<u>Version 1.82 (/updates)</u> is now available! Read about the new features and fixes from August.

Topics Debugging

In this article Initialize configurations

(https://vscode.dev/github/microsoft/vscode-docs/blob/main/docs/python/debugging.md)

# Python debugging in VS Code

The Python extension supports debugging of several types of Python applications. For a short walkthrough of basic debugging, see Tutorial - Configure and run the debugger (/docs/python/python-tutorial#\_configure-and-run-the-debugger). Also see the Flask tutorial (/docs/python/tutorial-flask). Both tutorials demonstrate core skills like setting breakpoints and stepping through code.

For general debugging features such as inspecting variables, setting breakpoints, and other activities that aren't language-dependent, review VS Code debugging (/docs/editor/debugging).

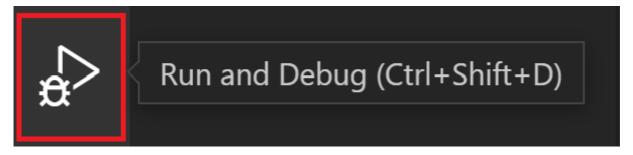
This article mainly addresses Python-specific debugging *configurations*, including the necessary steps for specific app types and remote debugging.

## Initialize configurations

A configuration drives VS Code's behavior during a debugging session. Configurations are defined in a launch.json file that's stored in a .vscode folder in your workspace.

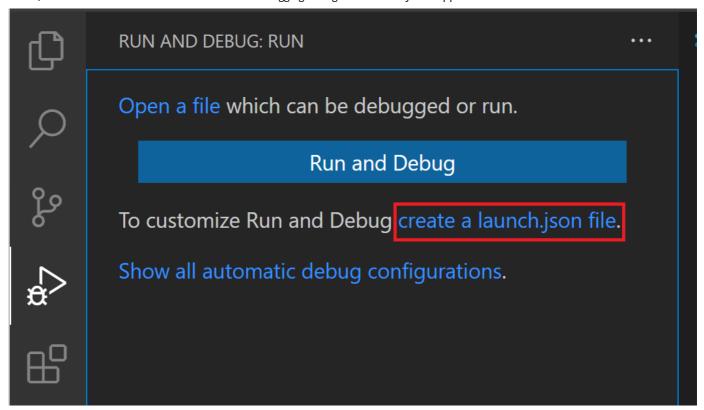
Note: To change debugging configuration, your code must be stored in a folder.

To initialize debug configurations, first select the Run view in the sidebar:



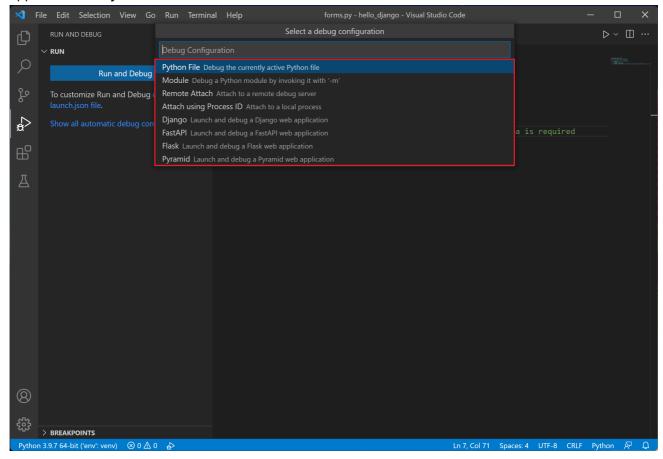
If you don't yet have any configurations defined, you'll see a button to **Run and Debug** and a link to create a configuration (launch.json) file:

×



To generate a launch.json file with Python configurations, do the following steps:

- 1. Select the **create a launch.json file** link (outlined in the image above) or use the **Run > Open configurations** menu command.
- 2. A configuration menu will open from the Command Palette allowing you to choose the type of debug configuration you want for the opened file. For now, in the **Select a debug configuration** menu that appears, select **Python File**.



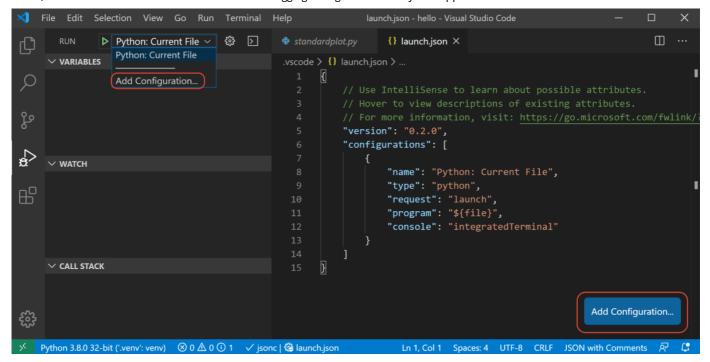
**Note**: Starting a debugging session through the Debug Panel, F5 or **Run > Start Debugging** when no configuration exists will also bring up the debug configuration menu, but will not create a launch.json file.

3. The Python extension then creates and opens a launch.json file that contains a pre-defined configuration based on what you previously selected, in this case, **Python File**. You can modify configurations (to add arguments, for example), and also add custom configurations.

The details of configuration properties are covered later in this article under Standard configuration and options. Other configurations are also described in this article under Debugging specific app types.

## Additional configurations

By default, VS Code shows only the most common configurations provided by the Python extension. You can select other configurations to include in launch.json by using the **Add Configuration** command shown in the list and the launch.json editor. When you use the command, VS Code prompts you with a list of all available configurations (be sure to select the **Python** option):



Selecting the **Attach using Process ID** one yields the following result:

```
III ...
standardplot.py
                     {} launch.json ×
.vscode > {} launch.json > ...
           // Use IntelliSense to learn about possible attributes.
           // Hover to view descriptions of existing attributes.
           // For more information, visit: https://go.microsoft.com/fwlink/?linkid=830387
           "version": "0.2.0",
            "configurations": [
                    "name": "Python: Attach using Process Id",
                    "type": "python",
                    "request": "attach",
                    "processId": "${command:pickProcess}",
 11
                    "justMyCode": true
 12
 13
 15
                    "name": "Python: Current File",
                    "type": "python",
 16
                    "request": "launch",
 17
                    "program": "${file}",
                    "console": "integratedTerminal",
 20
                    "justMyCode": true
 21
 22
       }
 23
                                                                             Add Configuration...
```

See Debugging specific app types for details on all of these configurations.

During debugging, the Status Bar shows the current configuration and the current debugging interpreter. Selecting the configuration brings up a list from which you can choose a different configuration:

```
Python 3.8.0 32-bit ('.venv': venv) ⊗ 0 🛦 0 🛈 1 🕨 Python: Current File (hello) 🗸 python | ✓ standardplot.py
```

By default, the debugger uses the same interpreter selected for your workspace, just like other features of Python extension for VS Code. To use a different interpreter for debugging specifically, set the value for python in launch.json for the applicable debugger configuration. Alternately, select the named interpreter on the Status Bar to select a different one.

## Basic debugging

If you're only interested in debugging a Python script, the simplest way is to select the down-arrow next to the run button on the editor and select **Debug Python File in Terminal**.

```
standardplot.py •

standardplot.py > ...

import matplotlib.pyplot as p
import numpy as np

Run Python File

Debug Python File

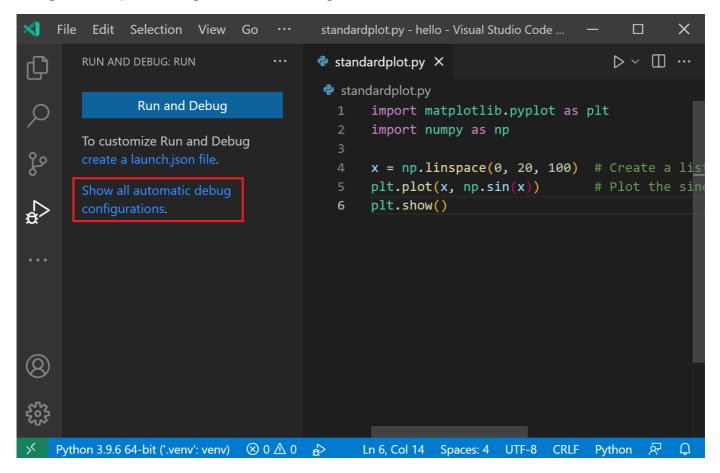
Run Current File in Interactive Window

x = np.linspace(0,20,100)

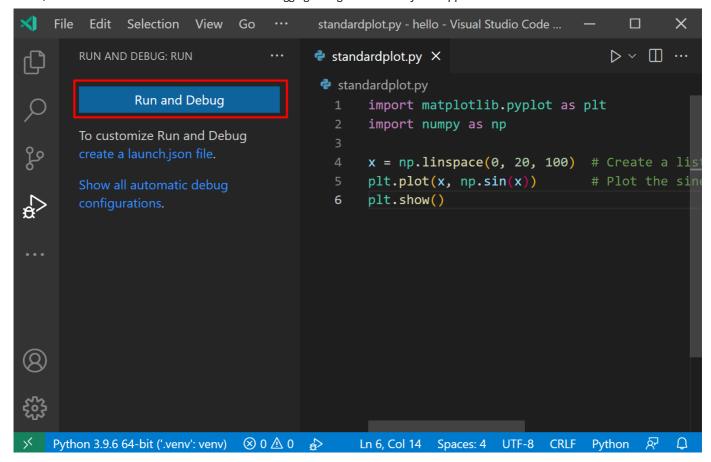
plt.plot(x, np.sin(x))

plt.show
```

If you're looking to debug a web application using Flask, Django or FastAPI, the Python extension provides dynamically created debug configurations based on your project structure under the **Show all automatic debug configurations** option, through the **Run and Debug** view.



But if you're looking to debug other kinds of applications, you can start the debugger through the **Run** view by clicking on the **Run and Debug** button.



When no configuration has been set, you'll be given a list of debugging options. Here, you can select the appropriate option to quickly debug your code.

Two common options are to use the **Python File** configuration to run the currently open Python file or to use the **Attach using Process ID** configuration to attach the debugger to a process that is already running.

For information about creating and using debugging configurations, see the Initialize configurations and Additional configurations sections. Once a configuration is added, it can be selected from the dropdown list and started using the **Start Debugging** button.

Start debugging

## Command line debugging

The debugger can also be run from the command line. The debugger command line syntax is as follows:

```
python -m debugpy
    --listen | --connect
    [<host>:]<port>
    [--wait-for-client]
    [--configure-<name> <value>]...
    [--log-to <path>] [--log-to-stderr]
    <filename> | -m <module> | -c <code> | --pid <pid>
    [<arg>]...
```

As an example, from the command line, you could start the debugger using a specified port (5678) and script using the following syntax. This example assumes the script is long-running and omits the --wait-for-client flag, meaning that the script will not wait for the client to attach.

```
python -m debugpy --listen 5678 ./myscript.py
```

You would then use the following configuration to attach from the VS Code Python extension.

```
{
  "name": "Python: Attach",
  "type": "python",
  "request": "attach",
  "connect": {
     "host": "localhost",
     "port": 5678
  }
}
```

Note: Specifying host is optional for listen, by default 127.0.0.1 is used.

If you wanted to debug remote code or code running in a docker container, on the remote machine or container, you would need to modify the previous CLI command to specify a host.

```
python -m debugpy --listen 0.0.0.0:5678 ./myscript.py
```

The associated configuration file would then look as follows.

```
"name": "Attach",
  "type": "python",
  "request": "attach",
  "connect": {
    "host": "remote-machine-name", // replace this with remote machine name
    "port": 5678
}
}
```

**Note**: Be aware that when you specify a host value other than 127.0.0.1 or localhost you are opening a port to allow access from any machine, which carries security risks. You should make sure that you're taking appropriate security precautions, such as using SSH tunnels, when doing remote debugging.

Flag	Options	Description
listen or - -connect	[ <host>:] <port></port></host>	<b>Required</b> . Specifies the host address and port for the debug adapter server to wait for incoming connections (listen) or to connect with a client that is waiting for an incoming connection (connect). This is the same address that is used in the VS Code debug configuration. By default, the host address is localhost (127.0.0.1).
wait-for- client	none	<b>Optional</b> . Specifies that the code should not run until there's a connection from the debug server. This setting allows you to debug from the first line of your code.

Flag	Options	Description
log-to	<path></path>	Optional. Specifies a path to an existing directory for saving logs.
log-to- stderr	none	Optional. Enables debugpy to write logs directly to stderr.
pid	<pid></pid>	<b>Optional</b> . Specifies a process that is already running to inject the debug server into.
 configure- <name></name>	<value></value>	<b>Optional</b> . Sets a debug property that must be known to the debug server before the client connects. Such properties can be used directly in <i>launch</i> configuration, but must be set in this manner for <i>attach</i> configurations. For example, if you don't want the debug server to automatically inject itself into subprocesses created by the process you're attaching to, useconfigure-subProcess false.

Note: [<arg>] can be used to pass command-line arguments along to the app being launched.

## Debugging by attaching over a network connection

### Local script debugging

There may be instances where you need to debug a Python script that's invoked locally by another process. For example, you may be debugging a web server that runs different Python scripts for specific processing jobs. In such cases, you need to attach the VS Code debugger to the script once it's been launched:

- 1. Run VS Code, open the folder or workspace containing the script, and create a launch.json for that workspace if one doesn't exist already.
- 2. In the script code, add the following and save the file:

```
import debugpy

# 5678 is the default attach port in the VS Code debug configurations. Unless
a host and port are specified, host defaults to 127.0.0.1
debugpy.listen(5678)
print("Waiting for debugger attach")
debugpy.wait_for_client()
debugpy.breakpoint()
print('break on this line')
```

- 3. Open a terminal using **Terminal**: **Create New Terminal**, which activates the script's selected environment.
- 4. In the terminal, install the debugpy package with python -m pip install --upgrade debugpy.
- 5. In the terminal, start Python with the script, for example, python3 myscript.py. You should see the "Waiting for debugger attach" message that's included in the code, and the script halts at the debugpy.wait\_for\_client() call.

- 6. Switch to the **Run and Debug** view (Ctrl+Shift+D), select the appropriate configuration from the debugger dropdown list, and start the debugger.
- 7. The debugger should stop on the debugpy.breakpoint() call, from which point you can use the debugger normally. You also have the option of setting other breakpoints in the script code using the UI instead of using debugpy.breakpoint().

### Remote script debugging with SSH

Remote debugging allows you to step through a program locally within VS Code while it runs on a remote computer. It is not necessary to install VS Code on the remote computer. For added security, you may want or need to use a secure connection, such as SSH, to the remote computer when debugging.

**Note**: On Windows computers, you may need to install Windows 10 OpenSSH (https://learn.microsoft.com/windows-server/administration/openssh/openssh\_install\_firstuse) to have the ssh command.

The following steps outline the general process to set up an SSH tunnel. An SSH tunnel allows you to work on your local machine as if you were working directly on the remote in a more secure manner than if a port was opened for public access.

### On the remote computer:

1. Enable port forwarding by opening the sshd\_config config file (found under /etc/ssh/ on Linux and under %programfiles(x86)%/openssh/etc on Windows) and adding or modifying the following setting:

AllowTcpForwarding yes

Note: The default for AllowTcpForwarding is yes, so you might not need to make a change.

2. If you had to add or modify AllowTcpForwarding, restart the SSH server. On Linux/macOS, run sudo service ssh restart; on Windows, run services.msc, select OpenSSH or sshd in the list of services, and select Restart.

### On the local computer:

- 1. Create an SSH tunnel by running ssh -2 -L sourceport:localhost:destinationport -i identityfile user@remoteaddress, using a selected port for destinationport and the appropriate username and the remote computer's IP address in user@remoteaddress. For example, to use port 5678 on IP address 1.2.3.4, the command would be ssh -2 -L 5678:localhost:5678 -i identityfile user@1.2.3.4. You can specify the path to an identity file, using the -i flag.
- 2. Verify that you can see a prompt in the SSH session.
- 3. In your VS Code workspace, create a configuration for remote debugging in your launch.json file, setting the port to match the port used in the ssh command and the host to localhost. You use localhost here because you've set up the SSH tunnel.

```
{
  "name": "Python: Attach",
  "type": "python",
  "request": "attach",
  "port": 5678,
  "host": "localhost",
  "pathMappings": [
      {
         "localRoot": "${workspaceFolder}", // Maps C:\Users\user1\project1
         "remoteRoot": "." // To current working directory ~/project1
    }
  ]
}
```

### Starting debugging

Now that an SSH tunnel has been set up to the remote computer, you can begin your debugging.

- 1. Both computers: make sure that identical source code is available.
- 2. Both computers: install debugpy (https://pypi.org/project/debugpy/) using python -m pip install -upgrade debugpy into your environment (while using a form of virtual environment is not required, it is a recommended best practice).
- 3. Remote computer: there are two ways to specify how to attach to the remote process.
  - 1. In the source code, add the following lines, replacing address with the remote computer's IP address and port number (IP address 1.2.3.4 is shown here for illustration only).

```
import debugpy

# Allow other computers to attach to debugpy at this IP address and port.
debugpy.listen(('1.2.3.4', 5678))

# Pause the program until a remote debugger is attached
debugpy.wait_for_client()
```

The IP address used in listen should be the remote computer's private IP address. You can then launch the program normally, causing it to pause until the debugger attaches.

2. Launch the remote process through debugpy, for example:

```
python3 -m debugpy --listen 1.2.3.4:5678 --wait-for-client -m myproject
```

This starts the package myproject using python3, with the remote computer's private IP address of 1.2.3.4 and listening on port 5678 (you can also start the remote Python process by specifying a file path instead of using -m, such as ./hello.py).

4. Local computer: Only if you modified the source code on the remote computer as outlined above, then in the source code, add a commented-out copy of the same code added on the remote computer. Adding these lines makes sure that the source code on both computers matches line by line.

```
#import debugpy

# Allow other computers to attach to debugpy at this IP address and port.
#debugpy.listen(('1.2.3.4', 5678))

# Pause the program until a remote debugger is attached
#debugpy.wait_for_client()
```

- 5. Local computer: switch to the **Run and Debug** view (Ctrl+Shift+D) in VS Code, select the **Python**: **Attach**
- 6. Local computer: set a breakpoint in the code where you want to start debugging.
- 7. Local computer: start the VS Code debugger using the modified **Python: Attach** configuration and the Start Debugging button. VS Code should stop on your locally set breakpoints, allowing you to step through the code, examine variables, and perform all other debugging actions. Expressions that you enter in the **Debug Console** are run on the remote computer as well.

Text output to stdout, as from print statements, appears on both computers. Other outputs, such as graphical plots from a package like matplotlib, however, appear only on the remote computer.

8. During remote debugging, the debugging toolbar appears as below:



On this toolbar, the disconnect button (Shift+F5) stops the debugger and allows the remote program to run to completion. The restart button (Ctrl+Shift+F5) restarts the debugger on the local computer but does **not** restart the remote program. Use the restart button only when you've already restarted the remote program and need to reattach the debugger.

## Set configuration options

When you first create launch.json, there are two standard configurations that run the active file in the editor in either the integrated terminal (inside VS Code) or the external terminal (outside of VS Code):

The specific settings are described in the following sections. You can also add other settings, such as args, that aren't included in the standard configurations.

**Tip**: It's often helpful in a project to create a configuration that runs a specific startup file. For example, if you want to always launch startup.py with the arguments --port 1593 when you start the debugger, create a configuration entry as follows:

```
"name": "Python: startup.py",
    "type": "python",
    "request": "launch",
    "program": "${workspaceFolder}/startup.py",
    "args" : ["--port", "1593"]
},
```

#### name

Provides the name for the debug configuration that appears in the VS Code dropdown list.

### type

Identifies the type of debugger to use; leave this set to python for Python code.

### request

Specifies the mode in which to start debugging:

- launch: start the debugger on the file specified in program
- attach : attach the debugger to an already running process. See Remote debugging for an example.

#### program

Provides the fully qualified path to the python program's entry module (startup file). The value \${file}, often used in default configurations, uses the currently active file in the editor. By specifying a specific startup file, you can always be sure of launching your program with the same entry point regardless of which files are open. For example:

```
"program": "/Users/Me/Projects/PokemonGo-Bot/pokemongo_bot/event_handlers/__init__.
py",
```

You can also rely on a relative path from the workspace root. For example, if the root is /Users/Me/Projects/PokemonGo-Bot then you can use the following example:

```
"program": "${workspaceFolder}/pokemongo_bot/event_handlers/__init__.py",
```

module

Provides the ability to specify the name of a module to be debugged, similarly to the -m argument when run at the command line. For more information, see Python.org

(https://docs.python.org/3/using/cmdline.html#cmdoption-m)

### python

The full path that points to the Python interpreter to be used for debugging.

If not specified, this setting defaults to the interpreter selected for your workspace, which is equivalent to using the value \${command:python.interpreterPath}. To use a different interpreter, specify its path instead in the python property of a debug configuration.

Alternately, you can use a custom environment variable that's defined on each platform to contain the full path to the Python interpreter to use, so that no other folder paths are needed.

If you need to pass arguments to the Python interpreter, you can use the pythonArgs property.

### pythonArgs

Specifies arguments to pass to the Python interpreter using the syntax "pythonArgs": ["<arg 1>", "<arg 2>",...].

### args

Specifies arguments to pass to the Python program. Each element of the argument string that's separated by a space should be contained within quotes, for example:

```
"args": ["--quiet", "--norepeat", "--port", "1593"],
```

### stopOnEntry

When set to true, breaks the debugger at the first line of the program being debugged. If omitted (the default) or set to false, the debugger runs the program to the first breakpoint.

#### console

Specifies how program output is displayed as long as the defaults for redirectOutput aren't modified.

Value	Where output is displayed
"internalConsole"	<b>VS Code debug console</b> . If redirectOutput is set to False, no output is displayed.
<pre>"integratedTerminal" (default)</pre>	VS Code Integrated Terminal (/docs/terminal/basics). If redirectOutput is set to True, output is also displayed in the debug console.
"externalTerminal"	Separate console window. If redirectOutput is set to True, output is also displayed in the debug console.

### purpose

There is more than one way to configure the Run button, using the purpose option. Setting the option to debug-test, defines that the configuration should be used when debugging tests in VS Code. However, setting the option to debug-in-terminal, defines that the configuration should only be used when accessing the Run Python File button on the top-right of the editor (regardless of whether the Run Python File or Debug Python File options the button provides is used). Note: The purpose option can't be used to start the debugger through F5 or Run > Start Debugging.

#### autoReload

Allows for the automatic reload of the debugger when changes are made to code after the debugger execution has hit a breakpoint. To enable this feature set {"enable": true} as shown in the following code.

```
"name": "Python: Current File",
  "type": "python",
  "request": "launch",
  "program": "${file}",
  "console": "integratedTerminal",
  "autoReload": {
     "enable": true
}
```

\*Note: When the debugger performs a reload, code that runs on import might be executed again. To avoid this situation, try to only use imports, constants, and definitions in your module, placing all code into functions. Alternatively, you can also use if \_\_name\_\_=="\_\_main\_\_" checks.

### subProcess

Specifies whether to enable subprocess debugging. Defaults to false, set to true to enable. For more information, see multi-target debugging (/docs/editor/debugging#\_multitarget-debugging).

#### cwd

Specifies the current working directory for the debugger, which is the base folder for any relative paths used in code. If omitted, defaults to \${workspaceFolder} (the folder open in VS Code).

As an example, say \${workspaceFolder} contains a py\_code folder containing app.py, and a data folder containing salaries.csv. If you start the debugger on py\_code/app.py, then the relative paths to the data file vary depending on the value of cwd:

cwd	Relative path to data file
Omitted or \${workspaceFolder}	data/salaries.csv
<pre>\${workspaceFolder}/py_code</pre>	/data/salaries.csv

#### cwd

### Relative path to data file

\${workspaceFolder}/data

salaries.csv

### redirectOutput

When set to true (the default for internalConsole), causes the debugger to print all output from the program into the VS Code debug output window. If set to false (the default for integratedTerminal and externalTerminal), program output is not displayed in the debugger output window.

This option is typically disabled when using "console": "integratedTerminal" or "console": "externalTerminal" because there's no need to duplicate the output in the debug console.

### justMyCode

When omitted or set to true (the default), restricts debugging to user-written code only. Set to false to also enable debugging of standard library functions.

### django

When set to true, activates debugging features specific to the Django web framework.

#### sudo

When set to true and used with "console": "externalTerminal", allows for debugging apps that require elevation. Using an external console is necessary to capture the password.

### pyramid

When set to true, ensures that a Pyramid app is launched with the necessary pserve command (https://docs.pylonsproject.org/projects/pyramid/en/latest/narr/startup.html?highlight=pserve).

### env

Sets optional environment variables for the debugger process beyond system environment variables, which the debugger always inherits. The values for these variables must be entered as strings.

### envFile

Optional path to a file that contains environment variable definitions. See Configuring Python environments - environment variable definitions file (/docs/python/environments#\_environment-variable-definitions-file).

### gevent

If set to true, enables debugging of gevent monkey-patched code (https://www.gevent.org/intro.html).

jinja

When set to true, activates debugging features specific to the Jinja (https://jinja.palletsprojects.com) templating framework.

## Breakpoints and logpoints

The Python extension supports breakpoints (/docs/editor/debugging#\_breakpoints) and logpoints (/docs/editor/debugging#\_logpoints) for debugging code. For a short walkthrough of basic debugging and using breakpoints, see Tutorial - Configure and run the debugger (/docs/python/python-tutorial#\_configure-and-run-the-debugger).

### Conditional breakpoints

Breakpoints can also be set to trigger based on expressions, hit counts, or a combination of both. The Python extension supports hit counts that are integers, in addition to integers preceded by the ==, >, >=, <, <=, and % operators. For example, you could set a breakpoint to trigger after five occurrences by setting a hit count of >5 For more information, see conditional breakpoints (/docs/editor/debugging#\_conditional-breakpoints) in the main VS Code debugging article.

### Invoking a breakpoint in code

In your Python code, you can call debugpy.breakpoint() at any point where you want to pause the debugger during a debugging session.

### Breakpoint validation

The Python extension automatically detects breakpoints that are set on non-executable lines, such as pass statements or the middle of a multiline statement. In such cases, running the debugger moves the breakpoint to the nearest valid line to ensure that code execution stops at that point.

## Debugging specific app types

The configuration dropdown provides various different options for general app types:

Attach	See Remote debugging in the previous section.
Django	Specifies "program": "\${workspaceFolder}/manage.py", "args": ["runserver"]. Also adds "django": true to enable debugging of Django HTML templates.
Flask	See Flask debugging below.
Gevent	Adds "gevent": true to the standard integrated terminal configuration.

### **Configuration Description**

### Pyramid

Removes program, adds "args": ["\${workspaceFolder}/development.ini"], adds "jinja": true for enabling template debugging, and adds "pyramid": true to ensure that the program is launched with the necessary pserve command (https://docs.pylonsproject.org/projects/pyramid/en/latest/narr/startup.html? highlight=pserve).

Specific steps are also needed for remote debugging and Google App Engine. For details on debugging tests, see Testing (/docs/python/testing).

To debug an app that requires administrator privileges, use "console": "externalTerminal" and "sudo": "True".

### Flask debugging

```
{
    "name": "Python: Flask",
    "type": "python",
    "request": "launch",
    "module": "flask",
    "env": {
        "FLASK_APP": "app.py"
    },
    "args": [
        "run",
        "--no-debugger"
    ],
    "jinja": true
},
```

As you can see, this configuration specifies "env": {"FLASK\_APP": "app.py"} and "args": ["run", "--no-debugger"]. The "module": "flask" property is used instead of program. (You may see "FLASK\_APP": "\${workspaceFolder}/app.py" in the env property, in which case modify the configuration to refer to only the filename. Otherwise, you may see "Cannot import module C" errors where C is a drive letter.)

"jinja": true setting also enables debugging for Flask's default Jinja templating engine.

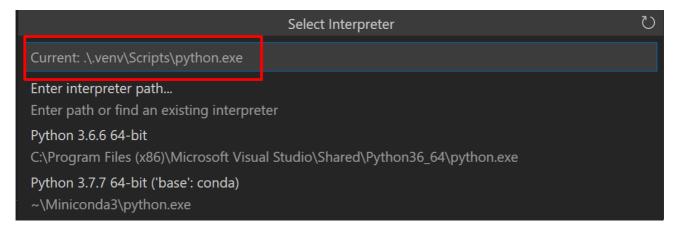
If you want to run Flask's development server in development mode, use the following configuration:

```
"name": "Python: Flask (development mode)",
    "type": "python",
    "request": "launch",
    "module": "flask",
    "env": {
        "FLASK_APP": "app.py",
        "FLASK_ENV": "development"
    },
    "args": [
        "run"
],
    "jinja": true
},
```

## Troubleshooting

There are many reasons why the debugger may not work. Sometimes the debug console reveals specific causes, but the main reasons are as follows:

• The path to the python executable is incorrect: check the path of your selected interpreter by running the **Python: Select Interpreter** command and looking at the current value:



- There are invalid expressions in the watch window: clear all expressions from the Watch window and restart the debugger.
- If you're working with a multi-threaded app that uses native thread APIs (such as the Win32 CreateThread function rather than the Python threading APIs), it's presently necessary to include the following source code at the top of whichever file you want to debug:

```
import debugpy
debugpy.debug_this_thread()
```

• If you are working with a **Linux** system, you may receive a "timed out" error message when trying to apply a debugger to any running process. To prevent this, you can temporarily run the following command:

```
echo 0 | sudo tee /proc/sys/kernel/yama/ptrace_scope
```

### Next steps

- Python environments (/docs/python/environments) Control which Python interpreter is used for editing and debugging.
- Testing (/docs/python/testing) Configure test environments and discover, run, and debug tests.
- Settings reference (/docs/python/settings-reference) Explore the full range of Python-related settings in VS Code.
- General debugging (/docs/editor/debugging) Learn about the debugging features of VS Code.

Was this documentation helpfu	umentation helpful	nis	Was
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Yes No

#### 1/19/2023

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