

# Running Fermat on Windows

## 1 Introduction

Fermat is a computer algebra system for polynomial and matrix computation, created by [Robert H. Lewis](#) and has seen various iterations and releases. Since March 28, 2013, no new releases of the Fermat program were released for Windows. This is in part due to many functions used by Fermat not being compatible with the Windows Kernel, as they rely on functions supported by a POSIX-compliant terminal.

## 2 WSL Support on Windows 10

Windows 10 introduced a new feature, named [WSL](#) (or the Windows Subsystem for Linux), which allows a user to natively run Linux applications within a Windows environment. It allows a user to install from a selection of modern and supported Linux distributions that run inside of the Windows environment, and allow access to a user's files within the Windows system.

This uses the virtualization technology present in modern processors, which gives the user almost 1:1 performance on these Linux terminals as they would get from running them natively.

### 2.1 WSL and Fermat

The major advantage of this feature is that a user no longer needs a special compile of the Fermat tool for Windows – instead, they can simply use the WSL infrastructure and run the tool natively on their system with minimal performance impact.

In testing Fermat on WSL vs. native Linux for a few of the Fermat examples (<https://faculty.fordham.edu/rlewis/fermat/getferm.html>) provided almost identical performance (+/- 3%), which could be attributed to system variability and noise.

## 3 Setting up Fermat on Windows

### 3.1 Preparing your Machine for WSL

#### 3.1.1 Enable Virtualization

To get the most performance from this type of installation, it is highly advisable that the user enables Virtualization technology on their system. To do so, one must enter the System BIOS and enable either AMD-V or VT-x for AMD and Intel platforms, respectively.

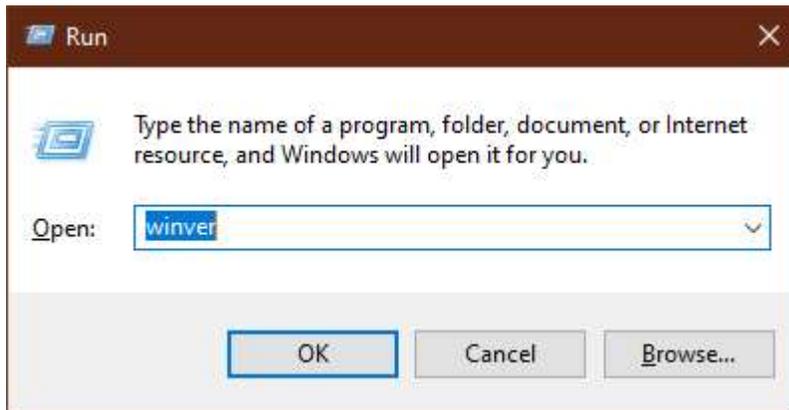
See the instructions provided by your Motherboard or System vendor for instructions on how to do this, as each vendor places this functionality in a different location and potentially under a different name.

#### 3.1.2 Ensuring your Windows 10 installation supports WSL

WSL requires up-to-date versions of Windows 10 to function, as they are relatively new features to the Windows ecosystem. There are two variants – WSL v1.0 and WSL v2.0. Details of their differences can be found here: <https://docs.microsoft.com/en-us/windows/wsl/compare-versions>

For the purposes of Fermat64, either are acceptable – and all testing in this guide was done with WSL v1.0 to ensure maximum compatibility with a wider array of users.

It is recommended that you are on a Windows Build newer than 18945, which you can find by using the Run dialog (Windows Key + R) and typing winver, then clicking OK:



A new dialog box will show up and display information about the OS Build your system is currently running:



If your version is not newer than 18945, please use Windows Update and update your system, or contact your IT department for help if in an organization that prevents updates initiated by the user.

### 3.2 Getting WSL Installed

Microsoft provides a very thorough guide for installing WSL on both Insiders and standard builds of windows, here: <https://docs.microsoft.com/en-us/windows/wsl/install-win10>

For most users, you must follow the [Manual Installation](#) instructions as of Feb 6, 2021, as the simplified installer is still in beta testing.

It is highly recommended that you also install Windows Terminal, which provides a highly advanced terminal emulator compared to the standard implementations found in Windows. The guide supplies a link for this installation as well.

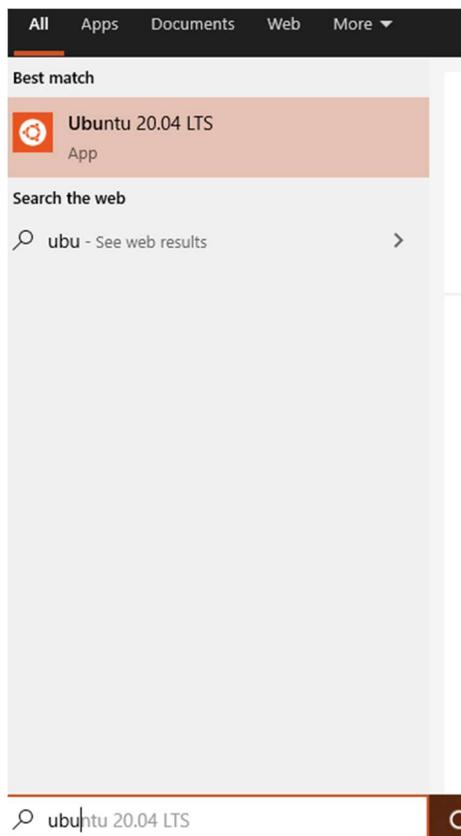
Once you have completed installing WSL, and installed a distribution to run against, you may continue to the next step.

Note: For this demonstration, we have chosen and are using the Ubuntu 20.04 LTS distribution.

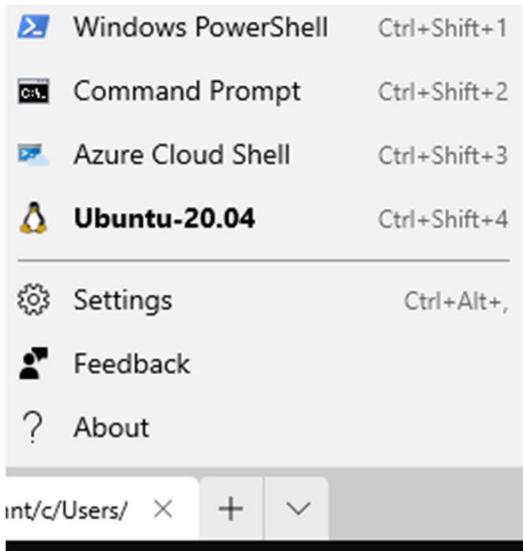
### 3.3 Installing and Running Fermat

Download the Linux version of Fermat from the web site in Windows as you normally would. The current version is 6.37 as of this writing, located here: <http://home.bway.net/lewis/fermat64/ferl6.tar.gz>

Move this file to a location of your choice, and launch your terminal application of choice. Since we are using Ubuntu 20.04 LTS, it is installed as an app from the start menu, and you can simply type Ubuntu and click on it to run:



If you installed the optional Terminal application, run that instead, and use the dropdown to add a new session of the Ubuntu 20.04 distribution:



This launches the Linux terminal into your Ubuntu 20.04 session, and all further screenshots assume you have used Terminal. Note that all steps will work exactly as described by launching the Ubuntu 20.04 session as described earlier, regardless.

You should see a screen similar to the one below:

A screenshot of a Linux terminal window. The window title is 'bradu@Demetra: /mnt/c/Users/'. The terminal output shows the following text:

```
Welcome to Ubuntu 20.04.2 LTS (GNU/Linux 5.4.72-microsoft-standard-WSL2 x86_64)

* Documentation:  https://help.ubuntu.com
* Management:    https://landscape.canonical.com
* Support:       https://ubuntu.com/advantage

System information as of Sat Feb  6 15:31:45 EST 2021

System load:  0.08          Processes:            8
Usage of /:   0.6% of 250.98GB Users logged in:       0
Memory usage: 0%          IPv4 address for eth0: 172.23.244.131
Swap usage:   0%

0 updates can be installed immediately.
0 of these updates are security updates.

This message is shown once a day. To disable it please create the
/home/bradu/.hushlogin file.
bradu@Demetra: /mnt/c/Users/damie$
```

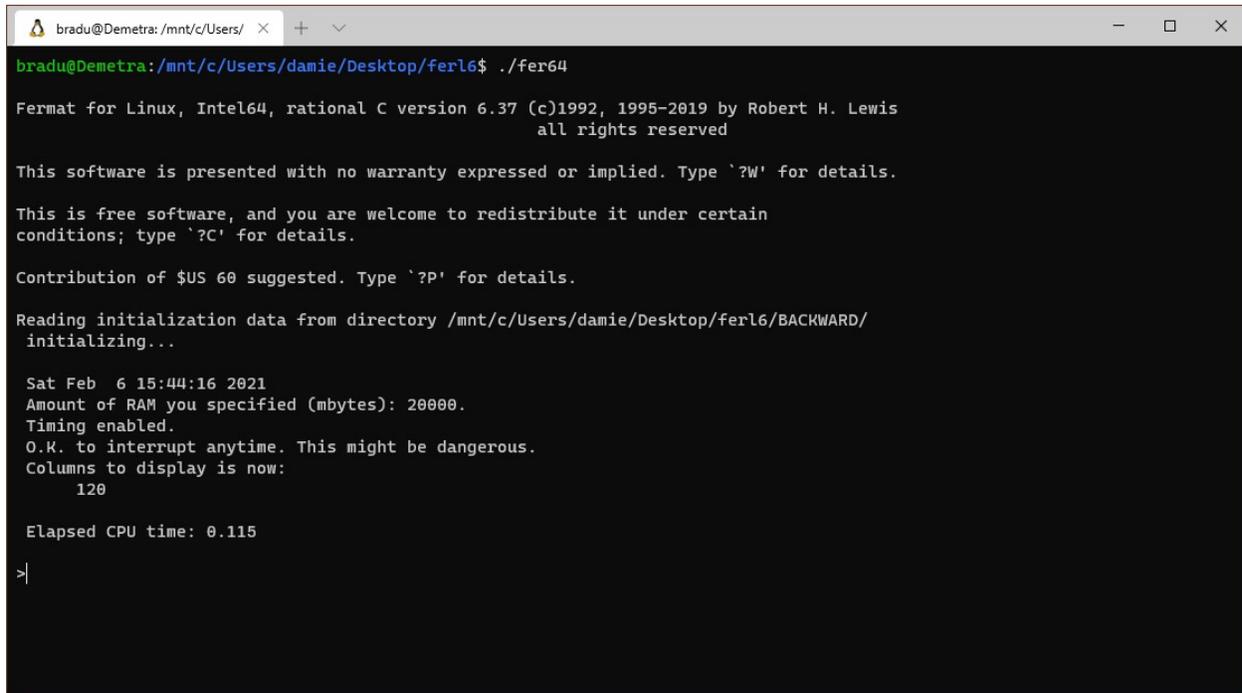
You can then navigate to the location you have saved your Fermat download to, by using the standard Linux navigation methods.

Note: To get to your Windows C: drive, for example, you may simply navigate to `/mnt/c/` (replace `c` with the desired drive as needed).

Extract the downloaded Fermat version as normal, by running:

```
$ tar -xvzf fer16.tar.gz
```

Navigate to the extracted folder, and you should be able to run the tool as per usual:

A terminal window with a dark background and light text. The window title is 'bradu@Demetra: /mnt/c/Users/'. The prompt is 'bradu@Demetra: /mnt/c/Users/damie/Desktop/fer16\$' and the command entered is './fer64'. The output text is as follows:

```
bradu@Demetra: /mnt/c/Users/damie/Desktop/fer16$ ./fer64
Fermat for Linux, Intel64, rational C version 6.37 (c)1992, 1995-2019 by Robert H. Lewis
all rights reserved

This software is presented with no warranty expressed or implied. Type '?W' for details.

This is free software, and you are welcome to redistribute it under certain
conditions; type '?C' for details.

Contribution of $US 60 suggested. Type '?P' for details.

Reading initialization data from directory /mnt/c/Users/damie/Desktop/fer16/BACKWARD/
initializing...

Sat Feb  6 15:44:16 2021
Amount of RAM you specified (mbytes): 20000.
Timing enabled.
O.K. to interrupt anytime. This might be dangerous.
Columns to display is now:
    120

Elapsed CPU time: 0.115
>|
```

### 3.4 Using Fermat

Please refer to the User Guide documentation from the main Fermat site for details, direct link here:

<http://home.bway.net/lewis/fermat/ferman.pdf>