Microsoft Surface Book balances battery life, display quality, performance, and portability

Real-world evaluation of the Microsoft Surface Book and seven other popular options

Finding the portable device that's right for your needs can be a balancing act. On-the-go professionals such as engineers and designers depend on laptops, convertibles, or 2-in-1s with powerful processors and great graphics, but might regret choosing a device based on computing power alone when the battery dies in the middle of an important meeting. Choosing a device that's three ounces lighter than another may not seem quite so important if your graphics don't pop off the screen. When contemplating your next device, it's important to consider which balance of these factors best meets your needs.

We evaluated the Microsoft® Surface Book® and seven popular 13" devices to see how they handled real-world everyday use. We ran down their batteries, examined their displays, put them through a series of performance tests, and verified the size and weight of each device.

The Microsoft Surface Book achieved a pleasing balance of factors that on-the-go professionals look for when choosing a new digital companion.

Read on to see how the systems compare.

Battery life | Display quality | Performance | Portability

Battery life

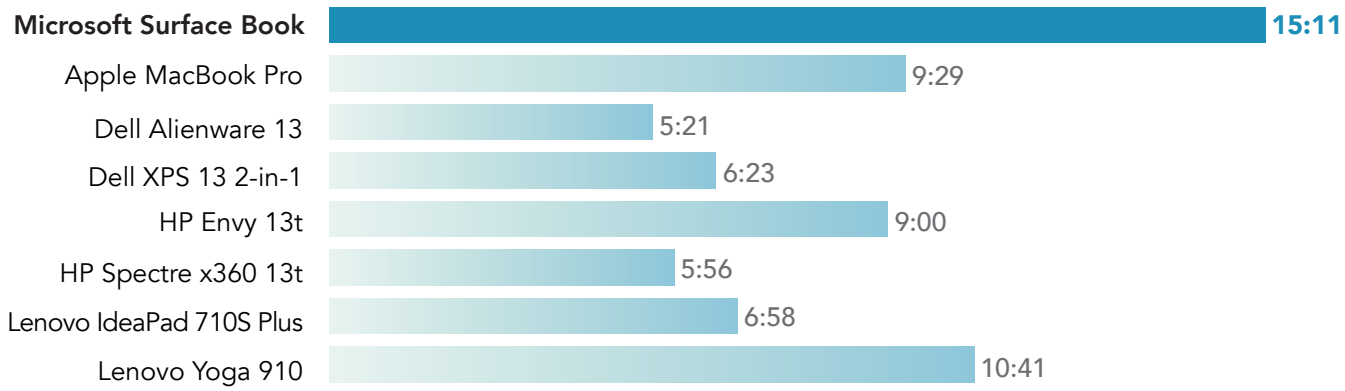
Having a computer that can get you through a day of work or a cross-country flight is a necessity for professionals who don't sit behind a desk every day. We found that the Microsoft Surface Bock delivered longer plug-free time than any of the competitors. In fact, at almost two full work days, the Microsoft Surface Book lasted four and a half hours longer than the Lenovo® Yoga™ 910 and more than a full workday longer than the Dell™ Alienware™ 13.

Microsoft Surface Book	Lenovo Yoga 910	Apple® MacBook Pro®	HP Envy 13t	Lenovo IdeaPad® 710S Plus	Dell XPS 13 2-in-1	HP Spectre x360 13t	Dell Alienware 13
Battery life rankings – *Lower is better*							
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Battery life radar chart scores – *Higher is better**							
8	*7*	*6*	*5*	*4*	*3*	*2*	*1*

* Go to page 11 to see the radar chart results on each device.

Battery life

Measured in hours:minutes — Higher is better



Display quality

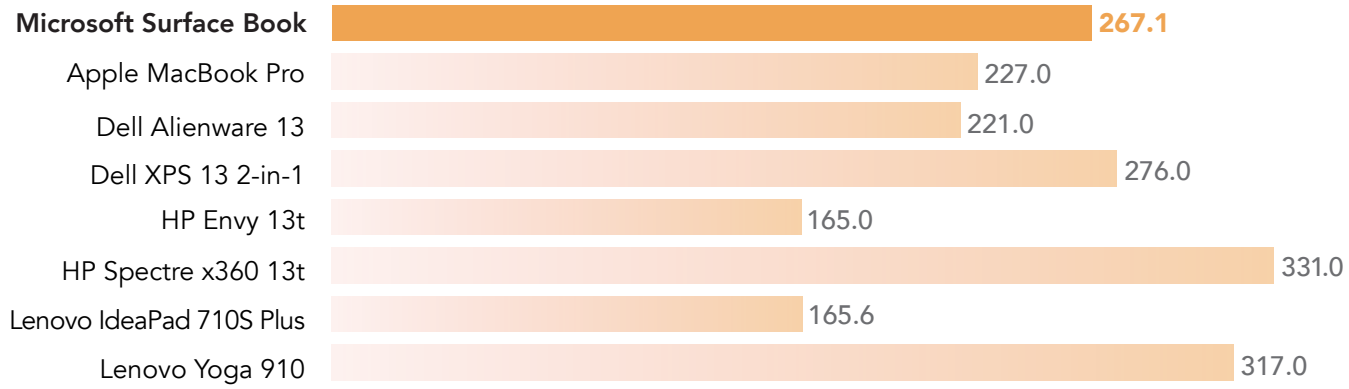
Screens with sharp graphics and text are pleasing to the eye and can actually improve a user's experience with a device. The Microsoft Surface Book had a high number of pixels per inch (PPI) and a high contrast ratio, both of which contribute to a better user experience. The Dell Alienware 13 was the only device to deliver a higher contrast ratio, but its display wasn't as sharp as the Microsoft Surface Book's because it had fewer PPI. And the HP Spectre x360 13t exhibited a sharper display than the Microsoft Surface Book, but the images were muddier because its contrast ratio was lower than that of the Microsoft Surface Book.

HP Spectre x360 13t	Microsoft Surface Book	Dell XPS 13 2-in-1	Dell Alienware 13	Lenovo Yoga 910	Apple MacBook Pro	HP Envy 13t	Lenovo IdeaPad 710S Plus
Display quality rankings – *Lower is better*							
1	2	Tied 2	4	5	6	7	8
Display quality radar chart scores – *Higher is better**							
8	6	6	5	4	3	2	1

* Go to page 11 to see the radar chart results on each device.

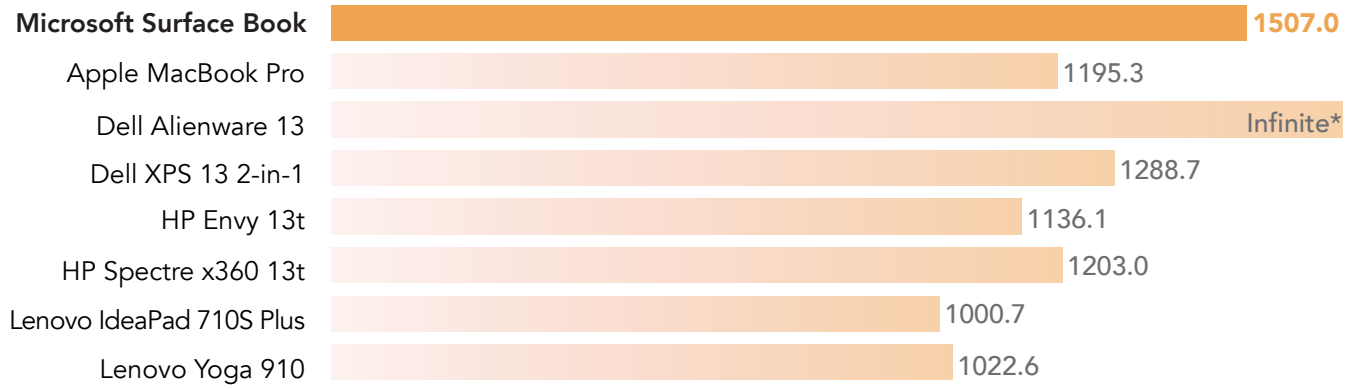
Display resolution

Measured in PPI — Higher is better



Contrast ratio

Measured in black/white contrast — Higher is better



*Alienware has an OLED display, which means the light sensor doesn't detect any light when measuring black, so the resulting contrast ratio is divided by zero (infinite).

Performance

The overall performance ranking of the Microsoft Surface Book was solidly in the middle of the pack, coming in just behind the Dell Alienware 13, tying with the HP Envy 13t, and outperforming the HP Spectre x360 13t, Dell XPS 13 2-in-1, and Lenovo Yoga 910. The Apple MacBook Pro ranked highest in overall performance, but the Microsoft Surface Book received better individual scores than the Apple MacBook Pro in web browsing speed, frames-per-second in 3D content creation, and multi-core processor and memory performance.


Apple MacBook Pro


Lenovo Yoga 910


Dell Alienware 13


Microsoft Surface Book


HP Envy 13t


HP Spectre x360 13t


Dell XPS 13 2-in-1


Lenovo IdeaPad 710S Plus

Performance rankings – *Lower is better*

1	2	3	4	Tied	4	6	7	8

Performance radar chart scores – *Higher is better**

8	7	6	4		4	3	2	1

* Go to page 11 to see the radar chart results on each device.

WebXPRT 2015

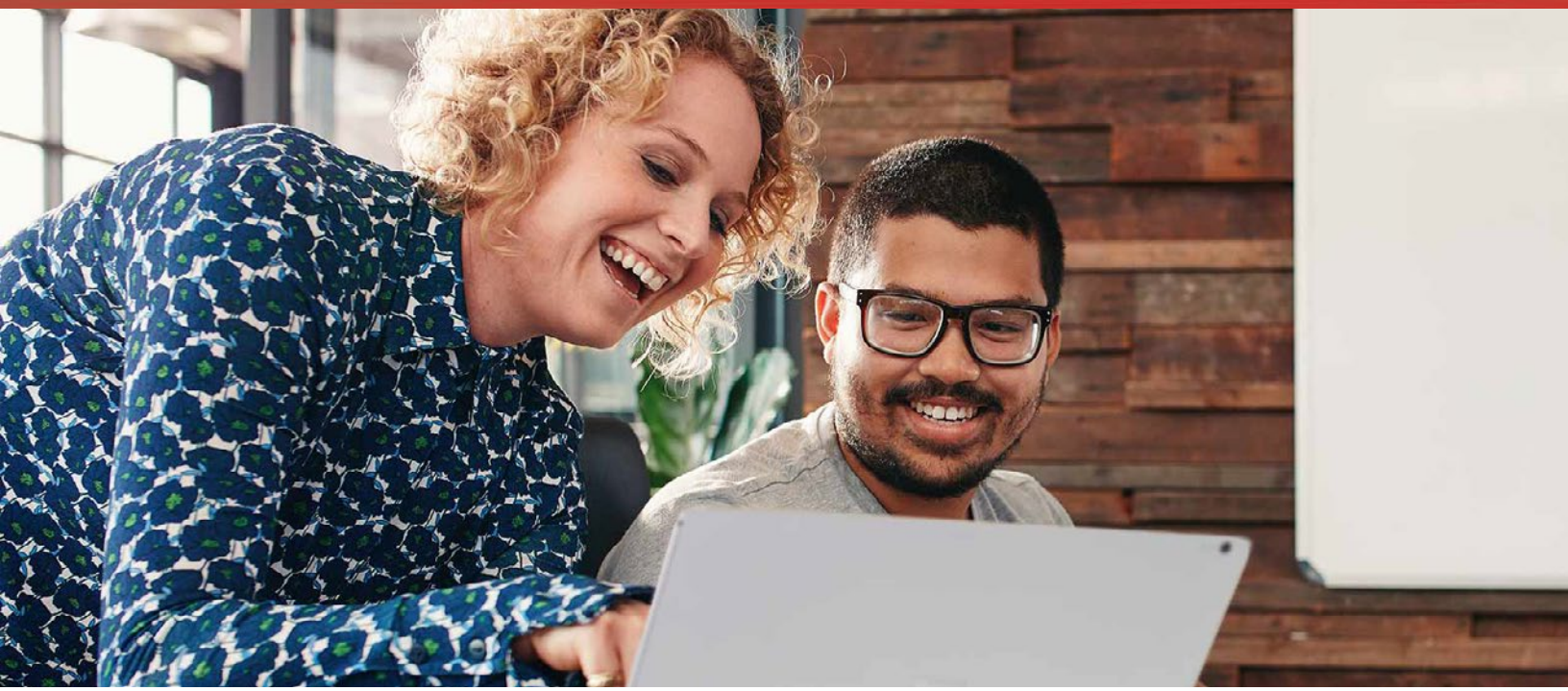
Overall score — Higher is better

Jetstream v1.1

Overall score — Higher is better

Kraken v1.1

Overall score — Higher is better



Geekbench 4.0.1

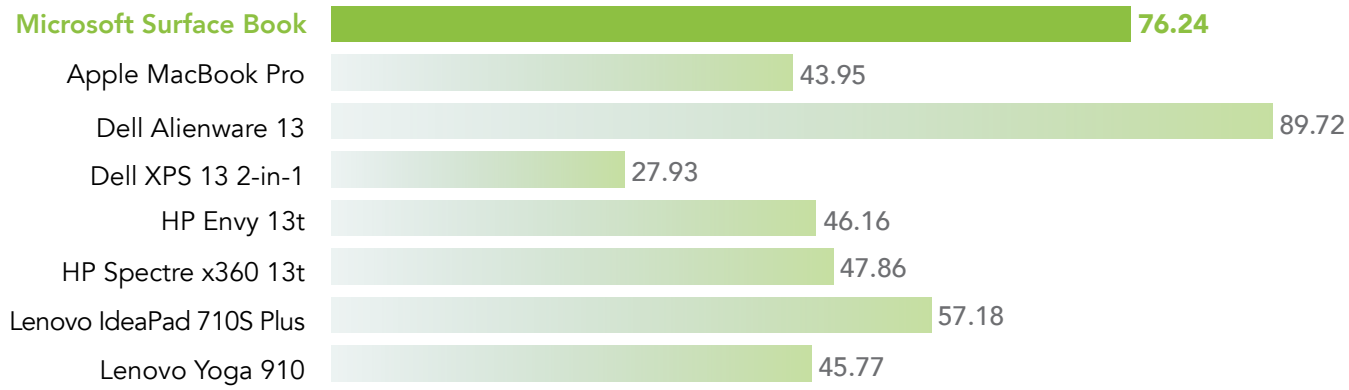
Single-core score — Higher is better

Geekbench 4.0.1

Multi-core score — Higher is better

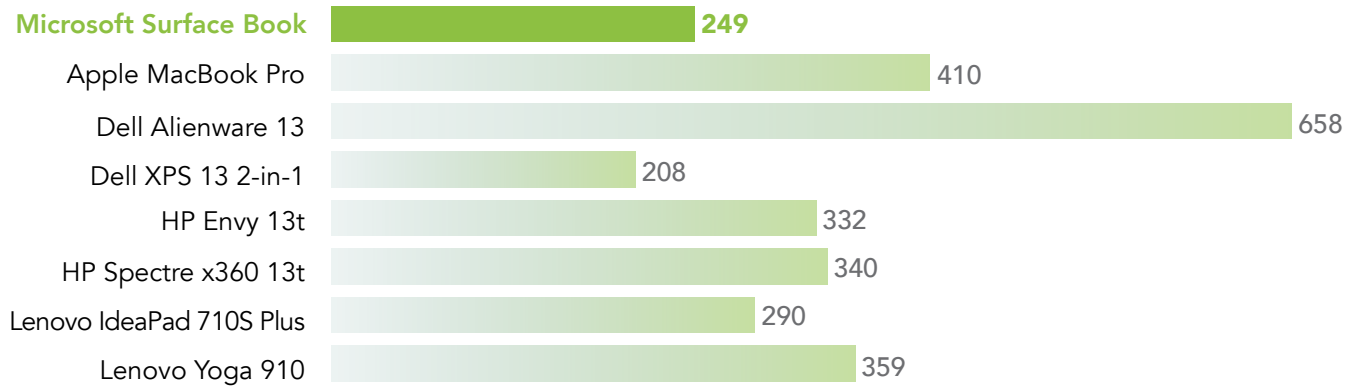
Cinebench R15

OpenGL score — Higher is better



Cinebench R15

CPU score — Higher is better



Portability

All of the devices we tested earn a lightweight classification because they weigh between two and six pounds. So, what do you sacrifice with the lightest devices? While the Dell XPS 13 2-in-1 was the lightest device, it didn't fare as well in the display, battery life, and performance categories. The HP Spectre x360 13t was lighter than the Microsoft Surface Book, but the short battery life of the HP Spectre x360 13t means while toting it to the airport is easier, you won't be able to work or watch movies for a big chunk of that cross-country flight. Compare that to the fifteen-hour battery life of the slightly heavier Microsoft Surface Book.


Dell XPS 13 2-in-1


HP Spectre x360 13t


Apple MacBook Pro


HP Envy 13t


Lenovo IdeaPad 710S Plus


Lenovo Yoga 910


Microsoft Surface Book


Dell Alienware 13

Portability rankings – *Lower is better*

1	2	3	4	5	6	7	8

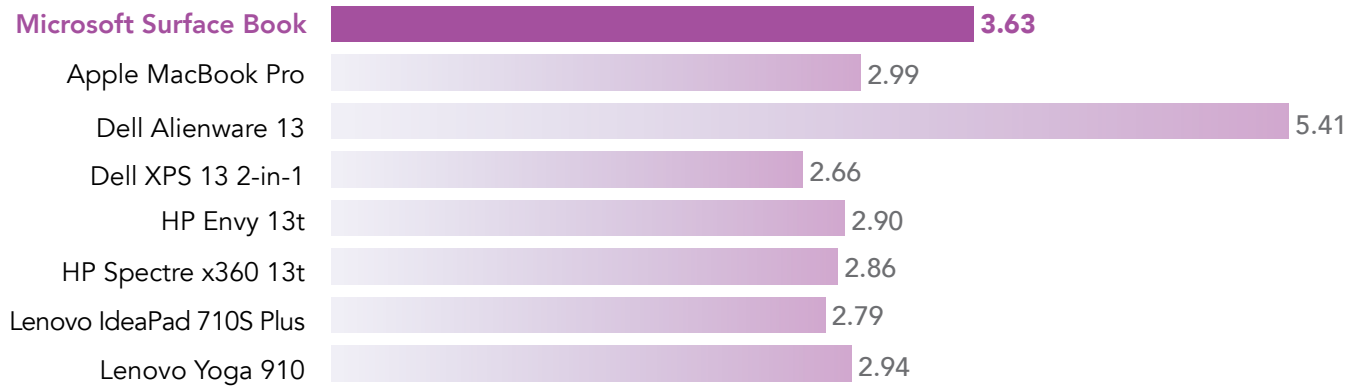
Portability radar chart scores – *Higher is better**

8	7	6	5	4	3	2	1

* Go to page 11 to see the radar chart results on each device.

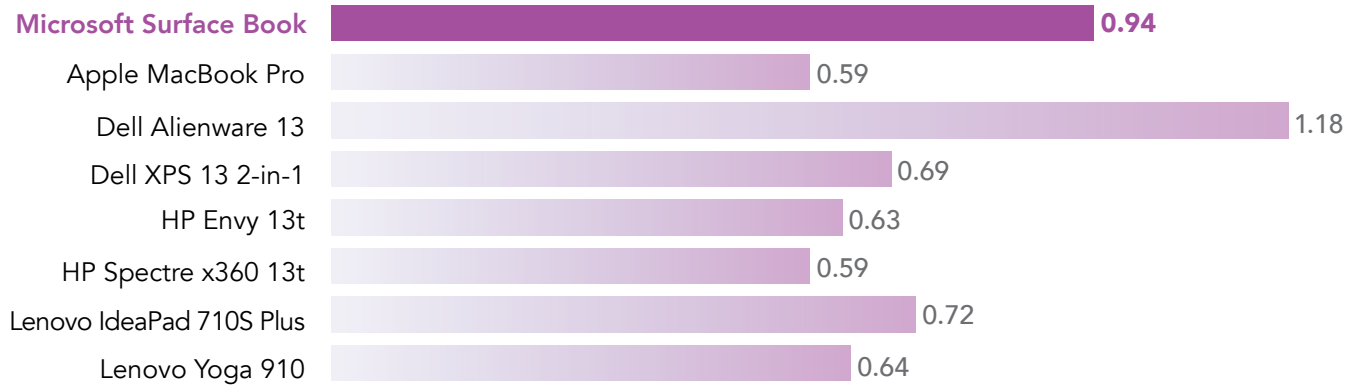
Weight

Measured in pounds — Lower is better



Thinness

Measured in inches — Lower is better

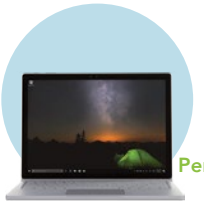


Footprint

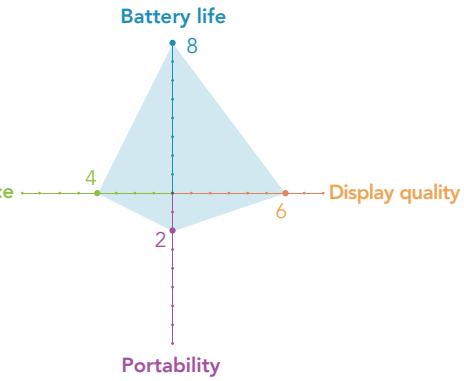
Measured in total square inches — Lower is better

A balancing act

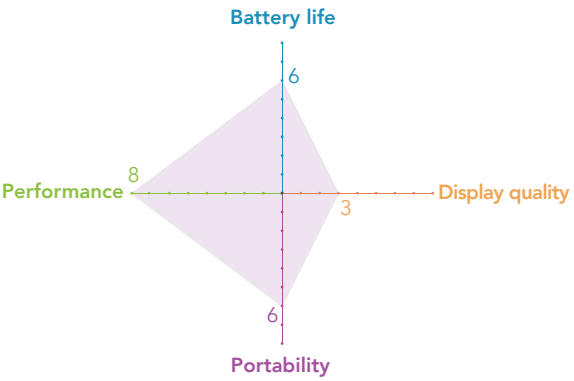
Using the results from our hands-on evaluation, we show how well each device balanced four categories: battery life, display quality, performance, and portability. Choosing a device for a particular attribute requires sacrifices in other areas.



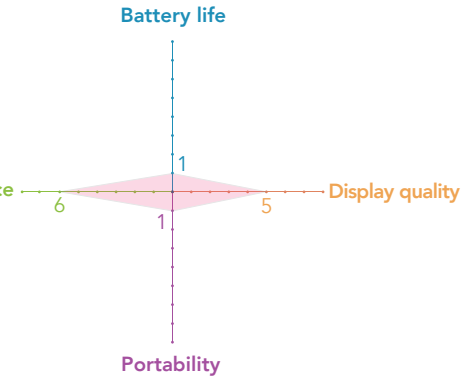
Microsoft Surface Book



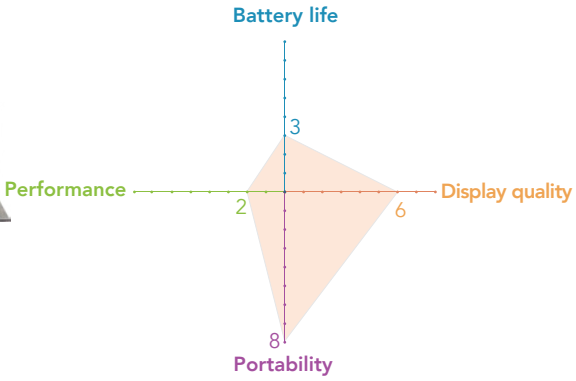
Apple MacBook Pro



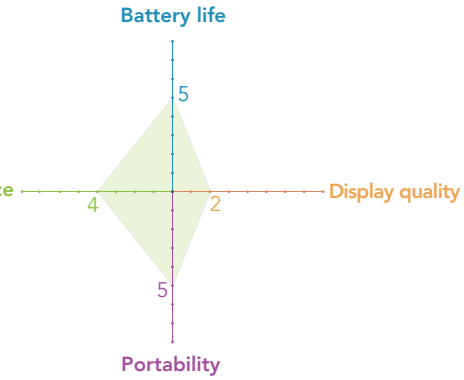
Dell Alienware 13



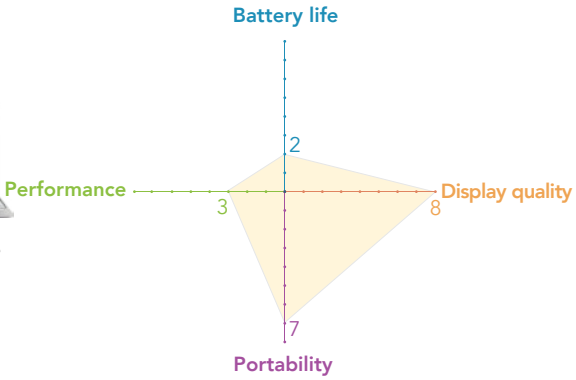
Dell XPS 13 2-in-1



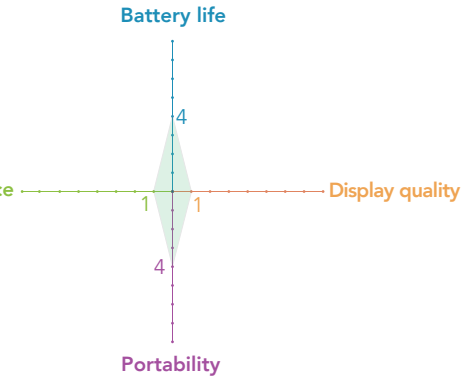
HP Envy 13t



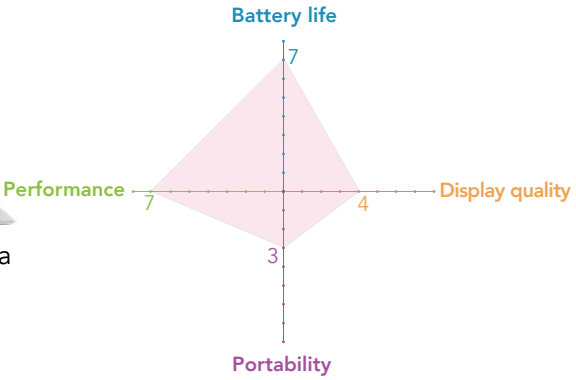
HP Spectre x360 13t

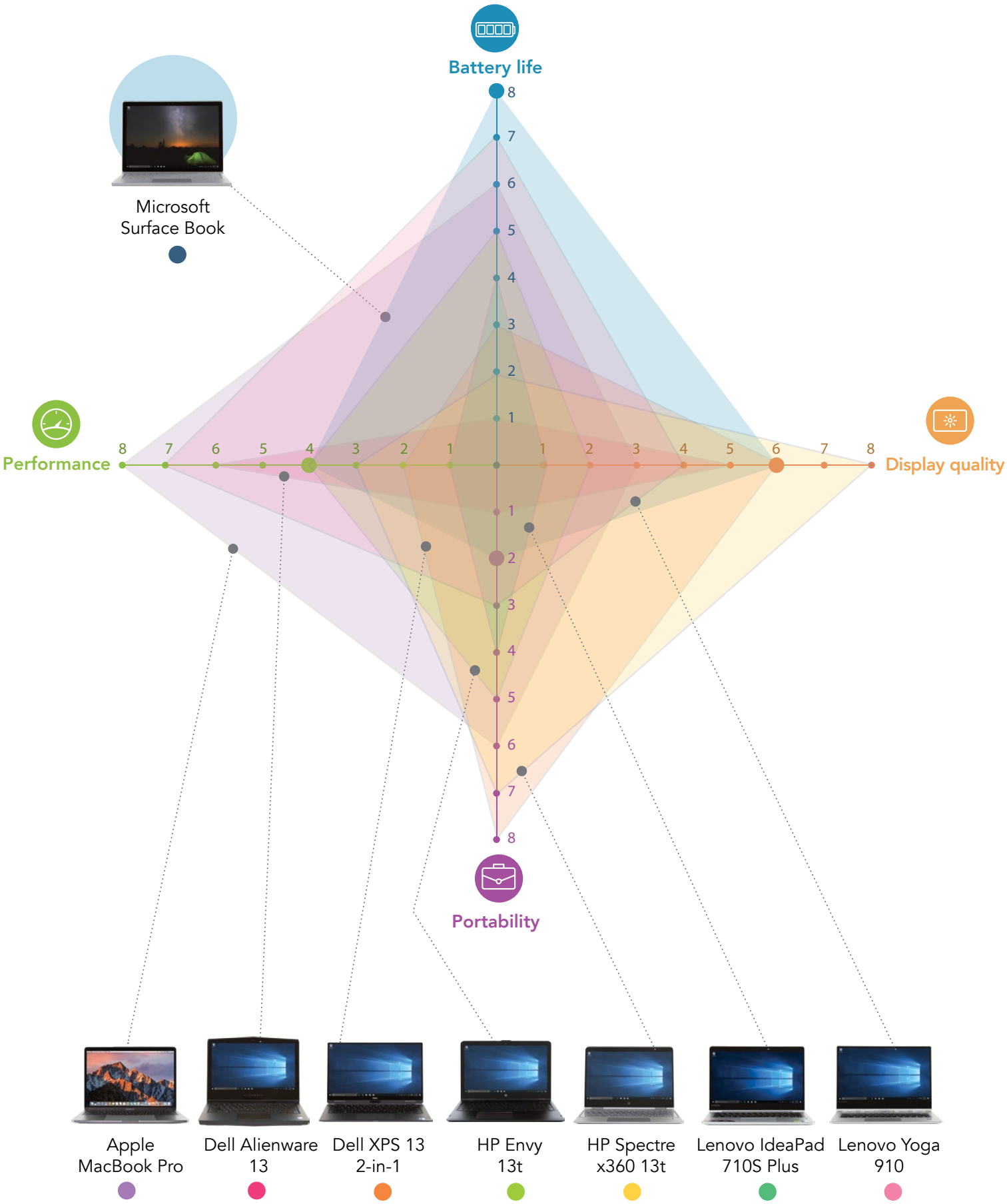


Lenovo IdeaPad 710S Plus



Lenovo Yoga 910




Battery life
Microsoft Surface Book
Performance
Display quality
Portability
Apple MacBook Pro
Dell Alienware 13
Dell XPS 13 2-in-1
HP Envy 13t
HP Spectre x360 13t
Lenovo IdeaPad 710S Plus
Lenovo Yoga 910

Conclusion

According to our analysis, the Microsoft Surface Book delivered an efficient balance of battery life, display quality, performance, and portability that would likely be attractive to many on-the-go professionals.

Microsoft Surface Book
a balanced option
compared to the devices below

Apple MacBook Pro
Dell Alienware 13
Dell XPS 13 2-in-1
HP Envy 13t
HP Spectre x360 13t
Lenovo IdeaPad 710S Plus
Lenovo Yoga 910

On June 28, 2017, we finalized the hardware and software configurations we tested. Updates for current and recently released hardware and software appear often, so unavoidably these configurations may not represent the latest versions available when this report appears. For older systems, we chose configurations representative of typical purchases of those systems. We concluded hands-on testing on July 11, 2017.

Since we kicked off this research, Microsoft announced the Surface Book 2, claiming that it's "the most powerful Surface Book ever" with "all-day battery life:" https://blogs.windows.com/devices/2017/10/17/introducing-surface-book-2-the-most-powerful-surface-book-ever/. We can't wait to get our hands on it.

Appendix A: System configuration information

System	Microsoft Surface Book	Dell Alienware 13	Apple MacBook Pro	Dell XPS 13 2-in-1	HP Envy 13t	HP Spectre x360 13t	Lenovo IdeaPad 710S Plus	Lenovo Yoga 910
Processor								
Vendor	Intel®	Intel	Intel	Intel	Intel	Intel	Intel	Intel
Name	Core™ i7	Core i7	Core i7	Core i7	Core i7	Core i7	Core i7	Core i7
Model number	6600U	7700HQ	N/A	7Y75	7500U	7560U	7500U	7500U
Core frequency (GHz)	2.6 – 3.4	2.8 – 3.8	3.5 – 4.0	1.3 – 3.6	2.7 – 3.5	2.4 – 3.8	2.70 – 3.50	2.70 – 3.50
Number of cores	2	4	2	2	2	2	2	2
Cache	4 MB L3	6 MB L3	4 MB L3	4 MB L3	4 MB L3	4 MB L3	4 MB L3	4 MB L3
Memory								
Amount (GB)	16 GB	32	16	16	16	16	8	16
Type	DDR3	DDR4	DDR3	DDR3	DDR3	DDR3	DDR4	DDR4
Speed (MHz)	1,866	2,400	2,133	1,866	1,866	1,866	2,400	2,133
Graphics								
Vendor	Intel / NVIDIA®	NVIDIA	Intel	Intel	Intel	Intel	Intel / NVIDIA	Intel
Model number	HD Graphics 520 / GeForce® GTX 965M	GTX 1060	Iris Plus Graphics 650	HD Graphics 615	HD Graphics 620	HD Graphics 640	HD Graphics 620 / GeForce GT 940MX	HD Graphics 620
Storage								
Amount	1 TB	1 TB	1 TB	1 TB	1 TB	1 TB	512 GB	1 TB
Type	SSD	SSD	SSD	SSD	SSD	SSD	NVMe SSD	NVMe SSD
Connectivity/expansion								
Wired internet	N/A	Killer E2500 Gigabit Ethernet	N/A	N/A	N/A	N/A	N/A	N/A
Wireless internet	Marvell® AVASTAR® Wireless-AC	Killer Wireless-n/a/ac 1535	802.11ac	Intel AC 8265	Intel AC 7265	Intel AC 8265	Intel Dual Band Wireless-AC 8265	Intel Dual Band Wireless-AC 8265
Bluetooth	4.0	4.1	4.2	4.2	4.2	4.2	4.0	4.1

System	Microsoft Surface Book	Dell Alienware 13	Apple MacBook Pro	Dell XPS 13 2-in-1	HP Envy 13t	HP Spectre x360 13t	Lenovo IdeaPad 710S Plus	Lenovo Yoga 910
USB	2 x USB 3.0, 1 x SD card reader, 1 x Surface Connect	2 x USB 3.0, 2 x USB-C	4 x USB-C	2 x USB-C	2 x USB 3.1, 2 x USB-C	1 x USB 3.1, 2 x USB-C	1 x USB-C, 1 x USB 3.0, 1 x USB 2.0, 4-in-1 Card Reader	1 x USB-C, 1 x USB 3.0, 1 x USB 2.0
Video	1 x Mini DisplayPort	1 x Mini DisplayPort, 1 x HDMI, 1 x Thunerbolt 3 USB-C	1 x Display Port over USB-C, 1 x VGA over USB-C, 1 x HDMI over USB-C	1 x Thunderbolt USB-C	1 x USB-C HDMI	2 x Thunderbolt USB-C	1 x USB-C (DisplayPort)	1 x USB 3.0 Type-C with video-out
Battery								
Type	Lithium-polymer	Lithium-polymer	Lithium-polymer	Lithium-polymer	Lithium-polymer	Lithium-polymer	Lithium-polymer	Lithium-polymer
Rated capacity (Wh)	N/A	76.0	49.2	46.0	53.6	57.8	46.0	78.0
Display								
Size (in.)	13.5	13.3	13.3	13.3	13.3	13.3	13.3	13.9
Type	PixelSense® Display	OLED	LED-backlit display with IPS technology	InfinityEdge	IPS BrightView	UWVA BrightView WLED-backlit	FHD IPS AntiGlare Multitouch	UHD IPS Multitouch
Resolution	3,000 x 2,000	2,560 x 1,440	2,560 x 1,600	3,200 x 1,800	1,920 x 1,080	3,840 x 2,160	1,920 x 1,080	3,840 x 2,160
Touchscreen	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Operating system								
Vendor	Microsoft	Microsoft	Apple	Microsoft	Microsoft	Microsoft	Microsoft	Microsoft
Name	Windows® 10 Pro	Windows® 10 Pro	macOS® Sierra	Windows 10 Pro	Windows 10 Pro	Windows 10 Pro	Windows 10 Pro	Windows 10 Pro
Build number or version	10.0.15063	10.0.15063	10.12.5	10.0.15063	10.0.15063	10.0.15063	10.0.15063	10.0.15063
BIOS								
BIOS name and version	Microsoft 90.1427.768	Alienware 1.1.5	N/A	Dell Inc. 01.00.15	Insyde F.04	American Megatrends® Inc. F.33	Lenovo 3NCN20WW (V2.03)	Lenovo 2JCN39WW
Dimensions with keyboard								
Height (in.)	0.9	1.2	0.6	0.7	0.6	0.6	0.7	0.6
Width (in.)	12.3	13.0	11.9	12.0	12.0	12.1	12.2	12.7
Depth (in.)	9.1	10.6	8.4	7.8	8.5	8.6	8.7	8.9
Weight (lbs.)	3.6	5.4	3.0	2.7	2.9	2.9	2.8	2.9
Dimensions without keyboard								
Height (in.)	0.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Width (in.)	12.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Depth (in.)	8.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Weight (lbs.)	1.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix B: How we tested

Setting up the systems

Capturing driver information from the OEM factory image

1. Connect an external HDD to the system.
2. On the external drive, create a directory named Drivers.
3. Hold the Shift key, and restart the system.
4. Choose Troubleshoot→Advanced options→Command prompt.
5. Type `DISM /image:C: /export-driver /destination:D:\drivers` (Note: In this scenario the external drive is labeled D; however, this name may be different depending on the configuration of the system.)

Installing Windows 10 Pro

1. In the BIOS, disable SecureBoot.
2. Install a clean version of Windows 10 Pro onto the test system.
3. Follow the on-screen instructions to complete installation, using the default selections when appropriate.
4. Open Device Manager, and use the OEM factory drivers captured onto the external HDD to install any missing drivers. (Note: Also, be sure to install the video driver.)
5. Run the Windows Update, and install all updates available.
6. Launch the Windows Store app, and install all Store app updates.
7. Verify the date and time are correct, and synchronize the system clock with the time server.
8. Disable Automatic Windows Update.
    a. Right-click the Windows Start button.
    b. Select Computer Management.
    c. Select Services and Applications.
    d. Select Services.
    e. Scroll down, and double-click Windows Update.
    f. Click Stop.
    g. From the Startup type `drop down menu`, select Disabled.

Capturing an image

1. Connect the external HDD to the test system.
2. Right-click on the desktop, and select Personalize→Home→Update & security→Backup→More options→See advanced settings→System Image Backup→Create a system image.
3. Verify that the external HDD is selected as the save drive, and click Next.
4. Verify that all drives are selected to back up, and click Next.
5. Click Start backup.
6. At Do you want to create a system repair disc, select No, and close the dialogs.

Restoring an image

1. Connect the external HDD to the test system.
2. Right-click the desktop, and select Personalize→Home→Update & security→Recovery.
3. Under Advanced startup, click Restart now.
4. Select Troubleshoot.
5. Select Advanced options.
6. Select System image recovery.
7. Select the User account.
8. Enter the system password, and click Continue.
9. Verify that the external HDD is selected, and click Next.
10. Once the recovery has completed, click Finish.

Performing battery life testing

Note: Performing this test requires the following items:

- A Gossen Mavolux 5032C USB luminance meter
- A five-minute 1080p .MP4 (329 MB) test video
- An external timer for noting the passage of time
- A video camera for capturing the runs

Setting up the test

1. Turn on the systems.
2. Copy the .MP4 file to each system, and verify that the video player is set to loop the video.
3. Verify that the displays will remain on, and disable power saving options.
   - For Windows:
     a. Right-click the desktop, and select Display settings.
     b. Select Power & sleep.
     c. Select Additional power settings.
     d. Select Change plan settings.
     e. Select Change advanced power settings, and make the following changes:
        - Display: Turn off Display = Never
        - Display: Dimmed display brightness = 0
        - Display: Enable adaptive brightness = Off
        - Battery: Critical battery action = Shutdown
        - Battery: Critical battery level = 2% (Note: If system doesn't allow 2%, select the next lowest value.)
        - Battery: Low battery notification = Off

     f. To save the above changes, click Apply.
   - For macOS:
     a. Select System Preferences.
     b. Select Desktop & Screensaver.
     c. Set Start Screensaver to Never.
     d. Return to System Preferences, and select Energy Saver.
        - Select Battery, and move the slider bar to Never.
        - Uncheck Slightly dim the display while on battery power.

     e. Go back to System Preferences, and select Displays.
        - Uncheck Automatically adjust brightness.
   - For iOS:
     a. Select Settings.
     b. Select Display & Brightness.
        - Disable Auto-Brightness.
        - Set Auto-Lock to Never.
4. To bring up a white screen, open a web browser, and type `about:blank` into the address bar.
5. Unplug the systems.
6. Allow the screens to warm up for 30 minutes.
7. Use the luminance meter to adjust each screen to a brightness as close to 200 nits as possible without going lower.
   - For Windows:
     a. Right-click the desktop, and select Display settings.
     b. Adjust the slider bar until the luminance meter reads 200 nits.
   - For macOS:
     a. Select System Preferences.
     b. Select Displays.
     c. Adjust the slider bar until the luminance meter reads 200 nits.
   - For iOS:
     a. Select Settings.
     b. Select Display & Brightness.
     c. Adjust the slider bar until the luminance meter reads 200 nits.

Running the test

1. Verify that the system's battery is fully charged.
2. Launch the test .MP4 video in full screen mode.
3. Start the video camera and the external timer.
4. Note the time, and unplug the system.
5. When all the systems have finished, stop the video camera.
6. Review the video camera footage, and report the battery life result.
7. Repeat steps 1 through 6 two times.

Performing display quality testing

Performing the colorimeter test using DisplayCAL3 v3.3.1

Note: Performing this test requires an X-Rite i1Display Pro colorimeter.

Setting up the test

1. From https://displaycal.net/#download, download DisplayCAL3.
2. Install DisplayCAL3 with the default options.
3. Connect the X-Rite i1Display Pro colorimeter to the test system, and launch DisplayCAL3.
4. To download the ArgyllCMS color engine needed for the test at the prompt, click Download.
5. At the Import colorimeter corrections from other display profiling software dialog, click Auto, and click OK.
6. Click the Settings drop-down menu, and select Office & Web (D65, Gamma 2.2).
7. Verify that the Display and Instrument show the correct hardware for the test.
8. For the Mode, set LCD (generic).
9. Set Correction to Auto (None).
10. Exit DisplayCAL3.

Running the test

1. Launch DisplayCAL3.
2. Click Calibrate & Profile.
3. Place the colorimeter on the screen so that the center aligns with the Measurement area. If necessary, adjust the window size to within a safe margin.
4. Click Start measurement.
5. When the test pauses on the grey screen, click Start measurement.
6. When the test pauses and starts chirping, click Stop measurement, and click Continue on to calibration.
7. Allow the test to run.
8. Take a screenshot, and record Gamut Coverage results.
9. Click Install Profile.
10. Click Verification.
11. From the drop-down menu, select Extended verification testchart.
12. Click Measurement Report, and click Save to the desktop.
13. Place the colorimeter on the screen, and click Start measurement.
14. Record the contrast ratio result.

Running the performance benchmarks

Performing the Cinebench R15.038 test

Setting up the test

1. From https://www.maxon.net/en/products/cinebench/, download the Cinebench R15.
2. Unzip the Cinebench R15 Windows package to the desktop.
3. To launch Cinebench from inside the unzipped directory, double-click the CINEBENCH Windows 64-Bit icon.
4. Click Agree to the EULA.
5. Exit Cinebench.

Running the test

1. Launch Cinebench.
2. Select File→Run all selected tests.
3. When the benchmark run completes, record the results.
4. Repeat steps 1 through 3 two times.

Performing the Geekbench v4.0.1 test

Setting up the test

1. From http://geekbench.com/download, download Geekbench 4.
2. Install the benchmark with default options.
3. Exit Geekbench.

Running the test

1. Launch Geekbench 4.
2. Click Run CPU Benchmark.
3. When the test completes, record the results.
4. Click Run Compute Benchmark.
5. When the test completes, record the results.
6. Repeat steps 1 through 5 two times.

Performing the JetStream v1.1 test

Running the test

1. Open the web browser under test, and go to http://browserbench.org/JetStream/.
2. Click Start Test.
3. When the test completes, record the results.
4. Repeat steps 1 through 3 two times.

Performing the Kraken v1.1 test

Running the test

1. Open the web browser under test, and go to https://krakenbenchmark.mozilla.org/kraken-1.1/driver.html. (Note: The test will run automatically.)
2. When the test completes, record the results.
3. Repeat steps 1 and 2 two times.

Performing the WebXPRT 2015 test

Running the test

1. Open the web browser under test, and go to www.principledtechnologies.com/benchmarkxprt/webxprt/.
2. Click Run WebXPRT 2015.
3. At the Ready to test your browser screen, click Continue.
4. Click the red play icon.
5. When the test completes, record the results.
6. Repeat steps 1 through 5 two times.

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