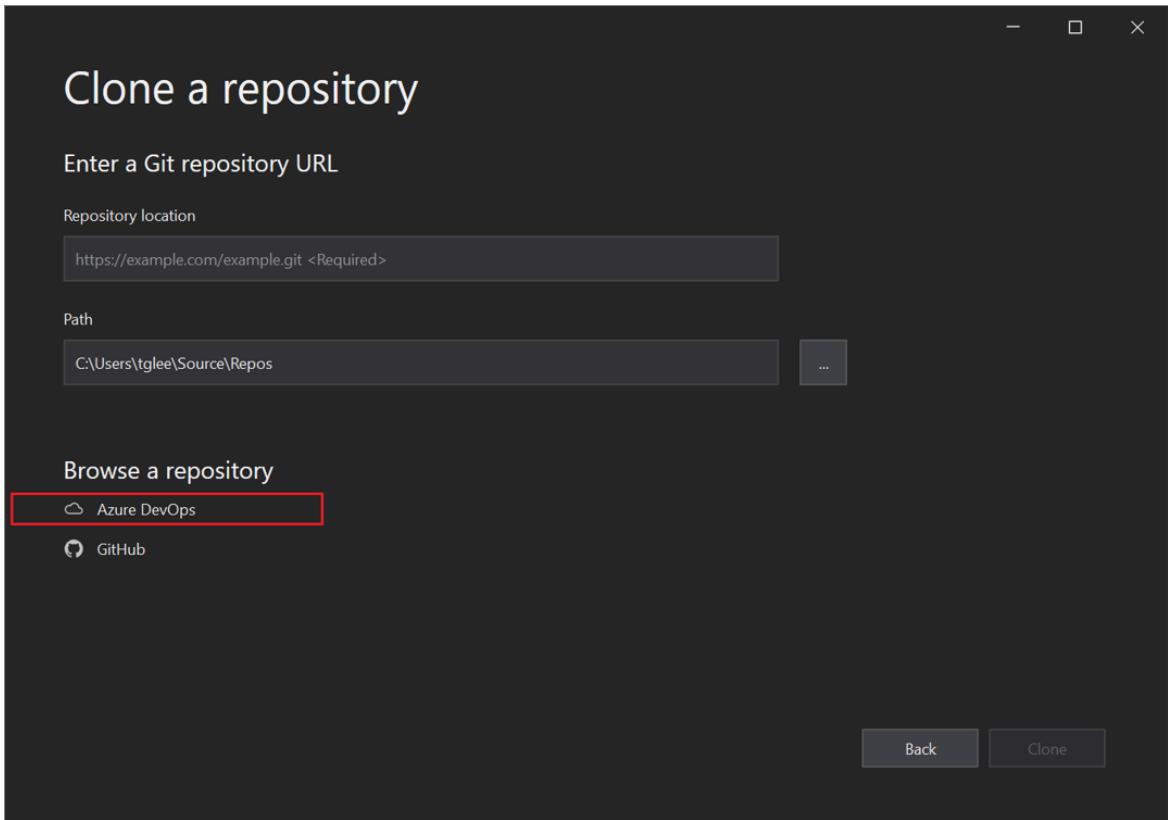
But no matter which version you have installed, you can always browse to and clone an Azure DevOps repo with Visual Studio.

Visual Studio 2019 version 16.8 and later

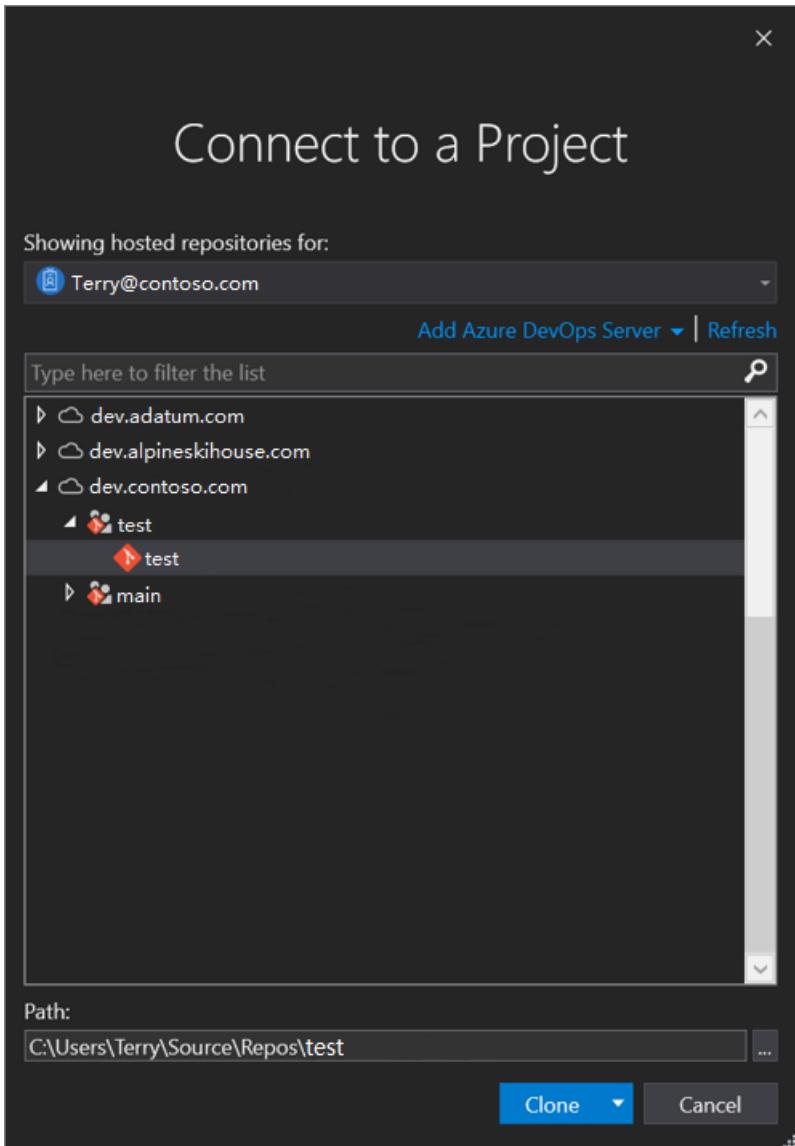
1. Open Visual Studio 2019 [version 16.8](#) or later.
2. On the start window, select **Clone a repository**.



3. In the **Browse a repository** section, select **Azure DevOps**.



4. If you see a sign-in window, sign in to your account.
5. In the **Connect to a Project** dialog box, choose the repo that you want to connect to, and then select **Clone**.

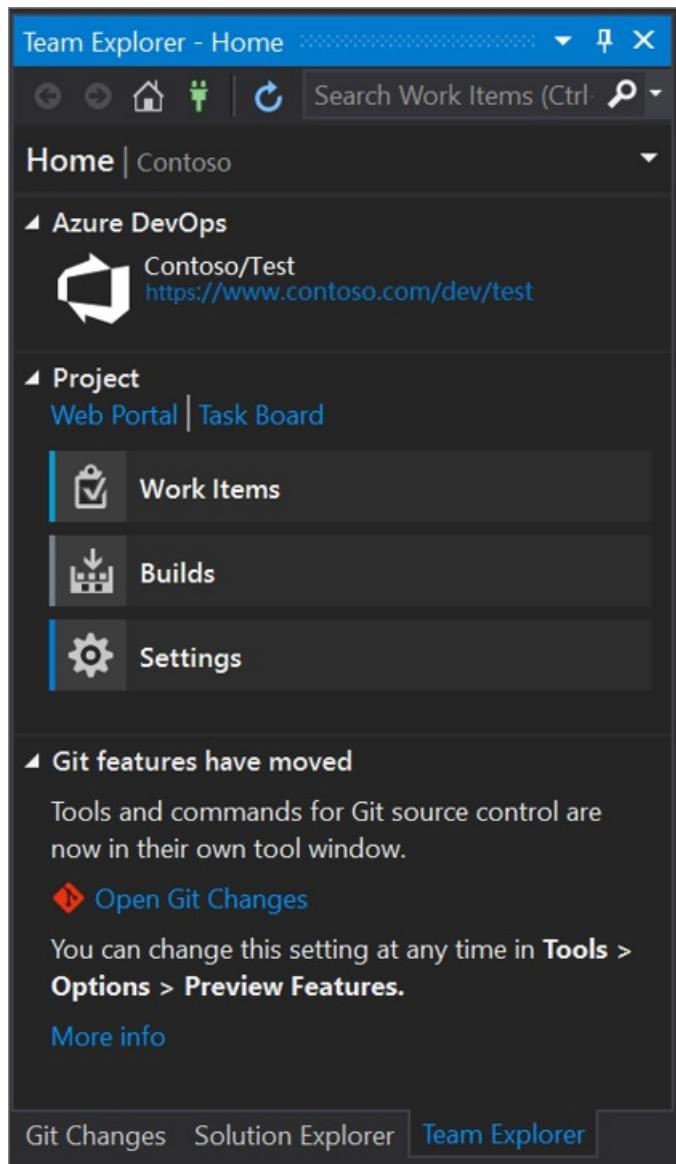


TIP

If you don't see a pre-populated list of repos to connect to, select **Add Azure DevOps Server** to enter a server URL. (Alternatively, you might see a "No servers found" prompt that includes links to add an existing Azure DevOps Server or to create an Azure DevOps account.)

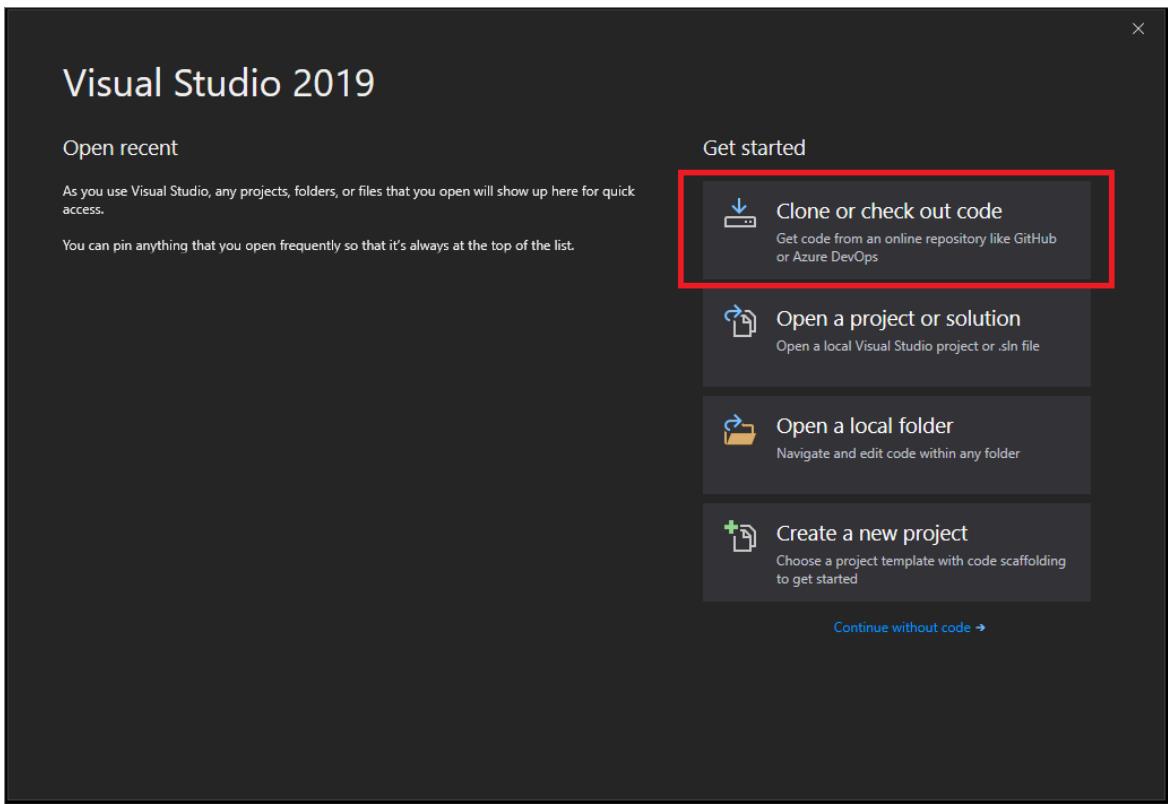
Next, Visual Studio opens **Solution Explorer** that shows the folders and files.

6. Select the **Team Explorer** tab to view the Azure DevOps actions.

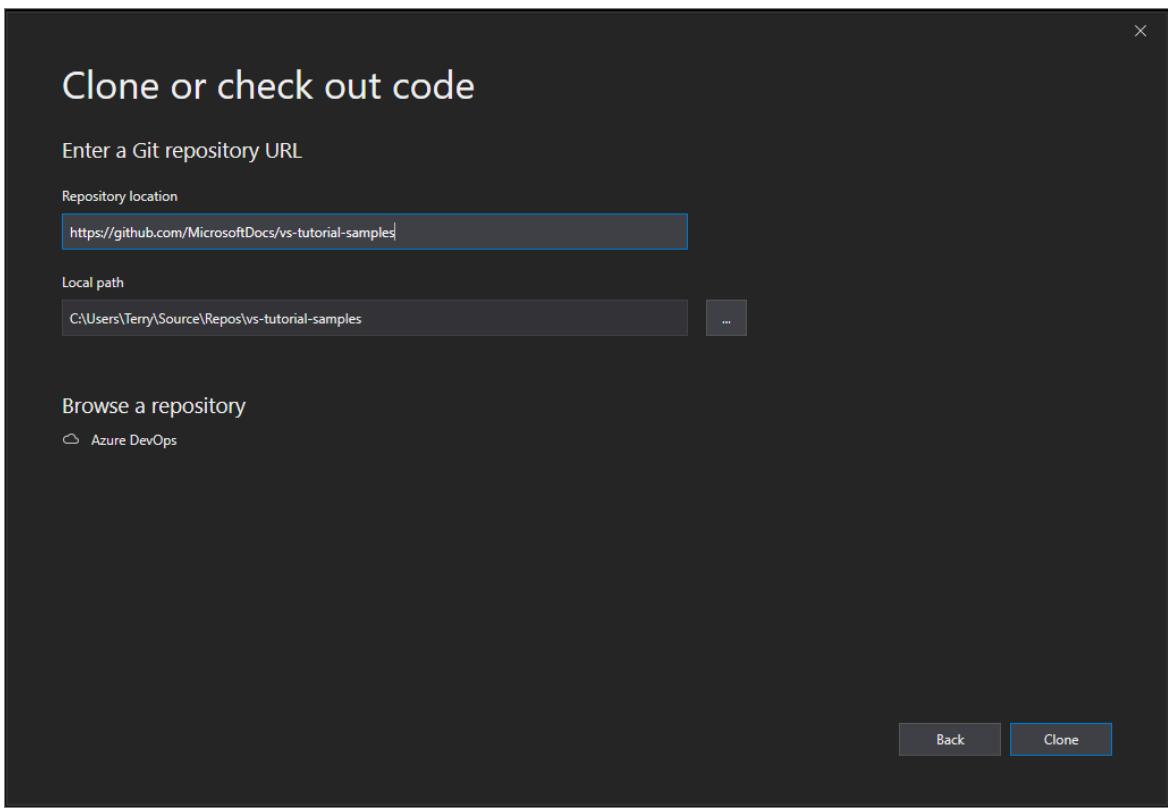


Visual Studio 2019 version 16.7 and earlier

1. Open Visual Studio 2019 **version 16.7** or earlier.
2. On the start window, select **Clone or check out code**.

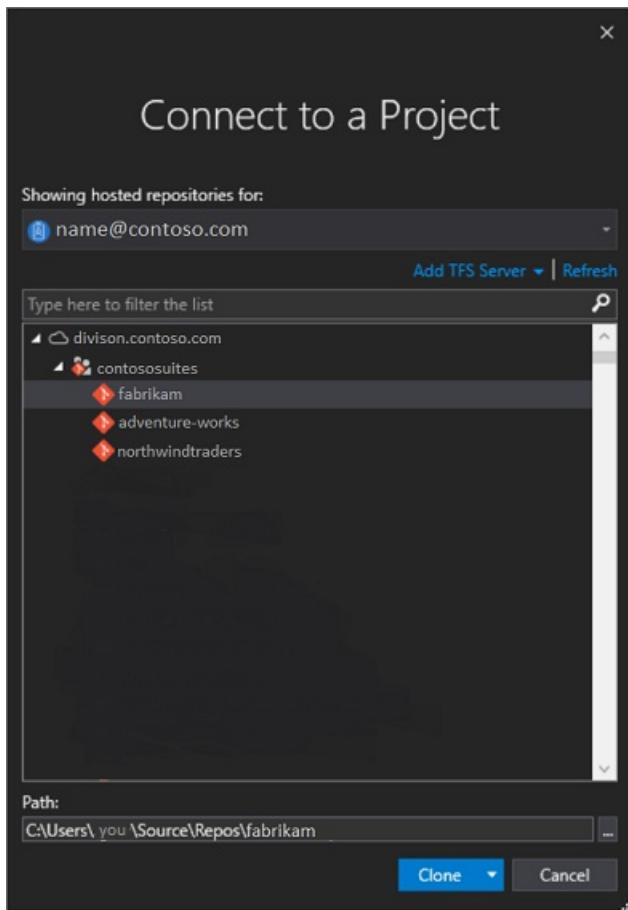


3. In the **Browse a repository** section, select **Azure DevOps**.



If you see a sign-in window, sign in to your account.

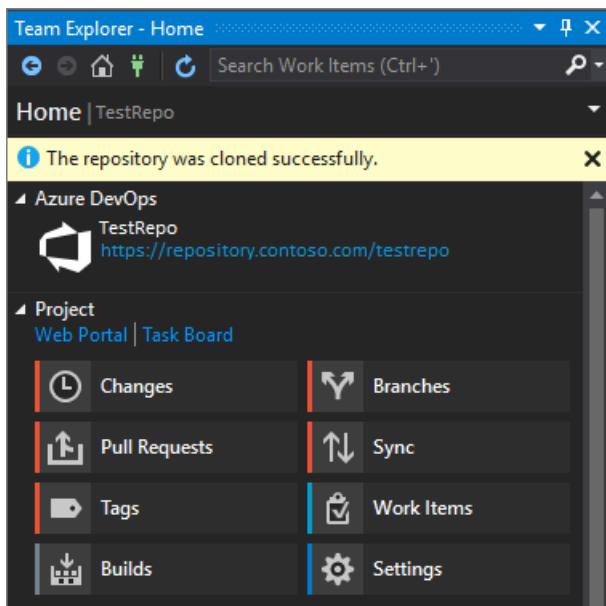
4. In the **Connect to a Project** dialog box, choose the repo that you want to connect to, and then select **Clone**.



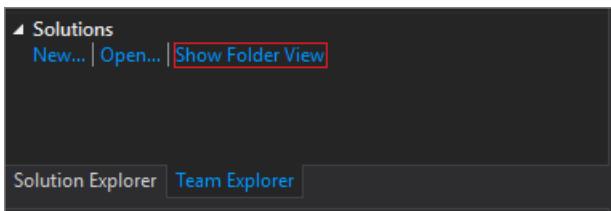
NOTE

What you see in the list box depends on the Azure DevOps repositories that you have access to.

Visual Studio opens **Team Explorer** and a notification appears when the clone is complete.

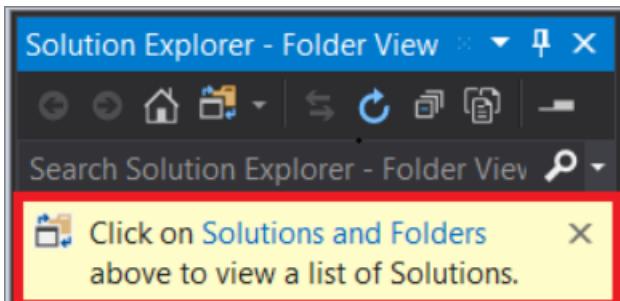


5. To view your folders and files, select the **Show Folder View** link.



Visual Studio opens Solution Explorer.

6. Choose the **Solutions and Folders** link to search for a solution file (specifically, an .sln file) to open.

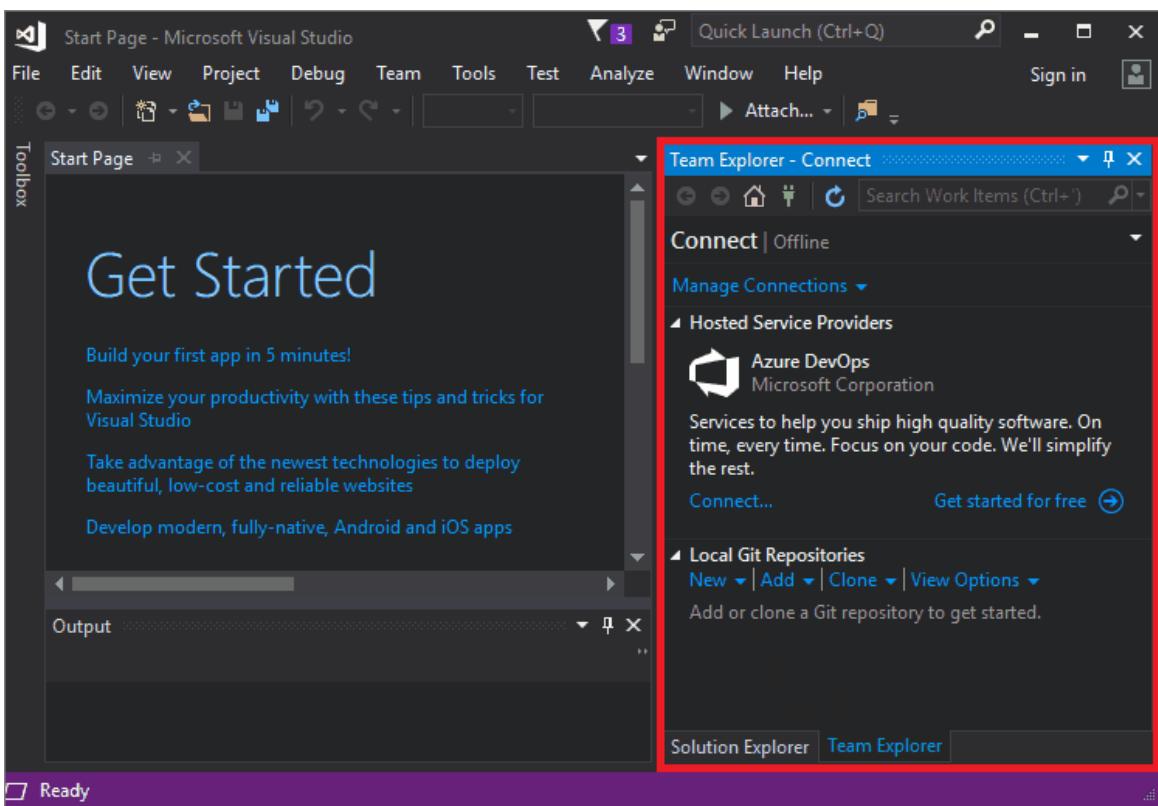


If you do not have a solution file in your repo, a 'No Solutions Found' message appears. However, you can double-click any file from the folder menu to open it in the Visual Studio code editor.

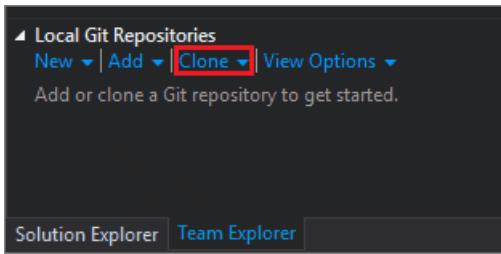
Open a project from a GitHub repo with Visual Studio 2017

1. Open Visual Studio 2017.
2. From the top menu bar, select **File > Open > Open from Source Control**.

The Team Explorer - Connect pane opens.

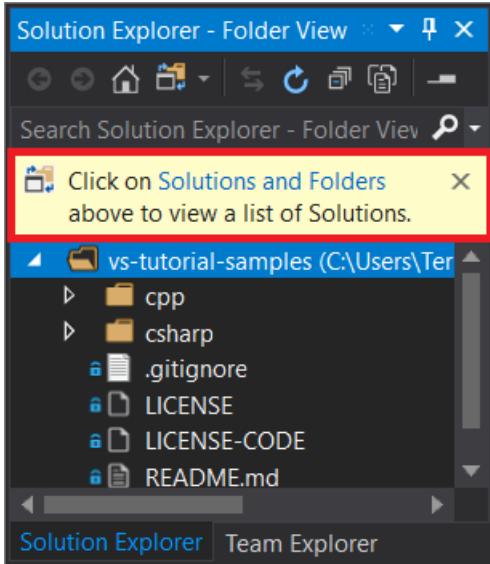


3. In the Local Git Repositories section, select **Clone**.

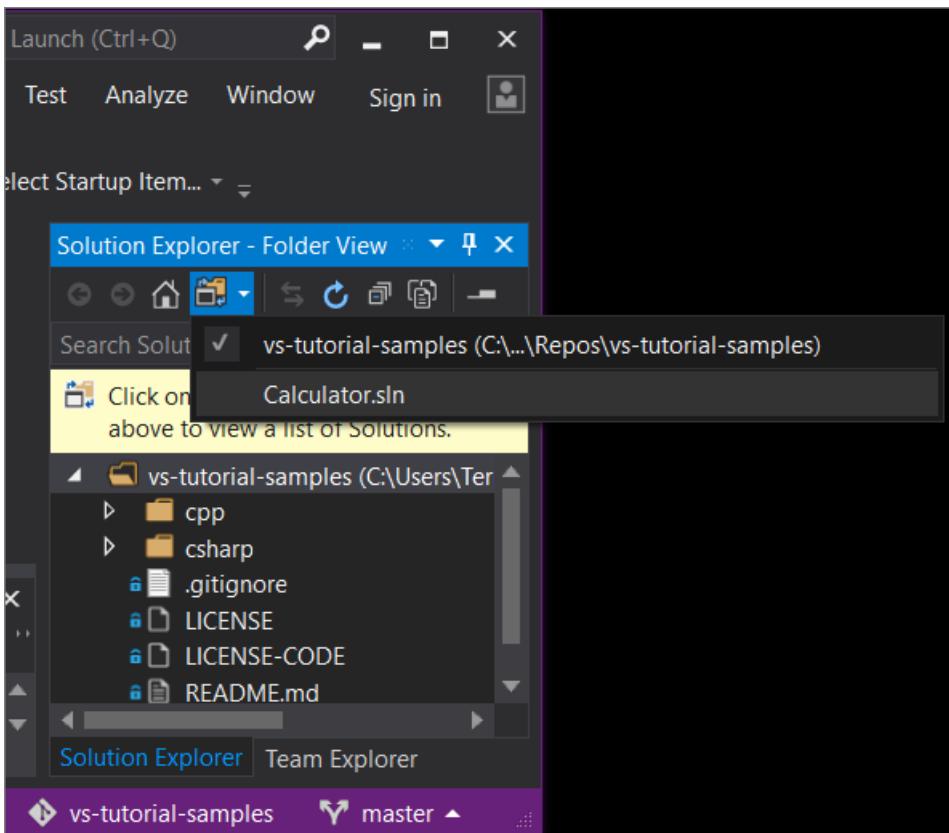


4. In the box that says **Enter the URL of a Git repo to clone**, type or paste the URL for your repo, and then press **Enter**. (You might receive a prompt to sign in to GitHub; if so, do so.)

After Visual Studio clones your repo, Team Explorer closes and Solution Explorer opens. A message appears that says *Click on Solutions and Folders above to view a list of Solutions*. Choose **Solutions and Folders**.



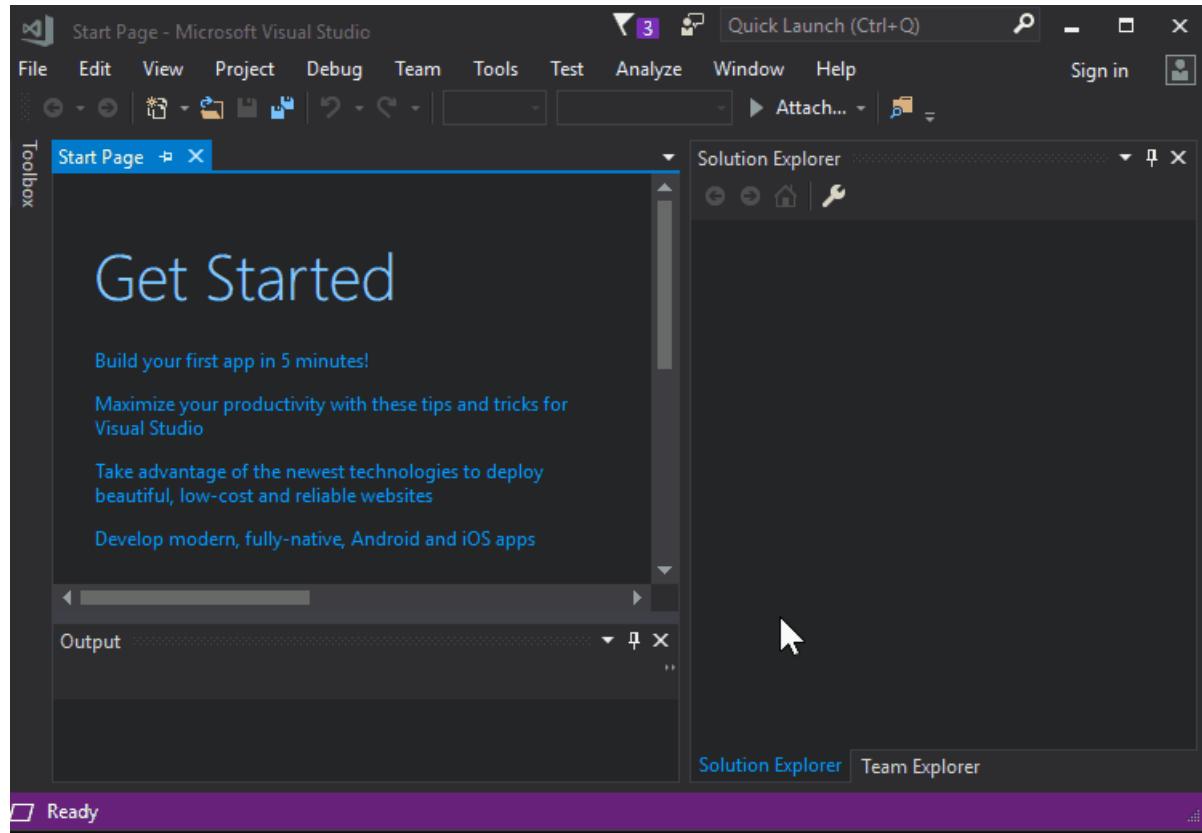
5. If you have a solution file available, it will appear in the "Solutions and Folders" fly-out menu. Choose it, and Visual Studio opens your solution.



If you do not have a solution file (specifically, a .sln file) in your repo, the fly-out menu will say "No Solutions Found." However, you can double-click any file from the folder menu to open it in the Visual Studio code editor.

Review your work

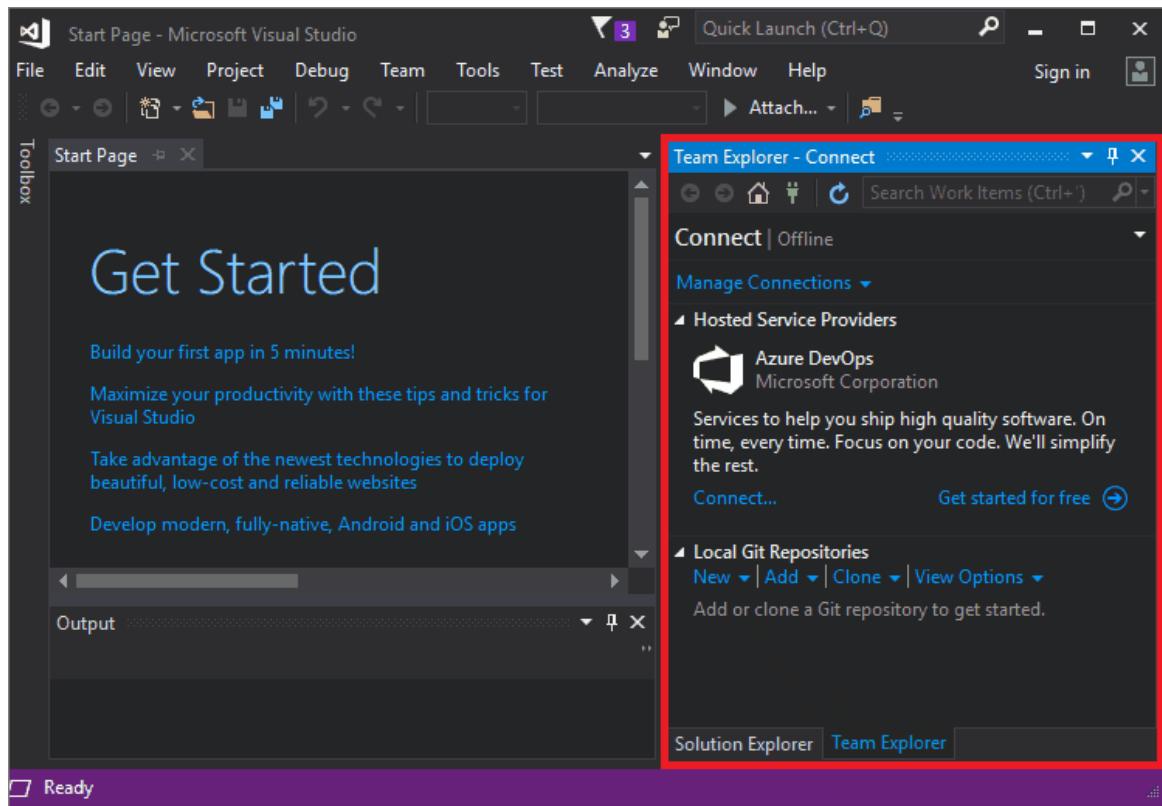
View the following animation to check the work that you completed in the previous section.



Open a project from an Azure DevOps repo with Visual Studio 2017

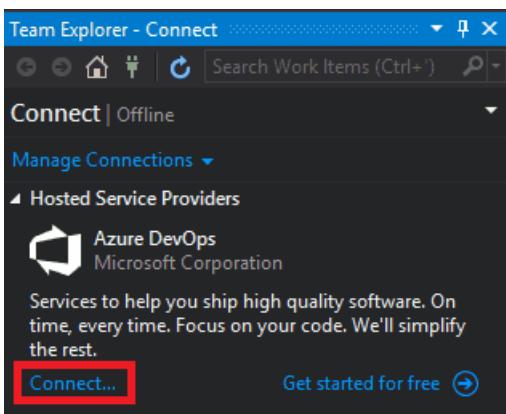
1. Open Visual Studio 2017.
2. From the top menu bar, select **File > Open > Open from Source Control**.

The **Team Explorer - Connect** pane opens.

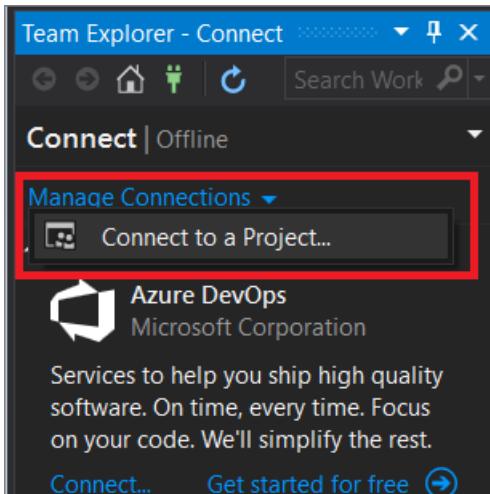


3. Here are two ways to connect to your Azure DevOps repo:

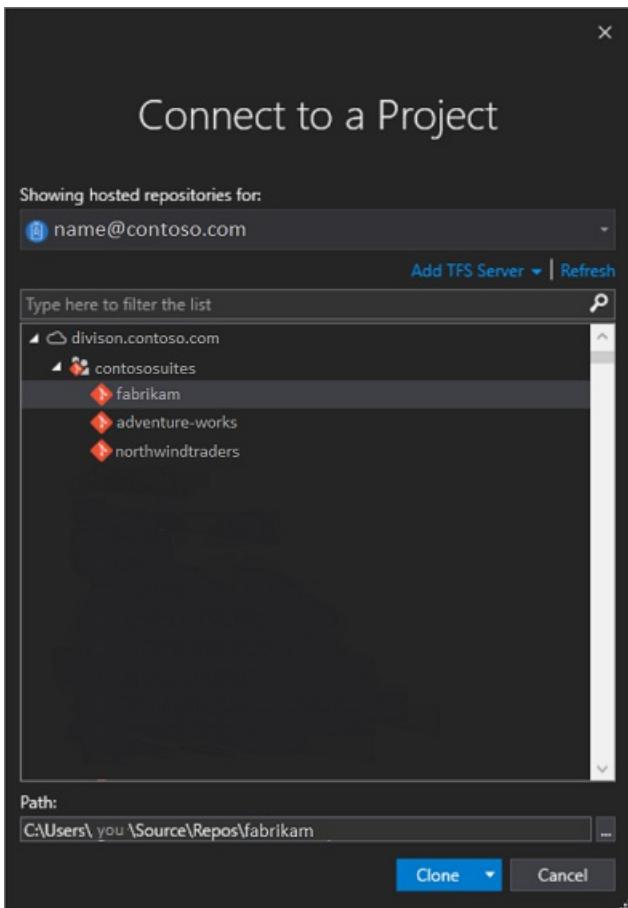
- In the Hosted Service Providers section, select Connect....



- In the Manage Connections drop-down list, select Connect to a Project....



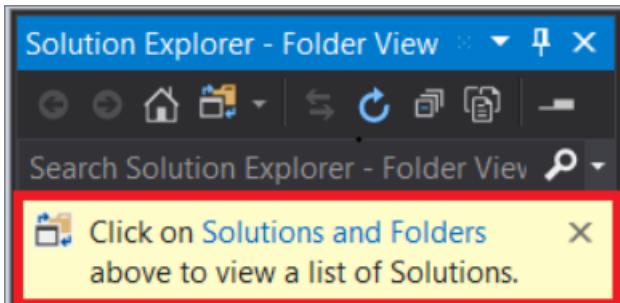
4. In the Connect to a Project dialog box, choose the repo that you want to connect to, and then select Clone.



NOTE

What you see in the list box depends on the Azure DevOps repositories that you have access to.

5. After Visual Studio clones your repo, Team Explorer closes and Solution Explorer opens. A message appears that says *Click on Solutions and Folders above to view a list of Solutions*. Choose **Solutions and Folders**.



A solution file (specifically, a .sln file), will appear in the "Solutions and Folders" fly-out menu. Choose it, and Visual Studio opens your solution.

If you do not have a solution file in your repo, the fly-out menu will say "No Solutions Found". However, you can double-click any file from the folder menu to open it in the Visual Studio code editor.

Next steps

Feel free to dive into any of the following language-specific tutorials:

- [Visual Studio tutorials | C#](#)
- [Visual Studio tutorials | Visual Basic](#)
- [Visual Studio tutorials | C++](#)

- [Visual Studio tutorials | Python](#)
- [Visual Studio tutorials | JavaScript, TypeScript, and Node.js](#)

See also

- [The Git experience in Visual Studio](#)
- [Compare Git and Team Explorer side-by-side](#)
- [Microsoft Learn: Get started with Git and GitHub in Visual Studio](#)
- [Microsoft Learn: Get started with Azure DevOps](#)
- [Azure DevOps Services: Get started with Azure Repos and Visual Studio](#)

[Visual Studio version control documentation](#)

Learn to use the code editor with Visual Basic

11/13/2021 • 11 minutes to read • [Edit Online](#)

In this 10-minute introduction to the code editor in Visual Studio, we'll add code to a file to look at some of the ways that Visual Studio makes writing, navigating, and understanding Visual Basic code easier.

TIP

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

TIP

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

This article assumes you're already familiar with Visual Basic. If you aren't, we suggest you look at a tutorial such as [Get started with Visual Basic in Visual Studio](#) first.

TIP

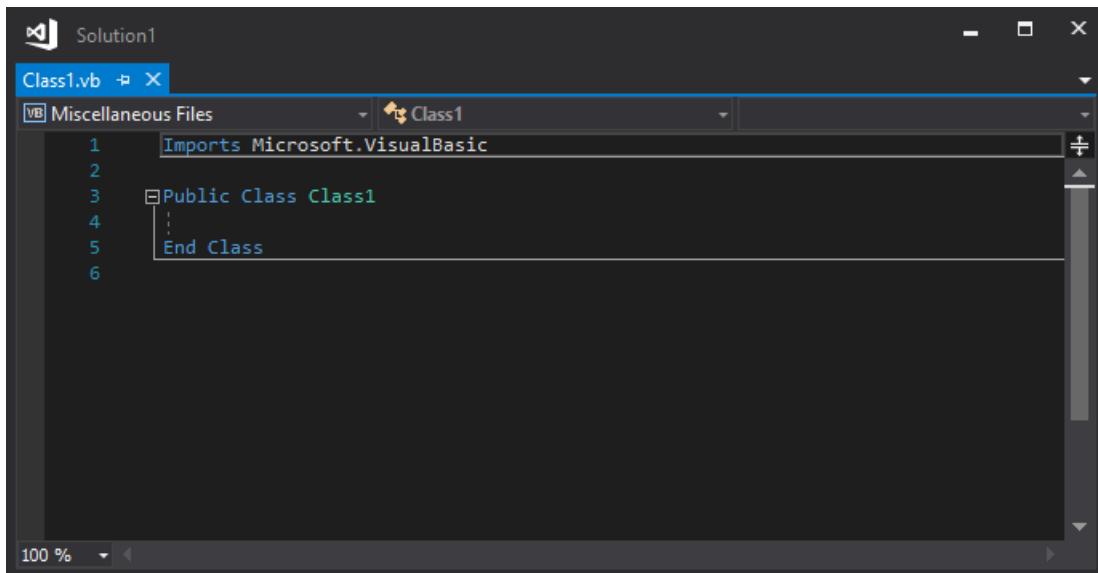
To follow along with this article, make sure you have the Visual Basic settings selected for Visual Studio. For information about selecting settings for the integrated development environment (IDE), see [Select environment settings](#).

Create a new code file

Start by creating a new file and adding some code to it.

1. Open Visual Studio.
2. From the **File** menu on the menu bar, choose **New File**.
3. In the **New File** dialog box, under the **General** category, choose **Visual Basic Class**, and then choose **Open**.

A new file opens in the editor with the skeleton of a Visual Basic class. (You can already notice that you don't have to create a full Visual Studio project to gain some of the benefits that the code editor offers, such as syntax highlighting. All you need is a code file!)

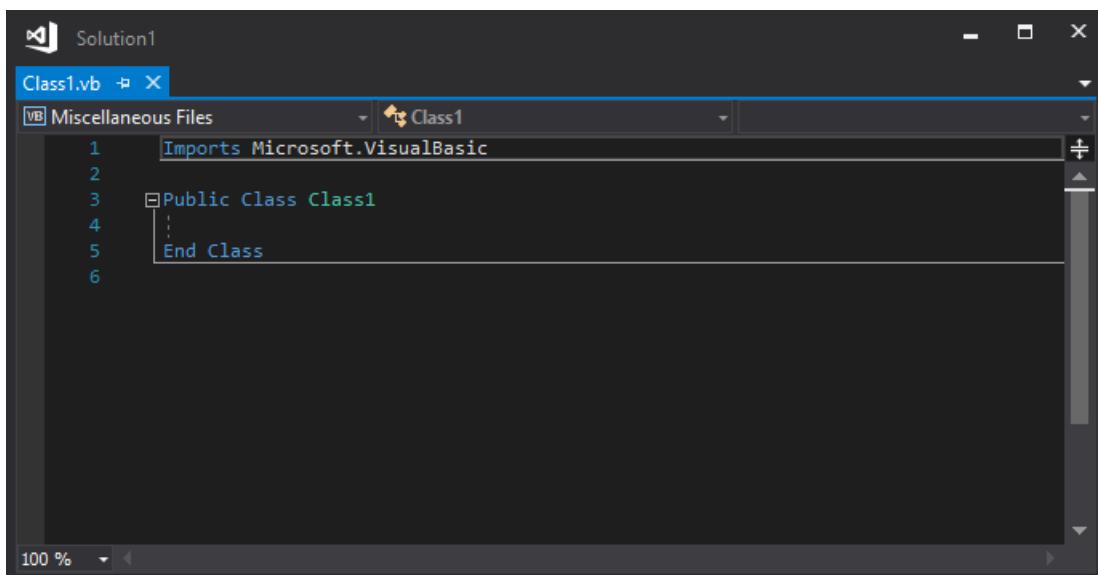


The screenshot shows the Visual Studio code editor with a dark theme. A single file named "Class1.vb" is open, containing the following code:

```
Imports Microsoft.VisualBasic
Public Class Class1
End Class
```

1. Open Visual Studio. Press **Esc** or click **Continue without code** on the start window to open the development environment.
2. From the **File** menu on the menu bar, choose **New File**.
3. In the **New File** dialog box, under the **General** category, choose **Visual Basic Class**, and then choose **Open**.

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The screenshot shows the Visual Studio code editor with a dark theme. A single file named "Class1.vb" is open, containing the following code:

```
Imports Microsoft.VisualBasic
Public Class Class1
End Class
```

1. Open Visual Studio. Press **Esc** or select **Continue without code** on the start window to open the development environment.
2. From the **File** menu on the menu bar, choose **New > File**.
3. In the **New File** dialog box, under the **General** category, choose **Visual Basic Class**, and then choose **Open**.

A new file opens in the editor with the skeleton of a Visual Basic class. (You can already notice that you don't have to create a full Visual Studio project to gain some of the benefits that the code editor offers, such as syntax highlighting. All you need is a code file!)

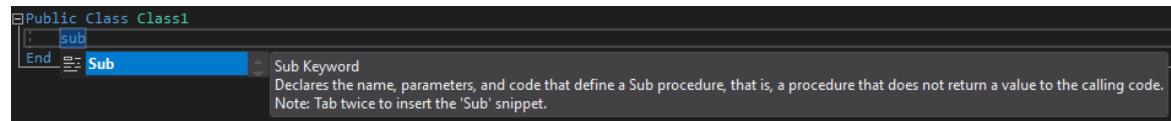
```
Imports Microsoft.VisualBasic
Public Class Class1
End Class
```

Use code snippets

Visual Studio provides useful *code snippets* that you can use to quickly and easily generate commonly used code blocks. [Code snippets](#) are available for different programming languages including Visual Basic, C#, and C++. Let's add the Visual Basic **Sub** snippet to our file.

1. Place your cursor above the line that says `End Class`, and type **sub**.

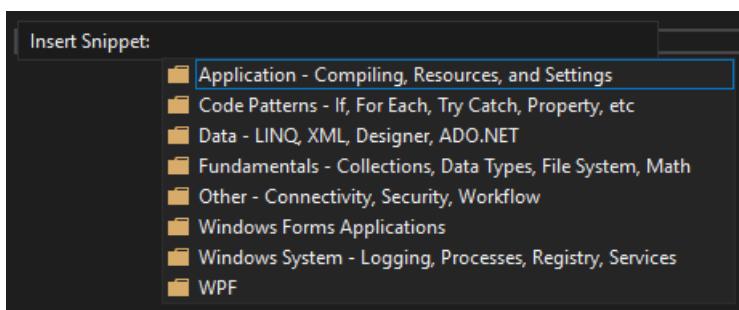
A pop-up dialog box appears with information about the `Sub` keyword and how to insert the **Sub** code snippet.



2. Press **Tab** twice to insert the code snippet.

The outline for the Sub procedure `MySub()` is added to the file.

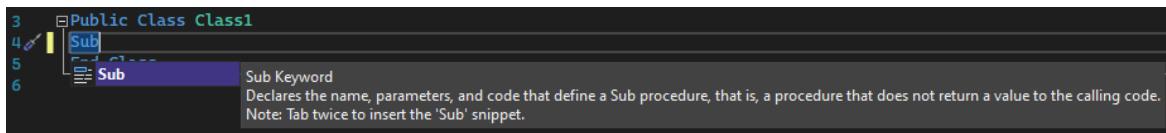
The available code snippets vary for different programming languages. You can look at the available code snippets for Visual Basic by choosing **Edit > IntelliSense > Insert Snippet** (or press **Ctrl+K, Ctrl+X**). For Visual Basic, code snippets are available for the following categories:



There are snippets for determining if a file exists on the computer, writing to a text file, reading a registry value, executing a SQL query, or creating a [For Each...Next statement](#), and many more.

1. Place your cursor above the line that says `End Class`, and type **sub**.

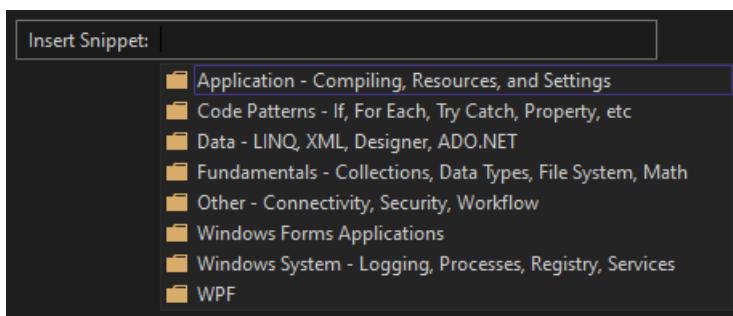
A pop-up dialog box appears with information about the `Sub` keyword and how to insert the **Sub** code snippet.



2. Press **Tab** twice to insert the code snippet.

The outline for the Sub procedure `MySub()` is added to the file.

The available code snippets vary for different programming languages. You can look at the available code snippets for Visual Basic by opening the right-click or context menu in the code editor and choosing **Snippet > Insert Snippet** (or press **Ctrl+K, Ctrl+X**). For Visual Basic, code snippets are available for the following categories:



Comment out code

The toolbar, which is the row of buttons under the menu bar in Visual Studio, can help make you more productive as you code. For example, you can toggle IntelliSense completion mode, increase or decrease a line indent, or comment out code that you don't want to compile. ([IntelliSense](#) is a coding aid that displays a list of matching methods, amongst other things.) In this section, we'll comment out some code.



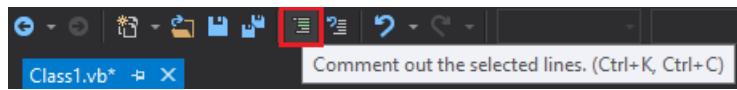
1. Paste the following code into the `MySub()` procedure body.

```
' _words is a string array that we'll sort alphabetically
Dim _words = New String() {
    "the",
    "quick",
    "brown",
    "fox",
    "jumps"
}

Dim morewords = New String() {
    "over",
    "the",
    "lazy",
    "dog"
}

Dim query = From word In _words
            Order By word.Length
            Select word
```

2. We're not using the `morewords` array, but we may use it later so we don't want to completely delete it. Instead, let's comment out those lines. Select the entire definition of `morewords` to the closing curly brace, and then choose the **Comment out the selected lines** button on the toolbar. If you prefer to use the keyboard, press **Ctrl+K, Ctrl+C**.



The Visual Basic comment character `'` is added to the beginning of each selected line to comment out the code.



- Paste the following code into the `MySub()` procedure body.

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Dim query = From word In _words
            Order By word.Length
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```

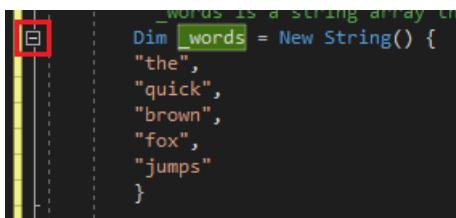
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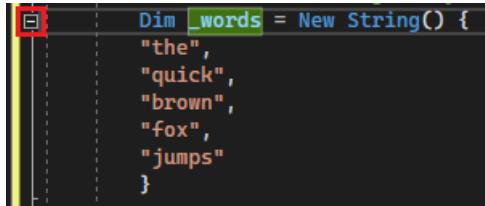
Collapse code blocks

You can collapse sections of code to focus just on the parts that are of interest to you. To practice, let's collapse the `_words` array to one line of code. Choose the small gray box with the minus sign inside it in the margin of the line that says `Dim _words = New String() {`. Or, if you're a keyboard user, place the cursor anywhere in the array definition and press **Ctrl+M, Ctrl+M**.



The code block collapses to just the first line, followed by an ellipsis (`...`). To expand the code block again, click the same gray box that now has a plus sign in it, or press **Ctrl+M, Ctrl+M** again. This feature is called **Outlining** and is especially useful when you're collapsing long methods or entire classes.

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    "quick",
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```

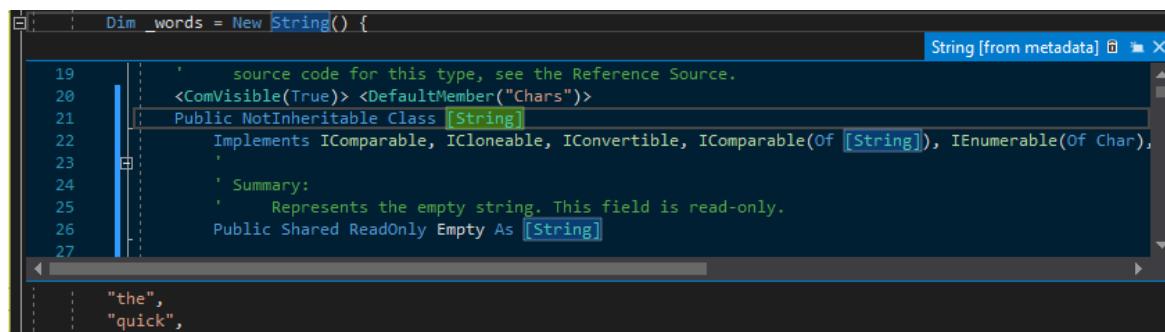
The code block collapses to just the first line, followed by an ellipsis (`...`). To expand the code block again, choose the same gray box that now has a plus sign in it, or press **Ctrl+M, Ctrl+M** again. This feature is called [Outlining](#) and is especially useful when you're collapsing long methods or entire classes.

View symbol definitions

The Visual Studio editor makes it easy to inspect the definition of a type, method, etc. One way is to navigate to the file that contains the definition, for example by choosing [Go to Definition](#) anywhere the symbol is referenced. An even quicker way that doesn't move your focus away from the file you're working in is to use [Peek Definition](#). Let's peek at the definition of the `String` type.

1. Right-click on the word `String` and choose [Peek Definition](#) from the content menu. Or, press **Alt+F12**.

A pop-up window appears with the definition of the `String` class. You can scroll within the pop-up window, or even peek at the definition of another type from the peeked code.



2. Close the peeked definition window by choosing the small box with an "x" at the top right of the pop-up window.

The Visual Studio editor makes it easy to inspect the definition of a type or class member. One way is to navigate to the file that contains the definition, for example by choosing [Go to Definition](#) anywhere the symbol is referenced. An even quicker way that doesn't move your focus away from the file you're working in is to use [Peek Definition](#). Let's peek at the definition of the `String` type.

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A pop-up window appears with the definition of the `String` class. You can scroll within the pop-up window, or even peek at the definition of another type from the peeked code.

A screenshot of the Visual Studio IDE showing the `String` class definition in the Object Browser. The code shows the declaration of the `String` class, its inheritance from `Object`, and its implementation of various interfaces like `IComparable`, `ICloneable`, etc. A tooltip for the `String` class is open, providing detailed information about its members.

2. Close the peek definition window by choosing the small box with an "x" at the top right of the pop-up window.

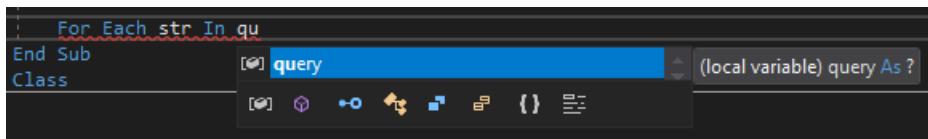
Use IntelliSense to complete words

IntelliSense is an invaluable resource when you're coding. It can show you information about available members of a type, or parameter details for different overloads of a method. You can also use IntelliSense to complete a word after you type enough characters to disambiguate it. Let's add a line of code to print out the ordered strings to the console window, which is the standard place for output from the program to go.

1. Below the `query` variable, start typing the following code:

```
For Each str In qu
```

You see IntelliSense show you **Quick Info** about the `query` symbol.



2. To insert the rest of the word `query` by using IntelliSense's word completion functionality, press **Tab**.
3. Finish off the code block to look like the following code.

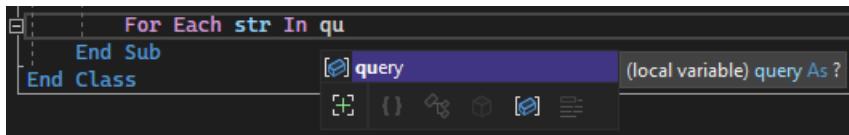
```
For Each str In query
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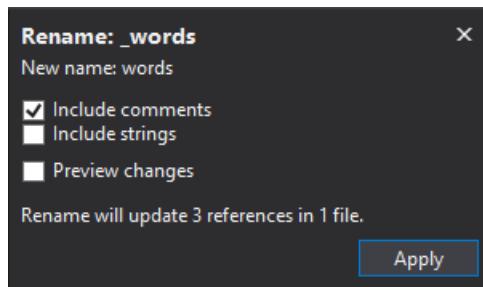
Refactor a name

Nobody gets code right the first time, and one of the things you might have to change is the name of a variable or method. Let's try out Visual Studio's [refactor](#) functionality to rename the `_words` variable to `words`.

1. Place your cursor over the definition of the `_words` variable and choose **Rename** from the right-click or context menu.

A pop-up **Rename** dialog box appears at the top right of the editor.

2. With the variable `_words` still selected, type in the desired name of `words`. Notice that the reference to `words` in the query is also automatically renamed. Before you press **Enter** or click **Apply**, select the **Include comments** checkbox in the **Rename** pop-up box.



3. Press **Enter** or click **Apply**.

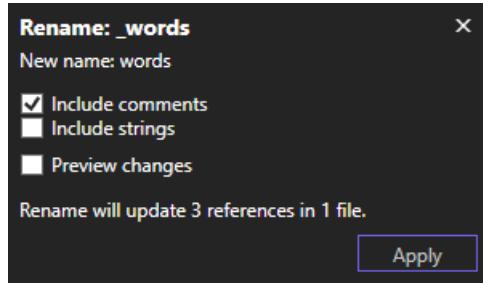
Both occurrences of `words` are renamed, as well as the reference to `words` in the code comment.

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3. Press **Enter** or choose **Apply**.

Both occurrences of `words` are renamed, as well as the reference to `words` in the code comment.

Next steps

See also

- [Code snippets](#)
- [Navigate code](#)
- [Outlining](#)
- [Go To Definition and Peek Definition](#)
- [Refactoring](#)
- [Use IntelliSense](#)

Compile and build in Visual Studio

11/13/2021 • 2 minutes to read • [Edit Online](#)

For a first introduction to building within the IDE, see [Walkthrough: Building an application](#).

You can use any of the following methods to build an application: the Visual Studio IDE, the MSBuild command-line tools, and Azure Pipelines:

BUILD METHOD	BENEFITS
IDE	<ul style="list-style-type: none">- Create builds immediately and test them in a debugger.- Run multi-processor builds for C++ and C# projects.- Customize different aspects of the build system.
CMake	<ul style="list-style-type: none">- Build projects using the CMake tool- Use the same build system across Linux and Windows platforms.
MSBuild command line	<ul style="list-style-type: none">- Build projects without installing Visual Studio.- Run multi-processor builds for all project types.- Customize most areas of the build system.
Azure Pipelines	<ul style="list-style-type: none">- Automate your build process as part of a continuous integration/continuous delivery pipeline.- Apply automated tests with every build.- Employ virtually unlimited cloud-based resources for build processes.- Modify the build workflow and create build activities to perform deeply customized tasks.

The documentation in this section goes into further details of the IDE-based build process. For more information on the other methods, see [CMake](#), [MSBuild](#) and [Azure Pipelines](#), respectively.

NOTE

This topic applies to Visual Studio on Windows. For Visual Studio for Mac, see [Compile and build in Visual Studio for Mac](#).

Overview of building from the IDE

When you create a project, Visual Studio creates default build configurations for the project and the solution that contains the project. These configurations define how the solutions and projects are built and deployed. Project configurations in particular are unique for a target platform (such as Windows or Linux) and build type (such as debug or release). You can edit these configurations however you like, and can also create your own configurations as needed.

For a first introduction to building within the IDE, see [Walkthrough: Building an application](#).

Next, see [Building and cleaning projects and solutions in Visual Studio](#) to learn about the different customizations you can make to the process. Customizations include [changing output directories](#), [specifying custom build events](#), [managing project dependencies](#), [managing build log files](#), and [suppressing compiler warnings](#).

From there, you can explore a variety of other tasks:

- [Understand build configurations](#)
- [Understand build platforms](#)
- [Manage project and solution properties.](#)
- [Specify build events in C# and Visual Basic.](#)
- [Set build options](#)
- [Build multiple projects in parallel.](#)

See also

- [Building \(compiling\) website projects](#)
- [Compile and build \(Visual Studio for Mac\)](#)
- [CMake projects in Visual Studio](#)

Tutorial: Learn to debug Visual Basic code using Visual Studio

11/13/2021 • 19 minutes to read • [Edit Online](#)

This article introduces the features of the Visual Studio debugger in a step-by-step walkthrough. If you want a higher-level view of the debugger features, see [First look at the debugger](#). When you *debug your app*, it usually means that you are running your application with the debugger attached. When you do this, the debugger provides many ways to see what your code is doing while it runs. You can step through your code and look at the values stored in variables, you can set watches on variables to see when values change, you can examine the execution path of your code, see whether a branch of code is running, and so on. If this is the first time that you've tried to debug code, you may want to read [Debugging for absolute beginners](#) before going through this article.

Although the demo app is Visual Basic, most of the features are applicable to C#, C++, F#, Python, JavaScript, and other languages supported by Visual Studio (F# does not support Edit-and-continue. F# and JavaScript do not support the **Autos** window). The screenshots are in Visual Basic.

In this tutorial, you will:

- Start the debugger and hit breakpoints.
- Learn commands to step through code in the debugger
- Inspect variables in data tips and debugger windows
- Examine the call stack

Prerequisites

You must have Visual Studio 2019 installed and the **.NET Core cross-platform development** workload.

You must have Visual Studio 2017 installed and the **.NET Core cross-platform development** workload.

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

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If you need to install the workload but already have Visual Studio, go to [Tools > Get Tools and Features...](#), which opens the Visual Studio Installer. The Visual Studio Installer launches. Choose the **.NET Core cross-platform development** workload, then choose **Modify**.

If you haven't already installed Visual Studio, go to the [Visual Studio downloads](#) page to install it for free.

If you need to install the workload but already have Visual Studio, go to [Tools > Get Tools and Features...](#), which opens the Visual Studio Installer. The Visual Studio Installer launches. Choose the **.NET desktop development** workload, then choose **Modify**.

Create a project

First, you'll create a .NET Core console application project. The project type comes with all the template files you'll need, before you've even added anything!

1. Open Visual Studio 2017.
2. From the top menu bar, choose **File > New > Project**.

3. In the **New Project** dialog box in the left pane, expand **Visual Basic**, and then choose **.NET Core**. In the middle pane, choose **Console App (.NET Core)**. Then name the project *get-started-debugging*.

If you don't see the **Console App (.NET Core)** project template, choose the **Open Visual Studio Installer** link in the left pane of the **New Project** dialog box.

The Visual Studio Installer launches. Choose the **.NET Core cross-platform development** workload, and then choose **Modify**.

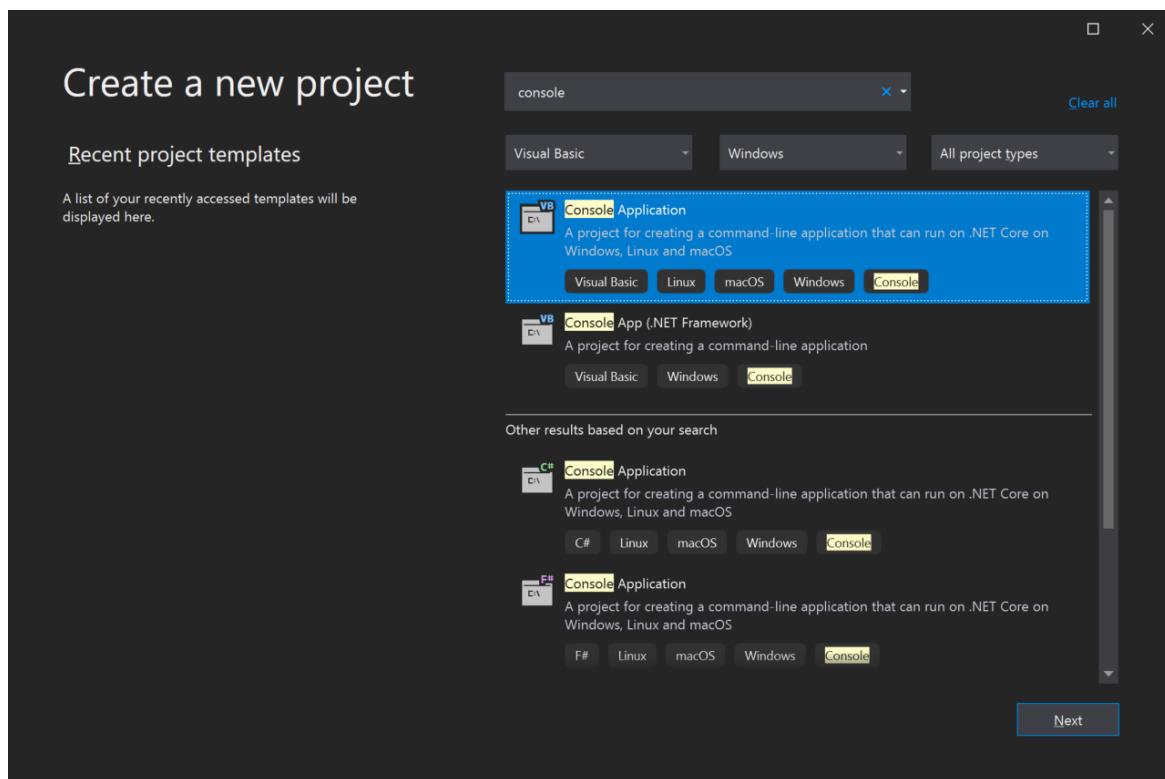
1. Open Visual Studio.

If the start window is not open, choose **File > Start Window**.

2. On the start window, choose **Create a new project**.

3. On the **Create a new project** window, enter, or type *console* in the search box. Next, choose **Visual Basic** from the Language list, and then choose **Windows** from the Platform list.

After you apply the language and platform filters, choose the **Console App** template for .NET Core, and then choose **Next**.



NOTE

If you do not see the **Console App** template, you can install it from the **Create a new project** window. In the **Not finding what you're looking for?** message, choose the **Install more tools and features** link. Then, in the Visual Studio Installer, choose the **.NET Core cross-platform development** workload.

4. In the **Configure your new project** window, type or enter *get-started-debugging* in the **Project name** box. Then, choose **Next**.

5. Choose either the recommended target framework (.NET Core 3.1) or .NET 5, and then choose **Create**.

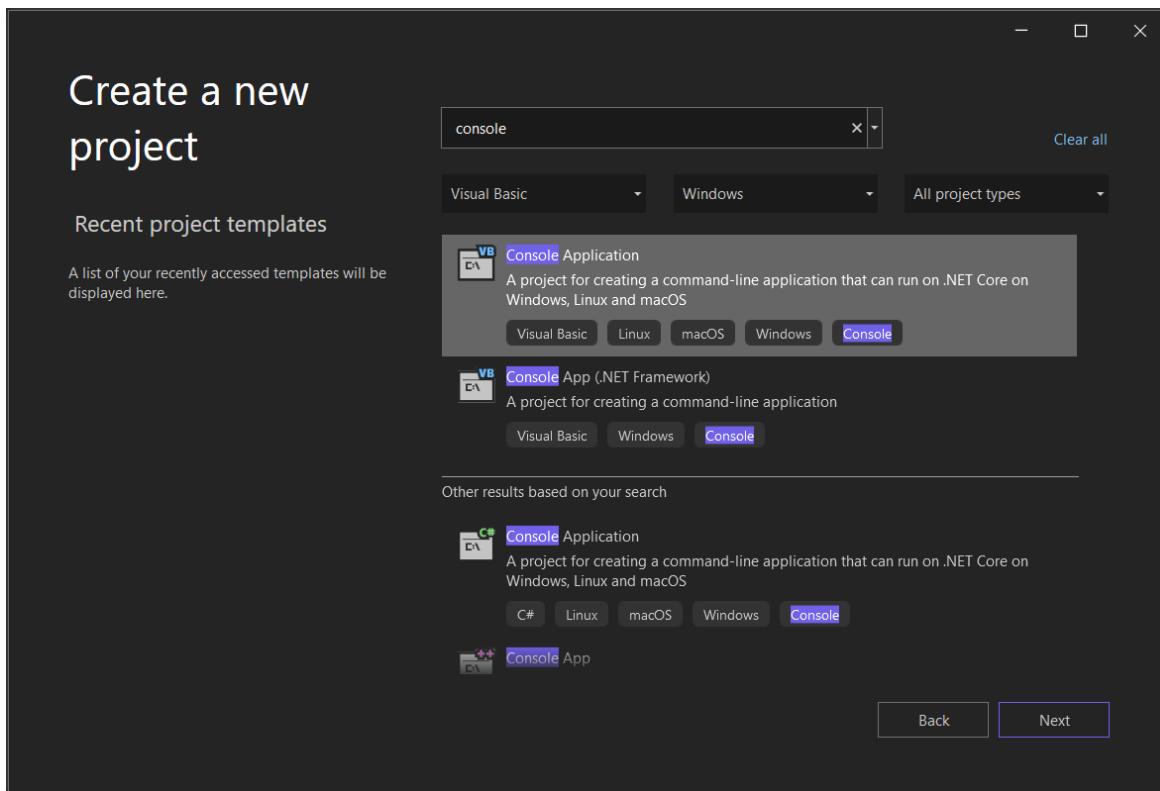
Visual Studio opens your new project.

1. Open Visual Studio.

If the start window is not open, choose **File > Start Window**.

2. On the start window, choose **Create a new project**.
3. On the **Create a new project** window, enter, or type *console* in the search box. Next, choose **Visual Basic** from the Language list, and then choose **Windows** from the Platform list.

After you apply the language and platform filters, choose the **Console Application** template for .NET Core, and then choose **Next**.



NOTE

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4. In the **Configure your new project** window, type or enter *get-started-debugging* in the **Project name** box. Then, choose **Next**.
5. On the **Additional Information** window, ensure the recommended target framework is (.NET 6.0), and then choose **Create**.

Visual Studio opens your new project.

Create the application

1. In *Program.vb*, replace all of the default code with the following code instead:

```

Imports System

Class ArrayExample
    Public Shared Sub Main()
        Dim letters As Char() = {"f"c, "r"c, "e"c, "d"c, " "c, "s"c, "m"c, "i"c, "t"c, "h"c}
        Dim name As String = ""
        Dim a As Integer() = New Integer(9) {}

        For i As Integer = 0 To letters.Length - 1
            name += letters(i)
            a(i) = i + 1
            SendMessage(name, a(i))
        Next

        Console.ReadKey()
    End Sub

    Private Shared Sub SendMessage(ByVal name As String, ByVal msg As Integer)
        Console.WriteLine("Hello, " & name & "! Count to " & msg)
    End Sub
End Class

```

Start the debugger!

1. Press F5 (Debug > Start Debugging) or the Start Debugging button  in the Debug Toolbar.

F5 starts the app with the debugger attached to the app process, but right now we haven't done anything special to examine the code. So the app just loads and you see the console output.

```

Hello, f! Count to 1
Hello, fr! Count to 2
Hello, fre! Count to 3
Hello, fred! Count to 4
Hello, fred ! Count to 5
Hello, fred s! Count to 6
Hello, fred sm! Count to 7
Hello, fred smi! Count to 8
Hello, fred smit! Count to 9
Hello, fred smith! Count to 10

```

In this tutorial, we'll take a closer look at this app using the debugger and get a look at the debugger features.

2. Stop the debugger by pressing the red stop  button (Shift + F5).
3. In the console window, press a key to close the console window.

1. Press F5 (Debug > Start Debugging) or select the green Start Debugging button in the Debug Toolbar.



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```
Hello, f! Count to 1
Hello, fr! Count to 2
Hello, fre! Count to 3
Hello, fred! Count to 4
Hello, fred ! Count to 5
Hello, fred s! Count to 6
Hello, fred sm! Count to 7
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```

In this tutorial, we'll take a closer look at this app using the debugger and get a look at the debugger features.

2. Stop the debugger by pressing (Shift + F5) or select the red **Stop Debugging** button in the Debug Toolbar.



3. In the console window, press a key to close the console window.

Set a breakpoint and start the debugger

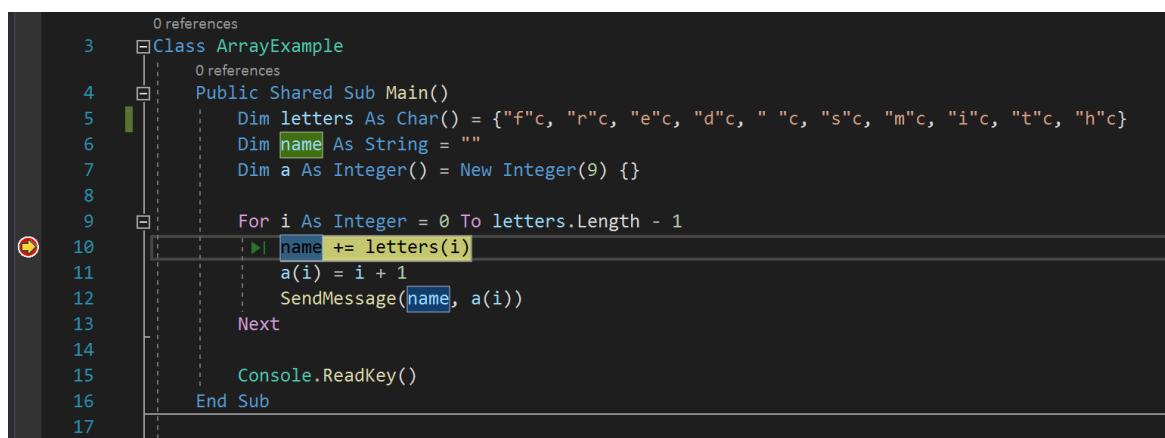
1. In the `For` loop of the `Main` function, set a breakpoint by clicking the left margin of the following line of code:

```
name += letters(i)
```

A red circle appears where you set the breakpoint.

Breakpoints are one of the most basic and essential features of reliable debugging. A breakpoint indicates where Visual Studio should suspend your running code so you can take a look at the values of variables, or the behavior of memory, or whether or not a branch of code is getting run.

2. Press F5 or the **Start Debugging** button , the app starts, and the debugger runs to the line of code where you set the breakpoint.



The yellow arrow represents the statement on which the debugger paused, which also suspends app execution at the same point (this statement has not yet executed).

If the app is not yet running, F5 starts the debugger and stops at the first breakpoint. Otherwise, F5 continues running the app to the next breakpoint.

Breakpoints are a useful feature when you know the line of code or the section of code that you want to examine in detail. For information on the different types of breakpoints you can set, such as conditional breakpoints, see [Using breakpoints](#).

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2. Press **F5** (Debug > Start Debugging) or the **Start Debugging** button in the Debug Toolbar, the app starts, and the debugger runs to the line of code where you set the breakpoint.

```
3  Class ArrayExample
4    Public Shared Sub Main()
5      Dim letters As Char() = {"f"c, "r"c, "e"c, "d"c, " "c, "s"c, "m"c, "i"c, "t"c, "h"c}
6      Dim name As String = ""
7      Dim a As Integer() = New Integer(9) {}
8
9      For i As Integer = 0 To letters.Length - 1
10     name += letters(i)
11     a(i) = i + 1
12     SendMessage(name, a(i))
13   Next
14
15   Console.ReadKey()
16 End Sub
17
18 Private Shared Sub SendMessage(ByVal name As String, ByVal msg As Integer)
19   Console.WriteLine("Hello, " & name & "! Count to " & msg)
20 End Sub
21 End Class
```

The yellow arrow represents the statement on which the debugger paused, which also suspends app execution at the same point (this statement has not yet executed).

If the app is not yet running, **F5** starts the debugger and stops at the first breakpoint. Otherwise, **F5** continues running the app to the next breakpoint.

Breakpoints are a useful feature when you know the line of code or the section of code that you want to examine in detail. For information on the different types of breakpoints you can set, such as conditional breakpoints, see [Using breakpoints](#).

Navigate code in the debugger using step commands

Mostly, we use the keyboard shortcuts here, because it's a good way to get fast at executing your app in the debugger (equivalent commands such as menu commands are shown in parentheses).

1. While paused in the `For` loop in the `Main` method, press **F11** (or choose **Debug > Step Into**) twice to advance to the `SendMessage` method call.

After pressing **F11** twice, you should be at this line of code:

```
SendMessage(name, a(i))
```

2. Press **F11** one more time to step into the `SendMessage` method.

The yellow pointer advances into the `SendMessage` method.

A screenshot of the Visual Studio debugger showing the code for the `SendMessage` method. The code is as follows:

```
17      1 reference
18  ↗  Private Shared Sub SendMessage(ByVal name As String, ByVal msg As Integer) ≤ 4ms elapsed
19      Console.WriteLine("Hello, " & name & "! Count to " & msg)
20  End Sub
21 End Class
22
```

F11 is the **Step Into** command and advances the app execution one statement at a time. F11 is a good way to examine the execution flow in the most detail. (To move faster through code, we show you some other options also.) By default, the debugger skips over non-user code (if you want more details, see [Just My Code](#)).

Let's say that you are done examining the `SendMessage` method, and you want to get out of the method but stay in the debugger. You can do this using the **Step Out** command.

3. Press **Shift + F11** (or **Debug > Step Out**).

This command resumes app execution (and advances the debugger) until the current method or function returns.

You should be back in the `For` loop in the `Main` method, paused at the `sendMessage` method call.

4. Press **F11** several times until you get back to the `SendMessage` method call again.

5. While paused at the method call, press **F10** (or choose **Debug > Step Over**) once.

A screenshot of the Visual Studio debugger showing the code for the `For` loop. The code is as follows:

```
8
9      For i As Integer = 0 To letters.Length - 1
10     name += letters(i)
11     a(i) = i + 1
12     SendMessage(name, a(i))
13  ↗  Next ≤ 1ms elapsed
14
15  ➤| Console.ReadKey()
16 End Sub
```

Notice this time that the debugger does not step into the `SendMessage` method. F10 advances the debugger without stepping into functions or methods in your app code (the code still executes). By pressing **F10** on the `sendMessage` method call (instead of **F11**), we skipped over the implementation code for `SendMessage` (which maybe we're not interested in right now). For more information on different ways to move through your code, see [Navigate code in the debugger](#).

In this article, we use the keyboard shortcuts, because it's a good way to get fast at executing your app in the debugger (equivalent commands such as menu commands are shown in parentheses).

1. While paused in the `For` loop in the `Main` method, press **F11** (or choose **Debug > Step Into**) twice to advance to the `SendMessage` method call.

After pressing **F11** twice, you should be at this line of code:

```
SendMessage(name, a(i))
```

2. Press **F11** one more time to step into the `sendMessage` method.

The yellow pointer advances into the `SendMessage` method.

A screenshot of the Visual Studio debugger showing the code for the `SendMessage` method. The code is as follows:

```
17      1 reference
18  ↗  Private Shared Sub SendMessage(ByVal name As String, ByVal msg As Integer) ≤ 2ms elapsed
19      Console.WriteLine("Hello, " & name & "! Count to " & msg)
20  End Sub
21 End Class
22
```

F11 is the **Step Into** command and advances the app execution one statement at a time. **F11** is a good way to examine the execution flow in the most detail. (To move faster through code, we show you some other options also.) By default, the debugger skips over non-user code (if you want more details, see [Just My Code](#)).

Let's say that you are done examining the `SendMessage` method, and you want to get out of the method but stay in the debugger. You can do this using the **Step Out** command.

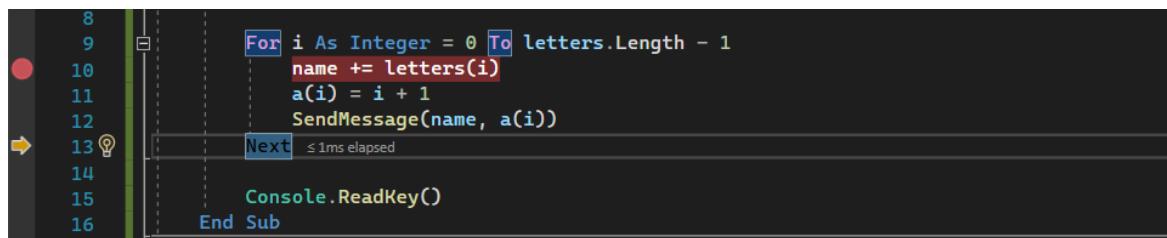
3. Press **Shift + F11** (or **Debug > Step Out**).

This command resumes app execution (and advances the debugger) until the current method or function returns.

You should be back in the `For` loop in the `Main` method, paused at the `SendMessage` method call.

4. Press **F11** several times until you get back to the `SendMessage` method call again.

5. While paused at the method call, press **F10** (or choose **Debug > Step Over**) once.



```
8
9
10
11
12
13
14
15
16
```

```
For i As Integer = 0 To letters.Length - 1
    name += letters(i)
    a(i) = i + 1
    SendMessage(name, a(i))
    Console.ReadKey()
End Sub
```

Notice this time that the debugger does not step into the `SendMessage` method. **F10** advances the debugger without stepping into functions or methods in your app code (the code still executes). By pressing **F10** on the `SendMessage` method call (instead of **F11**), we skipped over the implementation code for `SendMessage` (which maybe we're not interested in right now). For more information on different ways to move through your code, see [Navigate code in the debugger](#).

Navigate code using Run to Click

1. Press **F5** to advance to the breakpoint again.
2. In the code editor, scroll down and hover over the `Console.WriteLine` method in the `SendMessage` method until the green **Run to Click** button  appears on the left. The tooltip for the button shows "Run execution to here".



```
18
19
20
```

```
Private Shared Sub SendMessage(ByVal name As String, ByVal msg As Integer)
    Console.WriteLine("Hello, " & name & "! Count to " & msg)
End Sub
```

NOTE

The **Run to Click** button is new in Visual Studio 2017. (If you don't see the green arrow button, use **F11** in this example instead to advance the debugger to the right place.)

3. Click the **Run to Click** button .

The debugger advances to the `Console.WriteLine` method.

Using this button is similar to setting a temporary breakpoint. **Run to Click** is handy for getting around quickly within a visible region of app code (you can click in any open file).

1. Press F5 to advance to the breakpoint again.
2. In the code editor, scroll down and hover over the `Console.WriteLine` method in the `SendMessage` method until the green **Run to Click** button appears on the left. The tooltip for the button shows "Run execution to here".



3. Select the **Run to Click** button.

The debugger advances to the `Console.WriteLine` method.

Using this button is similar to setting a temporary breakpoint. **Run to Click** is handy for getting around quickly within a visible region of app code (you can click in any open file).

Restart your app quickly

Click the **Restart**  button in the Debug Toolbar (Ctrl + Shift + F5).

When you press **Restart**, it saves time versus stopping the app and restarting the debugger. The debugger pauses at the first breakpoint that is hit by executing code.

The debugger stops again at the breakpoint you previously set inside the `For` loop.

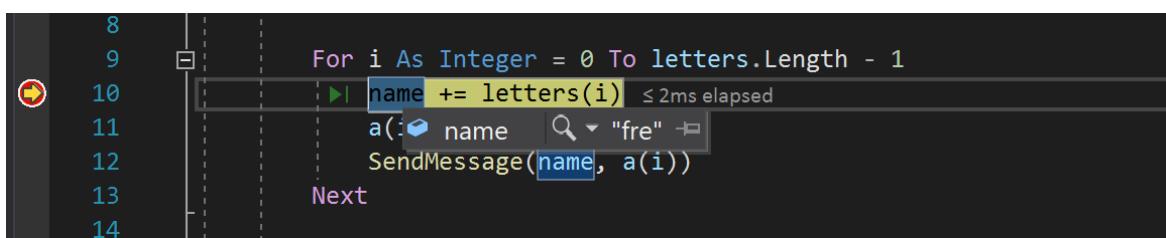
To restart your app, press the **Ctrl + Shift + F5** key combination, it saves time versus stopping the app and restarting the debugger. The debugger pauses at the first breakpoint that is hit by executing code.

The debugger stops again at the breakpoint you previously set inside the `For` loop.

Inspect variables with data tips

Features that allow you to inspect variables are one of the most useful features of the debugger, and there are different ways to do it. Often, when you try to debug an issue, you are attempting to find out whether variables are storing the values that you expect them to have at a particular time.

1. While paused on the `name += letters[i]` statement, hover over the `letters` variable and you see its default value, the value of the first element in the array, `"f"c`.
2. Next, hover over the `name` variable, and you see its current value, an empty string.
3. Press F5 (or **Debug > Continue**) a few times to iterate several times through the `For` loop, pausing again at the breakpoint, and hovering over the `name` variable each time to check its value.

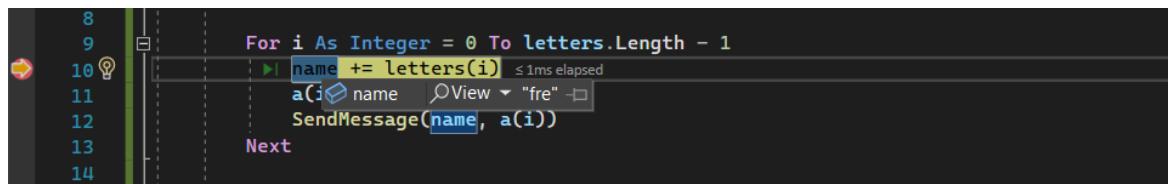


The value of the variable changes with each iteration of the `For` loop, showing values of `f`, then `fr`, then `fre`, and so on.

Often, when debugging, you want a quick way to check property values on variables, to see whether they are storing the values that you expect them to store, and the data tips are a good way to do it.

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3. Press **F5** (or **Debug > Continue**) a few times to iterate several times through the `For` loop, pausing again at the breakpoint, and hovering over the `name` variable each time to check its value.



The value of the variable changes with each iteration of the `For` loop, showing values of `f`, then `fr`, then `fre`, and so on.

Often, when debugging, you want a quick way to check property values on variables, to see whether they are storing the values that you expect them to store, and the data tips are a good way to do it.

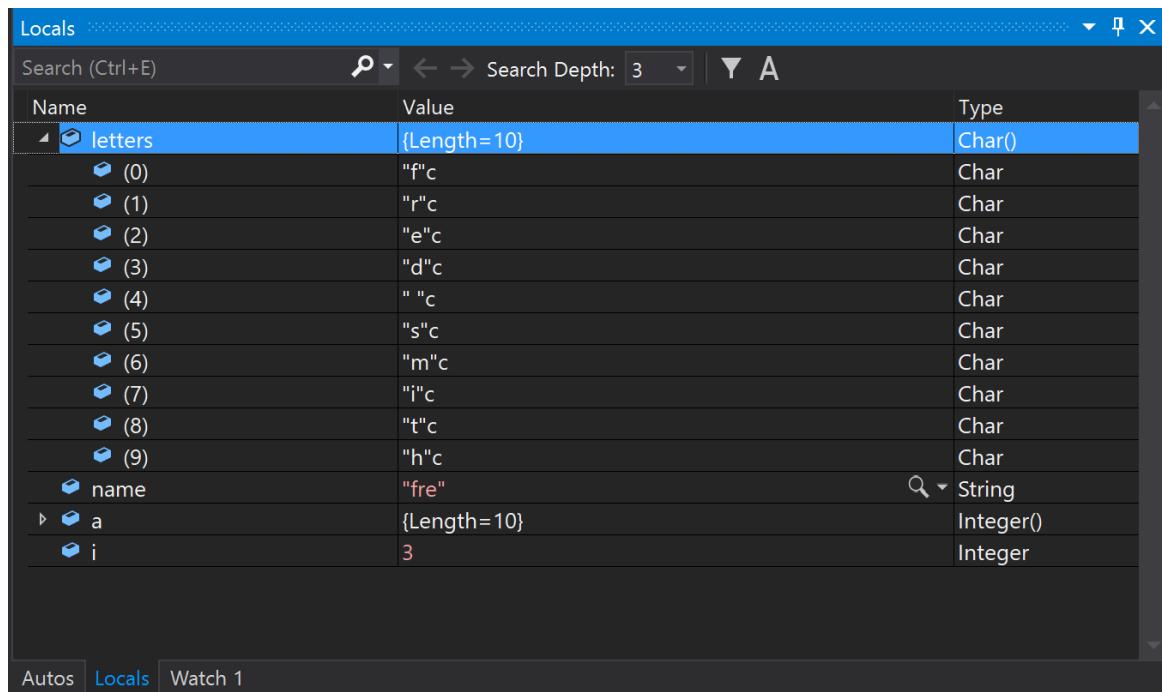
Inspect variables with the Autos and Locals windows

1. Look at the **Autos** window at the bottom of the code editor.

If it is closed, open it while paused in the debugger by choosing **Debug > Windows > Autos**.

In the **Autos** window, you see variables and their current value. The **Autos** window shows all variables used on the current line or the preceding line (Check documentation for language-specific behavior).

2. Next, look at the **Locals** window, in a tab next to the **Autos** window.
3. Expand the `letters` variable to show the elements that it contains.



The **Locals** window shows you the variables that are in the current **scope**, that is, the current execution context.

1. Look at the **Autos** window at the bottom of the code editor.

If it is closed, open it while paused in the debugger by choosing **Debug > Windows > Autos**.

In the **Autos** window, you see variables and their current value. The **Autos** window shows all variables used on the current line or the preceding line (Check documentation for language-specific behavior).

2. Next, look at the **Locals** window, in a tab next to the **Autos** window.

3. Expand the `letters` variable to show the elements that it contains.

The Locals window displays the following variable information:

Name	Value	Type
letters	{Length=10}	Char()
(0)	"f"c	Char
(1)	"r"c	Char
(2)	"e"c	Char
(3)	"d"c	Char
(4)	" "c	Char
(5)	"s"c	Char
(6)	"m"c	Char
(7)	"i"c	Char
(8)	"t"c	Char
(9)	"h"c	Char
name	"fre"	String
a	{Length=10}	Integer()
i	3	Integer

The **Locals** window shows you the variables that are in the current [scope](#), that is, the current execution context.

Set a watch

1. In the main code editor window, right-click the `name` variable and choose **Add Watch**.

The **Watch** window opens at the bottom of the code editor. You can use a **Watch** window to specify a variable (or an expression) that you want to keep an eye on.

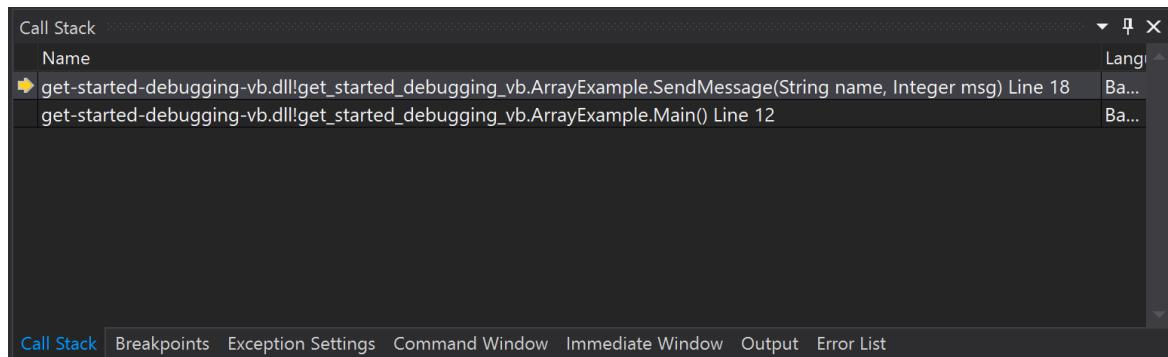
Now, you have a watch set on the `name` variable, and you can see its value change as you move through the debugger. Unlike the other variable windows, the **Watch** window always shows the variables that you are watching (they're grayed out when out of scope).

Examine the call stack

1. While paused in the `For` loop, click the **Call Stack** window, which is by default open in the lower right pane.

If it is closed, open it while paused in the debugger by choosing **Debug > Windows > Call Stack**.

2. Click **F11** a few times until you see the debugger pause in the `SendMessage` method. Look at the **Call Stack** window.



NOTE

The Call Stack window is similar to the Debug perspective in some IDEs like Eclipse.

The call stack is a good way to examine and understand the execution flow of an app.

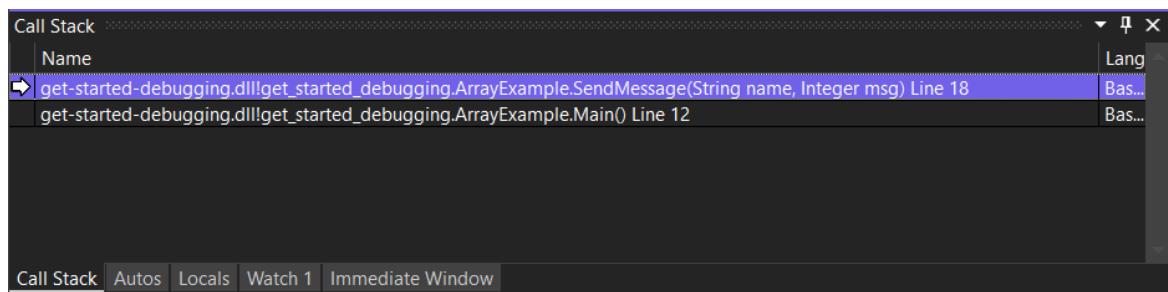
You can double-click a line of code to go look at that source code and that also changes the current scope being inspected by the debugger. This action does not advance the debugger.

You can also use right-click menus from the Call Stack window to do other things. For example, you can insert breakpoints into specified functions, advance the debugger using Run to Cursor, and go examine source code. For more information, see [How to: Examine the Call Stack](#).

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If it is closed, open it while paused in the debugger by choosing **Debug > Windows > Call Stack**.

2. Click **F11** a few times until you see the debugger pause in the `SendMessage` method. Look at the Call Stack window.



The Call Stack window shows the order in which methods and functions are getting called. The top line shows the current function (the `SendMessage` method in this app). The second line shows that `SendMessage` was called from the `Main` method, and so on.

NOTE

The Call Stack window is similar to the Debug perspective in some IDEs like Eclipse.

The call stack is a good way to examine and understand the execution flow of an app.

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Change the execution flow

1. Press **F11** twice to run the `Console.WriteLine` method.
2. With the debugger paused in the `SendMessage` method call, use the mouse to grab the yellow arrow (the execution pointer) on the left and move it up one line, back to `Console.WriteLine`.
3. Press **F11**.

The debugger reruns the `Console.WriteLine` method (you see this in the console window output).

By changing the execution flow, you can do things like test different code execution paths or rerun code without restarting the debugger.

WARNING

Often you need to be careful with this feature, and you see a warning in the tooltip. You may see other warnings, too. Moving the pointer cannot revert your application to an earlier app state.

4. Press **F5** to continue running the app.

Congratulations on completing this tutorial!

Next steps

In this tutorial, you've learned how to start the debugger, step through code, and inspect variables. You may want to get a high-level look at debugger features along with links to more information.

[First look at the debugger](#)

Get started with unit testing

11/13/2021 • 6 minutes to read • [Edit Online](#)

Use Visual Studio to define and run unit tests to maintain code health, ensure code coverage, and find errors and faults before your customers do. Run your unit tests frequently to make sure your code is working properly.

In this article, the code uses C# and C++, illustrations are in C#, but the concepts and features apply to .NET languages, C++, Python, JavaScript, and TypeScript.

Create unit tests

This section describes how to create a unit test project.

1. Open the project that you want to test in Visual Studio.

For the purposes of demonstrating an example unit test, this article tests a simple "Hello World" C# or C++ Console project named **HelloWorld** (**HelloWorldCore** in C#). The sample code for such a project is as follows:

- [.NET](#)
- [C++](#)

```
namespace HelloWorldCore

public class Program
{
    public static void Main()
    {
        Console.WriteLine("Hello World!");
    }
}
```

2. In **Solution Explorer**, select the solution node. Then, from the top menu bar, select **File > Add > New Project**.

3. In the new project dialog box, find the unit test project to use.

Type **test** in the search box to find a unit test project template for the test framework you want to use, such as **MSTest** (C#) or the **Native Unit Test** project (C++), and select it.

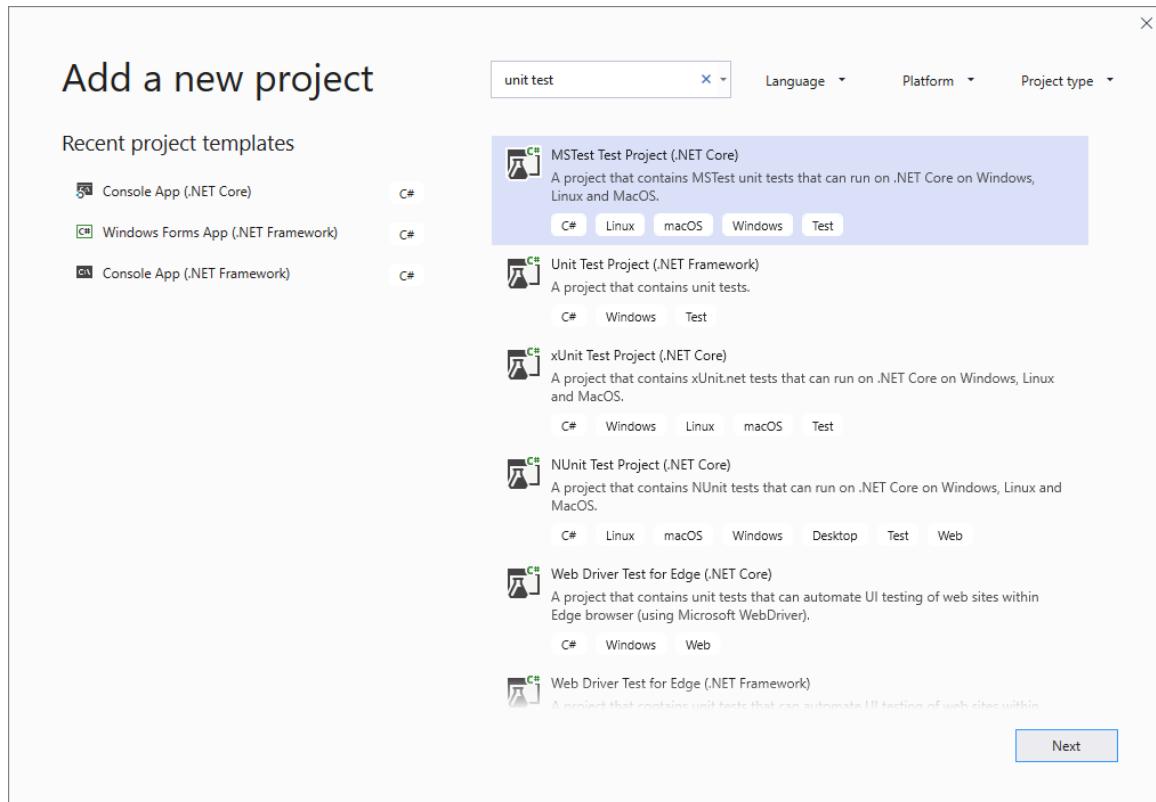
Expand the **Installed** node, choose the language that you want to use for your test project, and then choose **Test**.

Starting in Visual Studio 2017 version 14.8, the .NET languages include built-in templates for NUnit and xUnit. For C++, in this example select the **Native Unit Test** project, which uses Microsoft Native Unit Test Framework. (To use a different C++ test framework, see [Writing unit tests for C/C++](#)). For Python, see [Set up unit testing in Python code](#) to set up your test project.

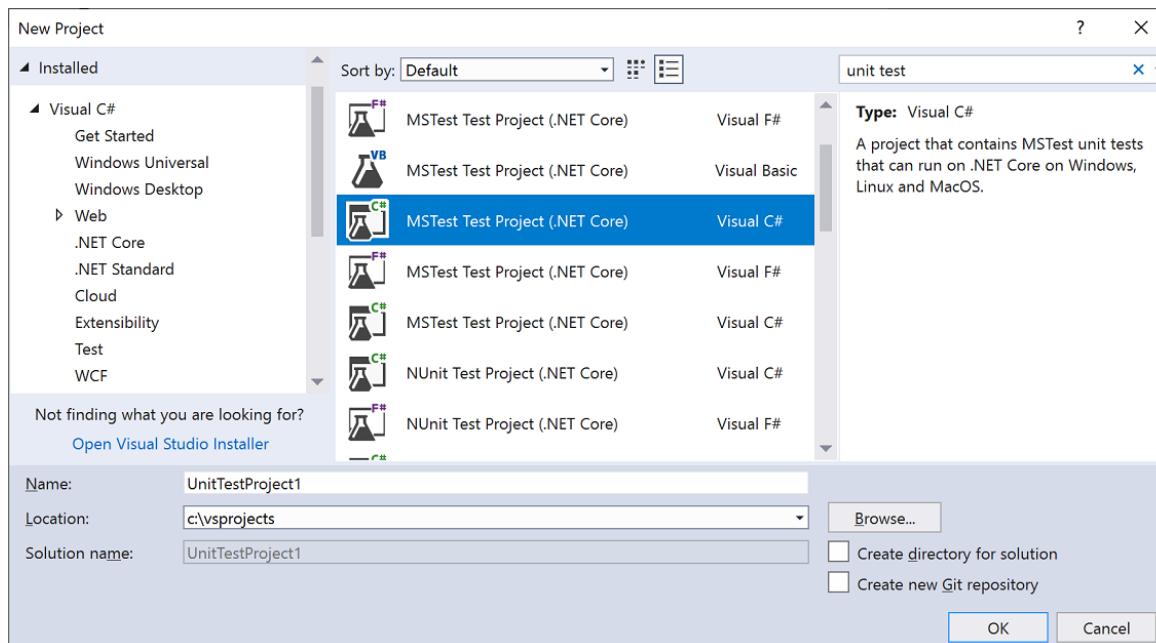
TIP

For C# only, you can create unit test projects from code using a faster method. For more information, see [Create unit test projects and test methods](#). To use this method with .NET Core or .NET Standard, Visual Studio 2019 is required.

The following illustration shows an MSTest unit test, which is supported in .NET.

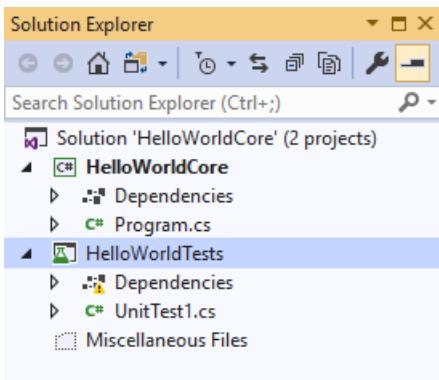


Click **Next**, choose a name for the test project, and then click **Create**.



Choose a name for the test project, such as `HelloWorldTests`, and then click **OK**.

The project is added to your solution.



4. In the unit test project, add a reference to the project you want to test by right-clicking on **References** or **Dependencies** and then choosing **Add Reference** or **Add Project Reference**.
5. Select the project that contains the code you'll test and click **OK**.



6. Add code to the unit test method.

For example, you might use the following code by selecting the correct documentation tab that matches your test framework: MSTest, NUnit, or xUnit (supported on .NET only), or C++ Microsoft Native Unit Test Framework.

- [MSTest](#)
- [NUnit](#)
- [xUnit](#)
- [Microsoft Native Unit Test Framework](#)

```

using Microsoft.VisualStudio.TestTools.UnitTesting;
using System.IO;
using System;

namespace HelloWorldTests
{
    [TestClass]
    public class UnitTest1
    {
        private const string Expected = "Hello World!";
        [TestMethod]
        public void TestMethod1()
        {
            using (var sw = new StringWriter())
            {
                Console.SetOut(sw);
                HelloWorldCore.Program.Main();

                var result = sw.ToString().Trim();
                Assert.AreEqual(Expected, result);
            }
        }
    }
}

```

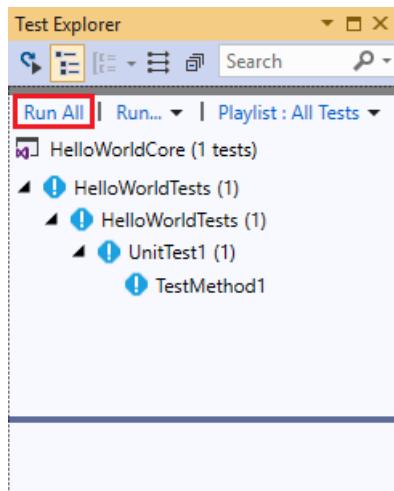
Run unit tests

1. Open [Test Explorer](#).

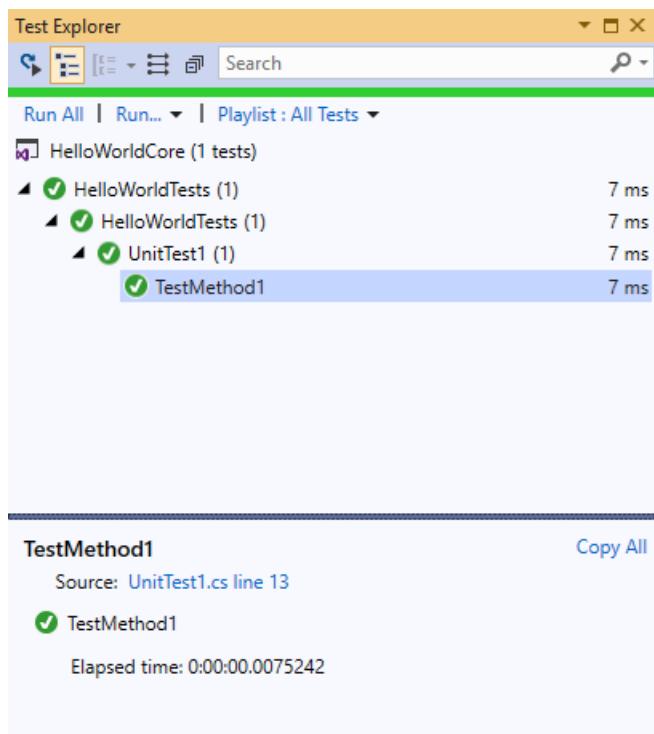
To open Test Explorer, choose **Test > Test Explorer** from the top menu bar (or press **Ctrl + E, T**).

To open Test Explorer, choose **Test > Windows > Test Explorer** from the top menu bar.

2. Run your unit tests by clicking **Run All** (or press **Ctrl + R, V**).



After the tests have completed, a green check mark indicates that a test passed. A red "x" icon indicates that a test failed.



TIP

You can use [Test Explorer](#) to run unit tests from the built-in test framework (MSTest) or from third-party test frameworks. You can group tests into categories, filter the test list, and create, save, and run playlists of tests. You can also debug tests and analyze test performance and code coverage.

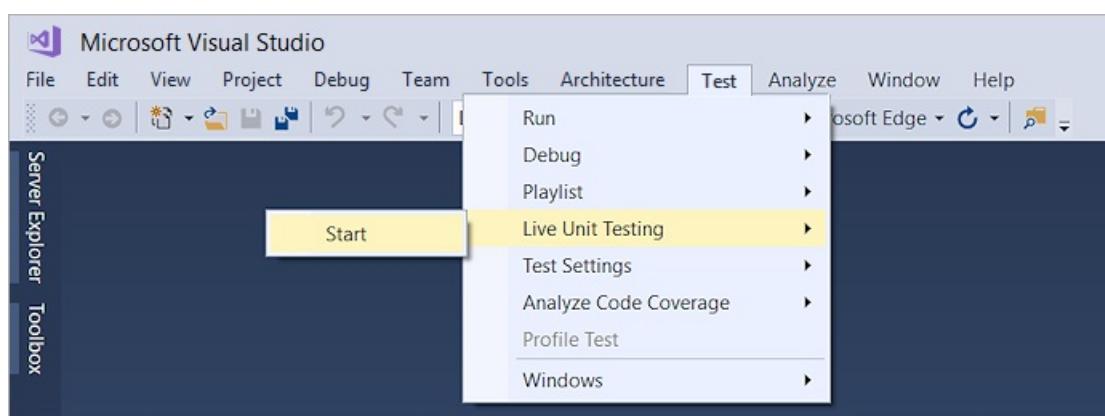
View live unit test results (Visual Studio Enterprise)

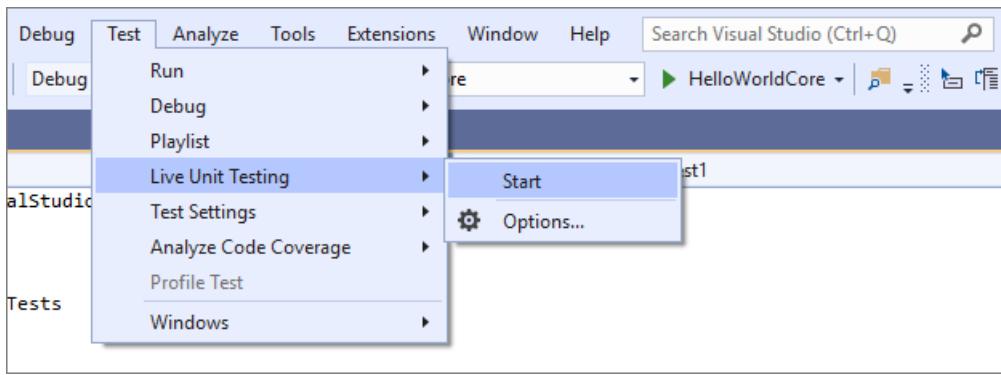
If you are using the MSTest, xUnit, or NUnit testing framework in Visual Studio 2017 or later, you can see live results of your unit tests.

NOTE

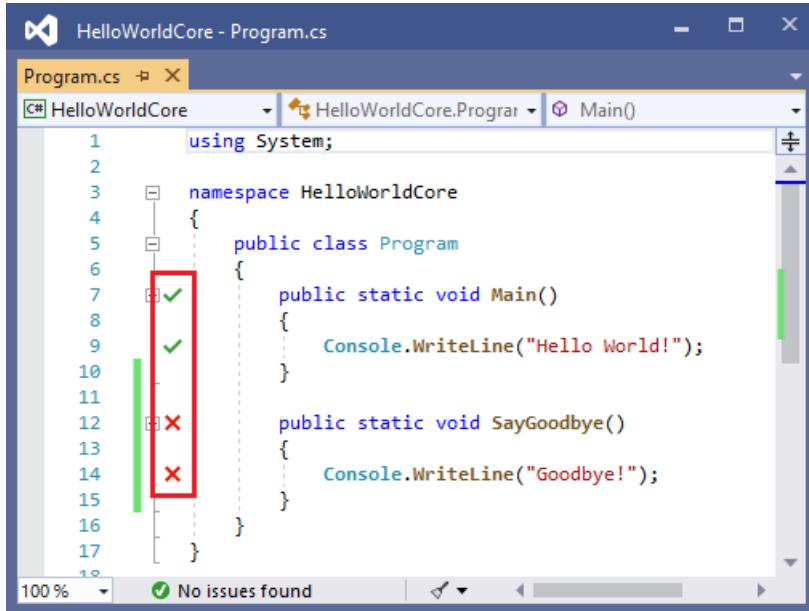
To follow these steps, Visual Studio Enterprise is required, along with .NET code and one of the following test frameworks: MSTest, xUnit, or NUnit.

1. Turn live unit testing from the **Test** menu by choosing **Test > Live Unit Testing > Start**.

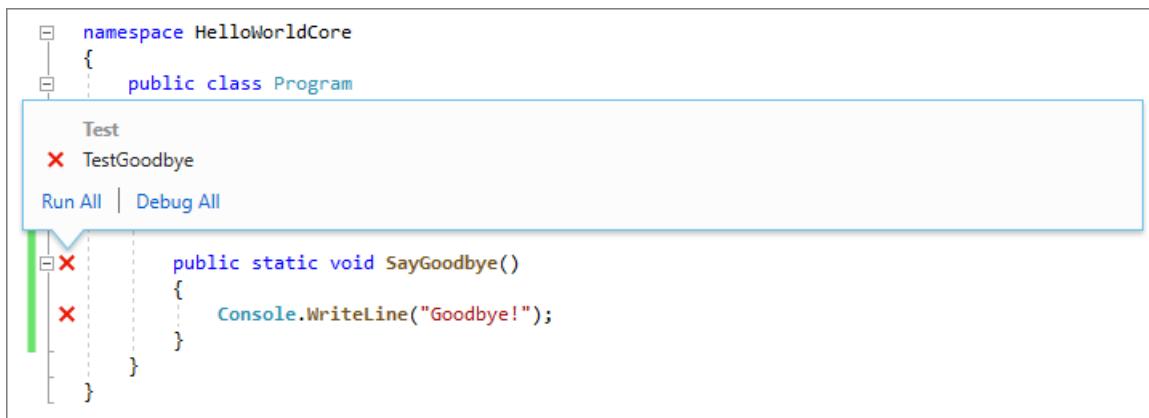




2. View the results of the tests within the code editor window as you write and edit code.



3. Click a test result indicator to see more information, such as the names of the tests that cover that method.



For more information about live unit testing, see [Live unit testing](#).

Use a third-party test framework

You can run unit tests in Visual Studio by using third-party test frameworks such as NUnit, Boost, or Google C++ Testing Framework, depending on your programming language. To use a third-party framework:

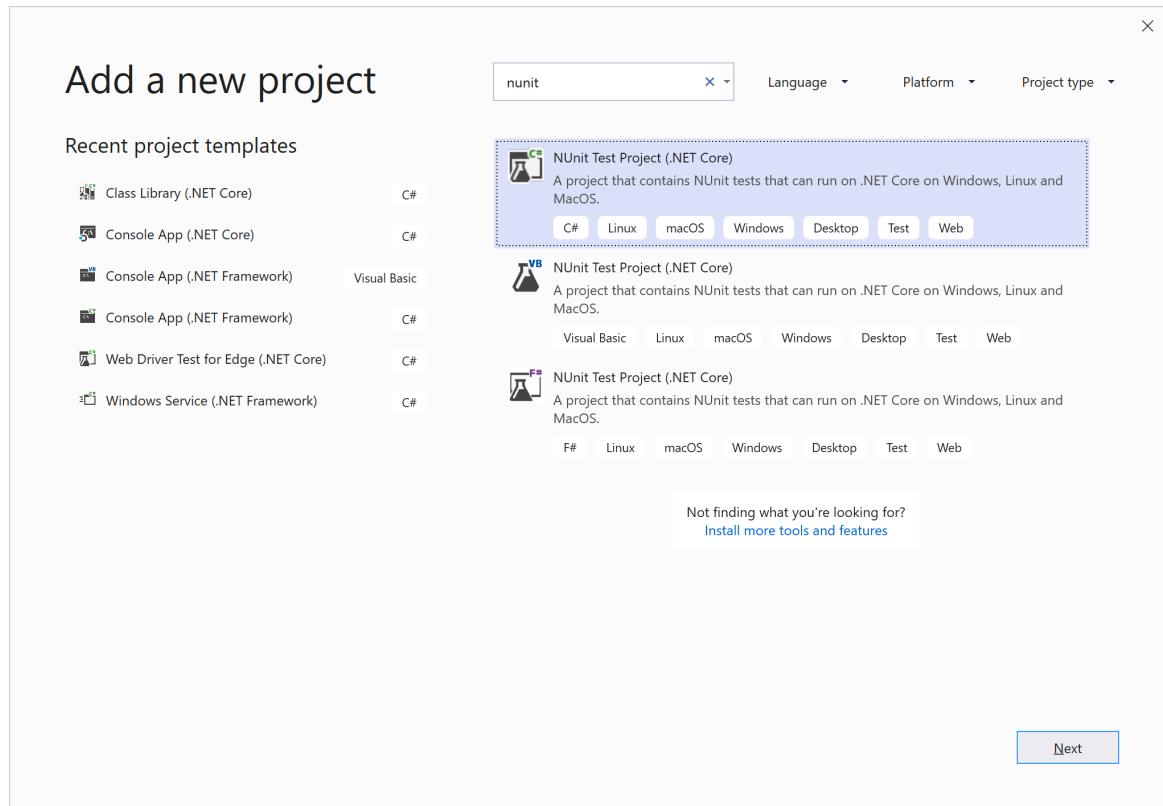
- Use the **NuGet Package Manager** to install the NuGet package for the framework of your choice.
- (.NET) Starting in Visual Studio 2017 version 14.6, Visual Studio includes pre-configured test project templates for NUnit and xUnit test frameworks. The templates also include the necessary NuGet packages to enable support.

- (C++) In Visual Studio 2017 and later versions, some frameworks like Google C++ Testing Framework are already included. For more information, see [Write unit tests for C/C++ in Visual Studio](#).

To add a unit test project:

1. Open the solution that contains the code you want to test.
2. Right-click on the solution in **Solution Explorer** and choose **Add > New Project**.
3. Select a unit test project template.

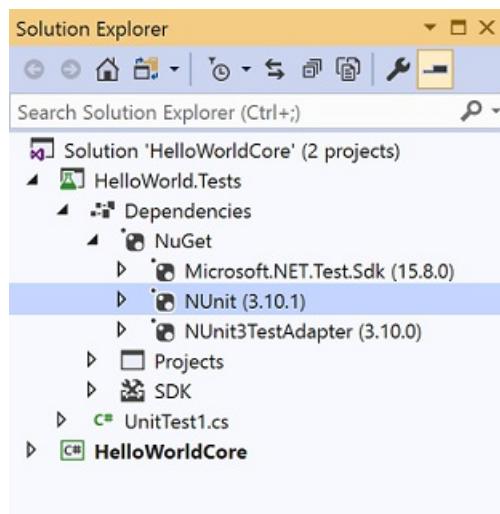
In this example, select **NUnit**



Click **Next**, name the project, and then click **Create**.

Name the project, and then click **OK** to create it.

The project template includes NuGet references to NUnit and NUnit3TestAdapter.



4. Add a reference from the test project to the project that contains the code you want to test.

Right-click on the project in **Solution Explorer**, and then select **Add > Reference**. (You can also add a

reference from the right-click menu of the **References** or **Dependencies** node.)

5. Add code to your test method.

The screenshot shows the Visual Studio IDE interface with the title bar "Program.cs" and "UnitTest1.cs*". The "UnitTest1.cs" tab is active. The code editor displays the following C# code:

```
1  using NUnit.Framework;
2  using System.IO;
3  using System;
4
5  namespace HelloWorldTests
6  {
7      public class Tests
8      {
9          private const string Expected = "Hello World!";
10         [SetUp]
11         public void Setup()
12         {
13         }
14
15         [Test]
16         public void Test1()
17         {
18             //Assert.Pass();
19             using (var sw = new StringWriter())
20             {
21                 Console.SetOut(sw);
22                 HelloWorldCore.Program.Main();
23
24                 var result = sw.ToString().Trim();
25                 Assert.AreEqual(Expected, result);
26             }
27         }
28     }
29 }
```

The code implements a unit test named `Test1` that calls the `Main` method of the `HelloWorldCore` program. It uses `StringWriter` to capture the console output and compares it against the expected value "Hello World!".

6. Run the test from **Test Explorer** or by right-clicking on the test code and choosing **Run Test(s)** (or **Ctrl + R, T**).

Next steps

[Unit test basics](#)

[Create and run unit tests for managed code](#)

[Write unit tests for C/C++](#)

Create a database and add tables in Visual Studio

11/13/2021 • 5 minutes to read • [Edit Online](#)

You can use Visual Studio to create and update a local database file in SQL Server Express LocalDB. You can also create a database by executing Transact-SQL statements in the **SQL Server Object Explorer** tool window in Visual Studio. In this topic, we'll create an *.mdf* file and add tables and keys by using the Table Designer.

Prerequisites

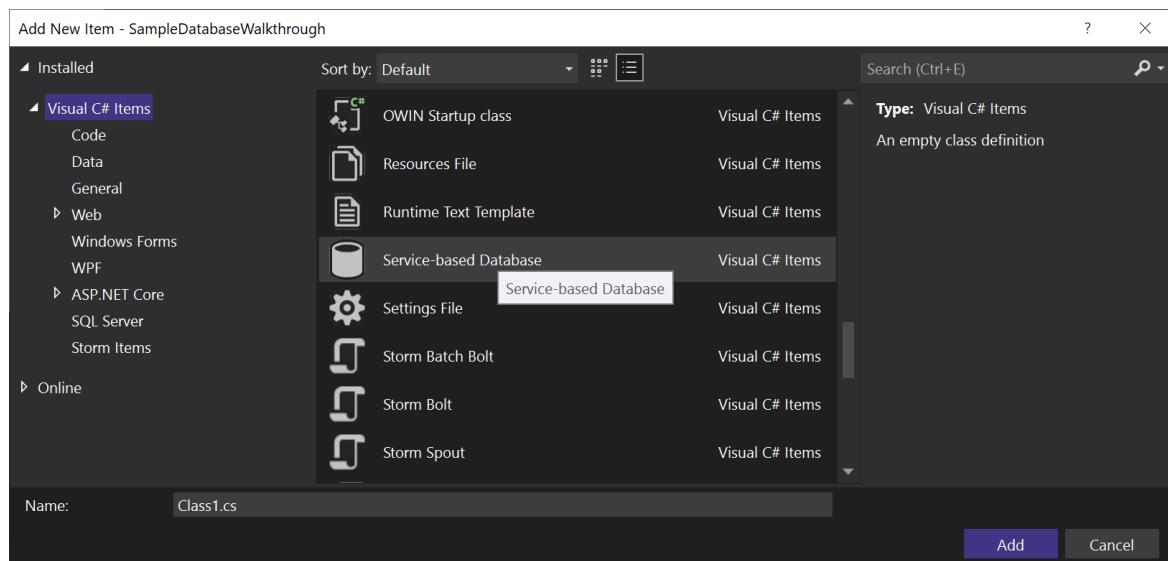
To complete this walkthrough, you'll need the **.NET desktop development** and **Data storage and processing** workloads installed in Visual Studio. To install them, open **Visual Studio Installer** and choose **Modify** (or **More > Modify**) next to the version of Visual Studio you want to modify.

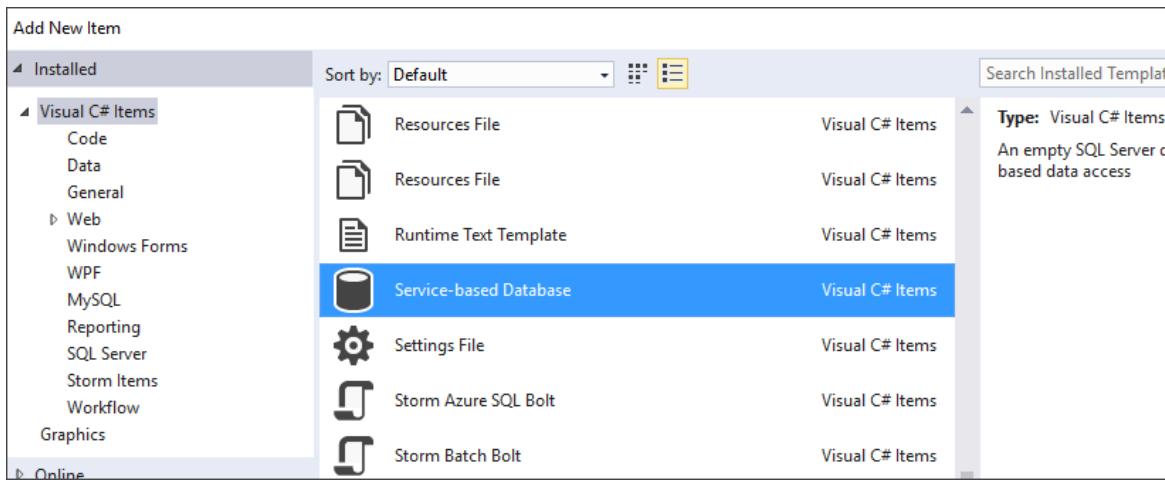
NOTE

The procedures in this article apply only to .NET Framework Windows Forms projects, not to .NET Core Windows Forms projects.

Create a project and a local database file

1. Create a new **Windows Forms App (.NET Framework)** project and name it **SampleDatabaseWalkthrough**.
2. On the menu bar, select **Project > Add New Item**.
3. In the list of item templates, scroll down and select **Service-based Database**.

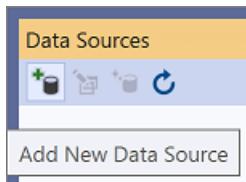
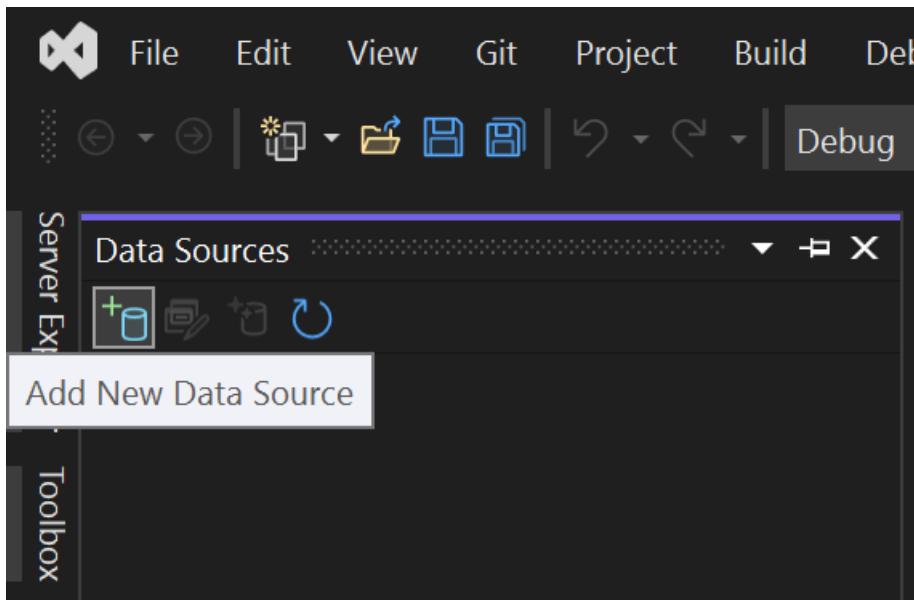




4. Name the database **SampleDatabase**, and then click **Add**.

Add a data source

1. If the **Data Sources** window isn't open, open it by pressing **Shift+Alt+D** or selecting **View > Other Windows > Data Sources** on the menu bar.
2. In the **Data Sources** window, select **Add New Data Source**.



The **Data Source Configuration Wizard** opens.

3. On the **Choose a Data Source Type** page, choose **Database** and then choose **Next**.
4. On the **Choose a Database Model** page, choose **Next** to accept the default (Dataset).
5. On the **Choose Your Data Connection** page, select the **SampleDatabase.mdf** file in the drop-down list, and then choose **Next**.
6. On the **Save the Connection String to the Application Configuration File** page, choose **Next**.
7. On the **Choose your Database Objects** page, you'll see a message that says the database doesn't contain any objects. Choose **Finish**.

View properties of the data connection

You can view the connection string for the *SampleDatabase.mdf* file by opening the Properties window of the data connection:

- Select **View > SQL Server Object Explorer** to open the **SQL Server Object Explorer** window. Expand `(localdb)\MSSQLLocalDB > Databases`, and then right-click on *SampleDatabase.mdf* and select **Properties**.
- Alternatively, you can select **View > Server Explorer**, if that window isn't already open. Open the Properties window by expanding the **Data Connections** node, right-clicking on *SampleDatabase.mdf*, and then selecting **Properties**.

TIP

If you can't expand the Data Connections node, or the *SampleDatabase.mdf* connection is not listed, select the **Connect to Database** button in the Server Explorer toolbar. In the **Add Connection** dialog box, make sure that **Microsoft SQL Server Database File** is selected under **Data source**, and then browse to and select the *SampleDatabase.mdf* file. Finish adding the connection by selecting **OK**.

Create tables and keys by using Table Designer

In this section, you'll create two tables, a primary key in each table, and a few rows of sample data. You'll also create a foreign key to specify how records in one table correspond to records in the other table.

Create the Customers table

1. In **Server Explorer**, expand the **Data Connections** node, and then expand the *SampleDatabase.mdf* node.

If you can't expand the Data Connections node, or the *SampleDatabase.mdf* connection is not listed, select the **Connect to Database** button in the Server Explorer toolbar. In the **Add Connection** dialog box, make sure that **Microsoft SQL Server Database File** is selected under **Data source**, and then browse to and select the *SampleDatabase.mdf* file. Finish adding the connection by selecting **OK**.

2. Right-click on **Tables** and select **Add New Table**.

The Table Designer opens and shows a grid with one default row, which represents a single column in the table that you're creating. By adding rows to the grid, you'll add columns in the table.

3. In the grid, add a row for each of the following entries:

COLUMN NAME	DATA TYPE	ALLOW NULLS
<code>CustomerID</code>	<code>nchar(5)</code>	False (cleared)
<code>CompanyName</code>	<code>nvarchar(50)</code>	False (cleared)
<code>ContactName</code>	<code>nvarchar (50)</code>	True (selected)
<code>Phone</code>	<code>nvarchar (24)</code>	True (selected)

4. Right-click on the `CustomerID` row, and then select **Set Primary Key**.
5. Right-click on the default row (`Id`), and then select **Delete**.
6. Name the Customers table by updating the first line in the script pane to match the following sample:

```
CREATE TABLE [dbo].[Customers]
```

You should see something like this:

The screenshot shows the SQL Server Management Studio (SSMS) interface. In the top tab bar, the 'dbo.Customers [Design]*' tab is selected. Below it, the 'Script File: dbo.Table.sql*' tab is also visible. The main area displays the table structure in a grid:

Name	Data Type	Allow Nulls	Default
CustomerID	nchar(5)	<input checked="" type="checkbox"/>	
CompanyName	nvarchar(50)	<input checked="" type="checkbox"/>	
ContactName	nvarchar(50)	<input checked="" type="checkbox"/>	
PhoneNumber	nvarchar(24)	<input checked="" type="checkbox"/>	
		<input checked="" type="checkbox"/>	

To the right of the table grid, there are sections for 'Keys (1)', 'Check Constraints (0)', 'Indexes (0)', 'Foreign Keys (0)', and 'Triggers (0)'. Below the table grid, the 'T-SQL' tab is selected, showing the generated CREATE TABLE script:

```
1 CREATE TABLE [dbo].[Customers]
2 (
3     [CustomerID] NCHAR(5) NOT NULL PRIMARY KEY,
4     [CompanyName] NVARCHAR(50) NOT NULL,
5     [ContactName] NVARCHAR(50) NULL,
6     [PhoneNumber] NVARCHAR(24) NULL
7 )
8
```

The status bar at the bottom indicates 'No issues found'.

This screenshot shows a second instance of SSMS. The top tab bar has a different connection name: 'SampleDatabaseWT - dbo.Customers [Design]*'. The table structure grid is identical to the one in the previous screenshot:

Name	Data Type	Allow Nulls	Default
CustomerID	nchar(5)	<input type="checkbox"/>	
CompanyName	nchar(50)	<input type="checkbox"/>	
ContactName	nchar(50)	<input checked="" type="checkbox"/>	
Phone	nvarchar(24)	<input checked="" type="checkbox"/>	
		<input type="checkbox"/>	

The 'T-SQL' tab shows the same CREATE TABLE script. The status bar indicates 'No issues found'.

7. In the upper-left corner of **Table Designer**, select **Update**, or press **Shift+Alt+U**.
8. In the **Preview Database Updates** dialog box, select **Update Database**.

The Customers table is created in the local database file.

Create the Orders table

1. Add another table, and then add a row for each entry in the following table:

COLUMN NAME	DATA TYPE	ALLOW NULLS
OrderID	int	False (cleared)

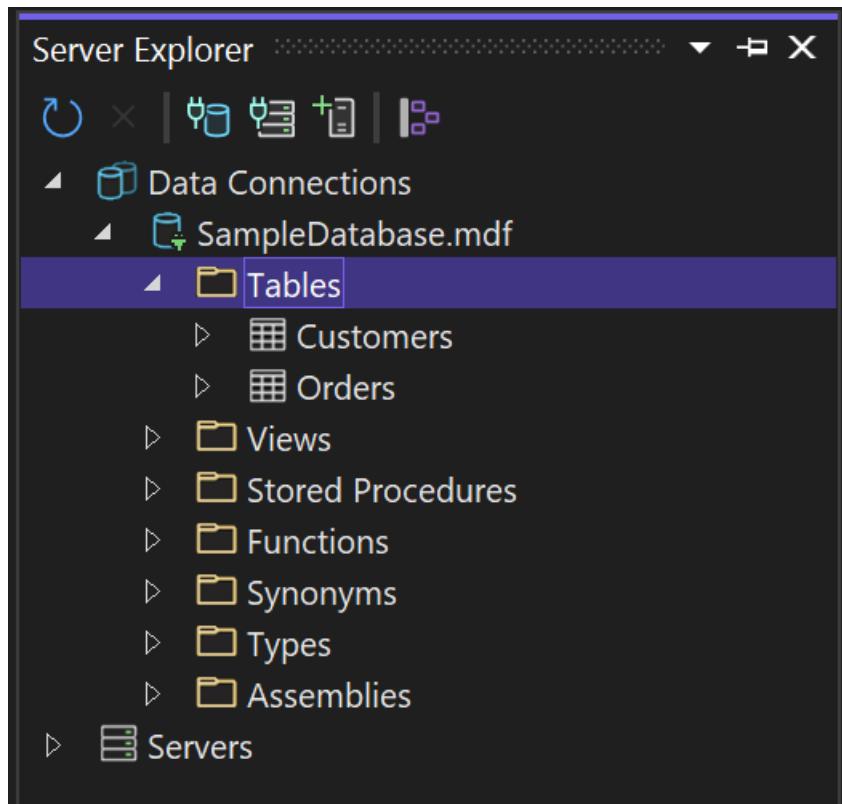
COLUMN NAME	DATA TYPE	ALLOW NULLS
CustomerID	nchar(5)	False (cleared)
OrderDate	datetime	True (selected)
OrderQuantity	int	True (selected)

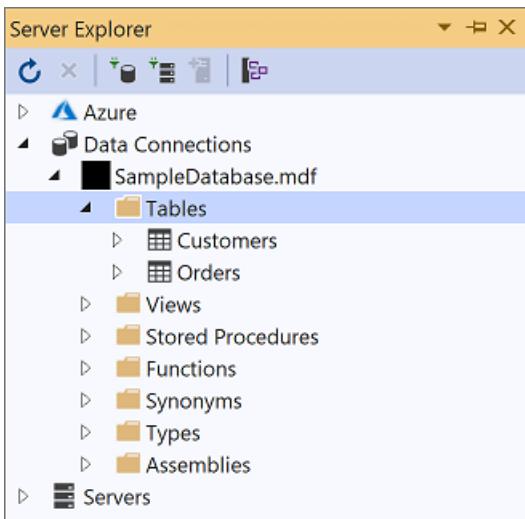
2. Set OrderID as the primary key, and then delete the default row.
3. Name the Orders table by updating the first line in the script pane to match the following sample:

```
CREATE TABLE [dbo].[Orders]
```

4. In the upper-left corner of the **Table Designer**, select **Update**, or press **Shift+Alt+U..**
5. In the **Preview Database Updates** dialog box, select **Update Database**.

The Orders table is created in the local database file. If you expand the **Tables** node in Server Explorer, you see the two tables:

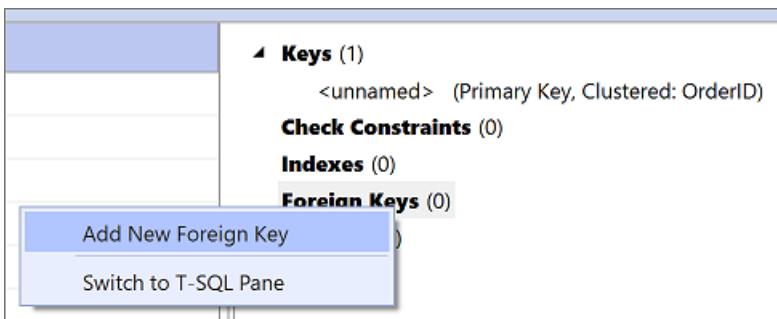




If you don't see it, hit the **Refresh** toolbar button.

Create a foreign key

1. In the context pane on the right side of the Table Designer grid for the Orders table, right-click on **Foreign Keys** and select **Add New Foreign Key**.



2. In the text box that appears, replace the text **ToTable** with **Customers**.
3. In the T-SQL pane, update the last line to match the following sample:

```
CONSTRAINT [FK_Orders_Customers] FOREIGN KEY ([CustomerID]) REFERENCES [Customers]([CustomerID])
```

4. In the upper-left corner of the **Table Designer**, select **Update** (**Shift+Alt+U**).
5. In the **Preview Database Updates** dialog box, select **Update Database**.

The foreign key is created.

Populate the tables with data

1. In **Server Explorer** or **SQL Server Object Explorer**, expand the node for the sample database.
2. Open the shortcut menu for the **Tables** node, select **Refresh**, and then expand the **Tables** node.
3. Open the shortcut menu for the **Customers** table, and then select **View Data**.
4. Add whatever data you want for some customers.

You can specify any five characters you want as the customer IDs, but choose at least one that you can remember for use later in this procedure.

5. Open the shortcut menu for the **Orders** table, and then select **Show Table Data**.
6. Add data for some orders. As you enter each row, it is saved in the database.

IMPORTANT

Make sure that all order IDs and order quantities are integers and that each customer ID matches a value that you specified in the **CustomerID** column of the Customers table.

Congratulations! You now know how to create tables, link them with a foreign key, and add data.

See also

- [Accessing data in Visual Studio](#)