



## Experience better graphics and AI benchmark performance with the versatile Microsoft Surface Book 3 13.5"

A Surface Book 3 (13.5") delivered better graphics and AI performance on benchmarks vs. an Apple MacBook Pro (13") with Apple M1 chip, while also offering a detachable touchscreen and pen capabilities for flexibility

An increase in consumers staying home led to the highest global PC market growth in a decade at the end of 2020.<sup>1</sup> To help people stay connected via videoconferencing apps, games, and more, systems that offer strong graphics performance and robust feature sets are in high demand.

At Principled Technologies, we compared the Microsoft Surface Book 3 13.5" to the Apple® MacBook Pro® 13" with Apple M1 chip in several areas that laptop users value. We found that the Surface Book 3 13.5" offered significantly better graphics and AI performance on industry-standard benchmarks. And if you're into gaming, our research shows (see Table 1 for details) that the Microsoft Surface Book 3 13.5" with 10th Gen Intel® Core™ processor is compatible with the 50 most popular games on Steam, while the Apple MacBook Pro 13" with Apple M1 chip would work with only 40 percent of those games.

With additional features such as a detachable touchscreen that transforms your laptop into a tablet, two 1080p HD video cameras (front and rear-facing), and Surface Pen support, the Microsoft Surface Book 3 13.5" could offer a strong balance of performance and functionality.



**93% better graphics performance**  
score on Geekbench 5



**60% less time**  
to upscale/enlarge an image using AI machine learning technology on multiple tests



**Play more of the Steam games you want to play**  
with better gaming compatibility



**Experience display features not available on the Apple MacBook Pro 13"**  
with touch-screen and pen support

## Staying home with the Microsoft Surface Book 3 13.5"

Spending more time at home has its pluses and minuses, but one thing is certain: people are relying on their devices even more to stay connected, which makes laptop performance and versatility key.

To gauge performance of the systems in some key areas, we compared the Microsoft Surface Book 3 13.5" powered by an Intel Core i7-1065G7 processor to the Apple MacBook Pro 13" with Apple M1 chip in the following areas:

- Graphics performance
- AI performance
- Gaming compatibility

We configured both test systems as similarly as possible; each system had 16 GB of RAM, a 256GB SSD, and similar screen resolutions (3000x2000 for the Surface Book 3 13.5" and 2560x1600 for the MacBook Pro 13").

For further system configuration details and information about how we tested, see the [appendix to this report](#), which begins on page 10.

### About the Microsoft Surface Book 3

The Surface Book 3 comes in two sizes, 13.5" and 15", though we used only the smaller form factor in our testing for the fairest comparison to the MacBook Pro. The Surface Book 3 runs on a 10th Gen Intel Core processor and has up to 32 GB of RAM. Additionally, it offers a touch-screen PixelSense™ display and an option for NVIDIA® GeForce® GTX 1660 Ti graphics (our test system had NVIDIA GeForce GTX 1650 with Max-Q). For commercial customers, it also offers an NVIDIA Quadro RTX 3000 with Max-Q Design w/ 6 GB GDDR6 graphics memory option for professional high-end graphics use.

To learn more about the Surface Book 3, visit <https://www.microsoft.com/en-us/p/surface-book-3/8xbw9g3z71f1?activetab=pivot%3aoverviewtab>.



- **More total screen real estate with a 3:2 screen ratio**  
Offers more vertical desktop space than the 16:10 screen ratio on the Apple MacBook Pro
- **PixelSense™ Touchscreen support**  
More ways to use your apps than a MacBook Pro
- **Support for Surface Pen**  
Draw, write, and sketch using Surface Pen
- **Support multiple external monitors**  
Native support for multiple monitors vs. a single monitor on MacBook Pro 13" with M1 chip
- **Detachable screen**  
for turning into a tablet
- **More memory options**  
Configurable with up to 32 GB of RAM—the Apple MacBook Pro 13" with M1 chip offers only 16GB
- **Better camera options**  
Two cameras, both with 1080p HD video: 5.0MP front-facing camera and 8.0MP rear-facing autofocus camera vs. a single front-facing 720p FaceTime HD camera on the MacBook Pro 13" with M1 chip

## Get superior graphics benchmark performance on the Microsoft Surface Book 3 13.5"

Laptops are in large part visual tools, which makes graphics performance paramount for tasks like video conferencing, sharing images with friends and family, watching videos, creating content, and gaming. In our tests using multiple industry-standard benchmarks, we found that the Microsoft Surface Book 3 13.5" offered better graphics performance scores than the Apple MacBook Pro 13" with M1 chip did.

One of the benchmarks we used was Geekbench 5 Compute, a benchmark that tests a system's potential for tasks such as gaming and video editing. As Figure 1 shows, the Microsoft Surface Book 3 13.5" scored 93.3 percent higher on the Geekbench 5 benchmark than the Apple MacBook Pro 13" with Apple M1 chip.

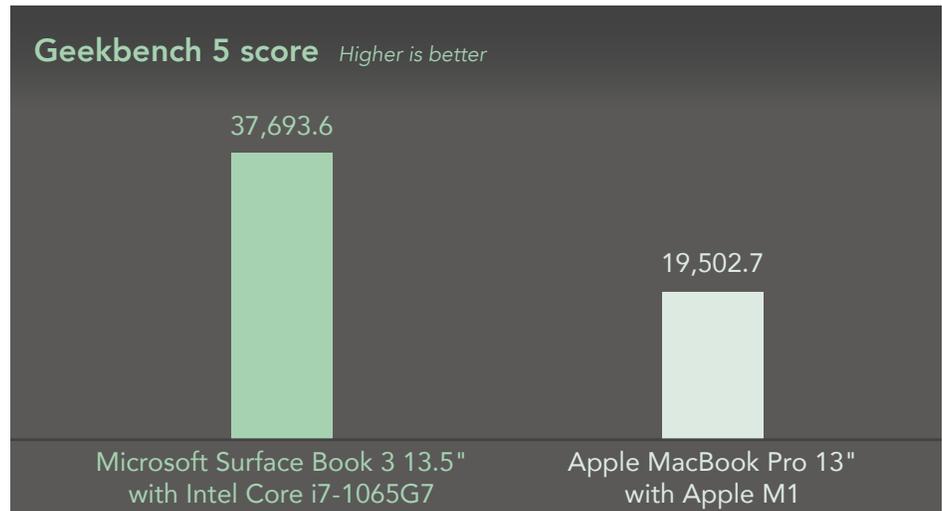
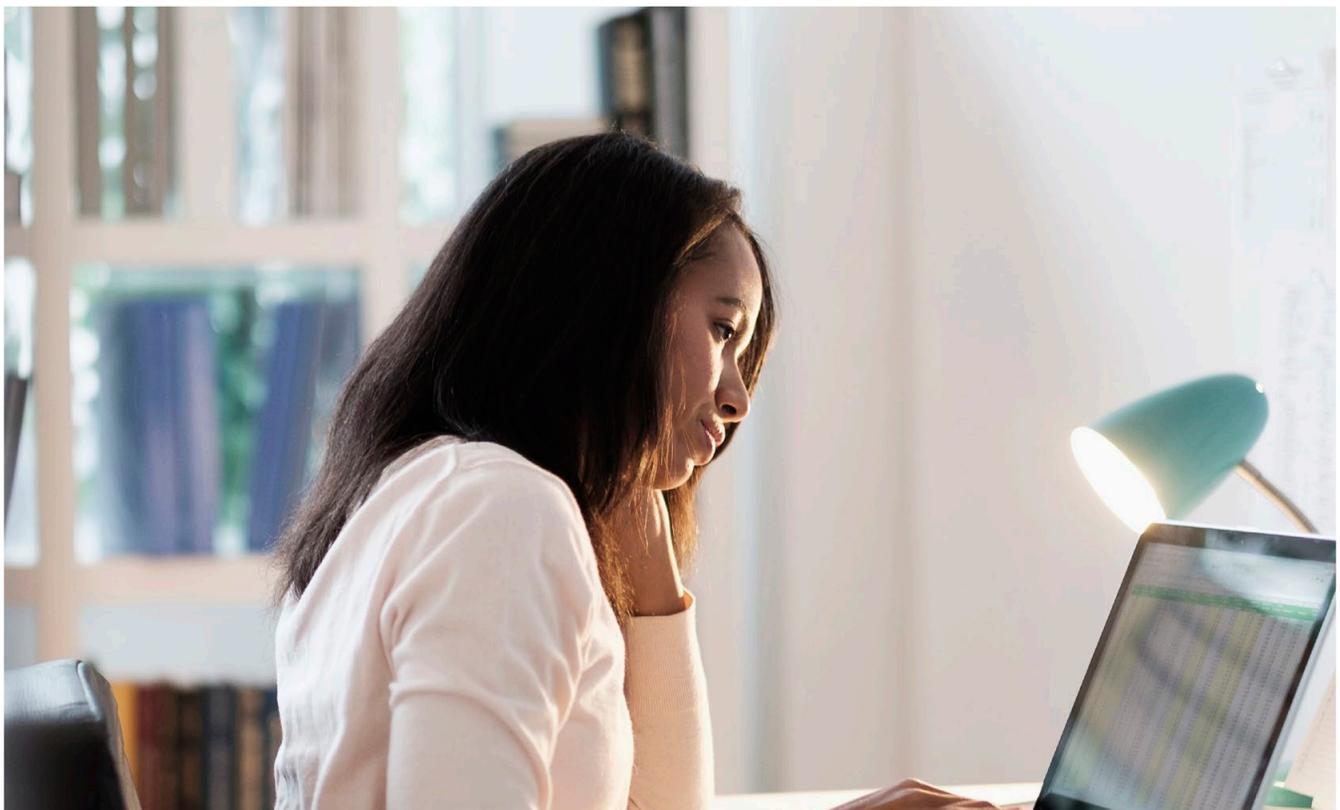


Figure 1: Benchmark scores for Geekbench 5 v5 3.1 OpenCL Compute. Higher is better. Source: Principled Technologies.



Unigine Heaven and Unigine Valley benchmarks are GPU-intensive tools that stress graphics and video performance. On both benchmarks, the Microsoft Surface Book 3 13.5" outperformed the Apple MacBook Pro 13" with M1 chip, by 90.7 percent and 54.6 percent, respectively (see Figures 2 and 3).

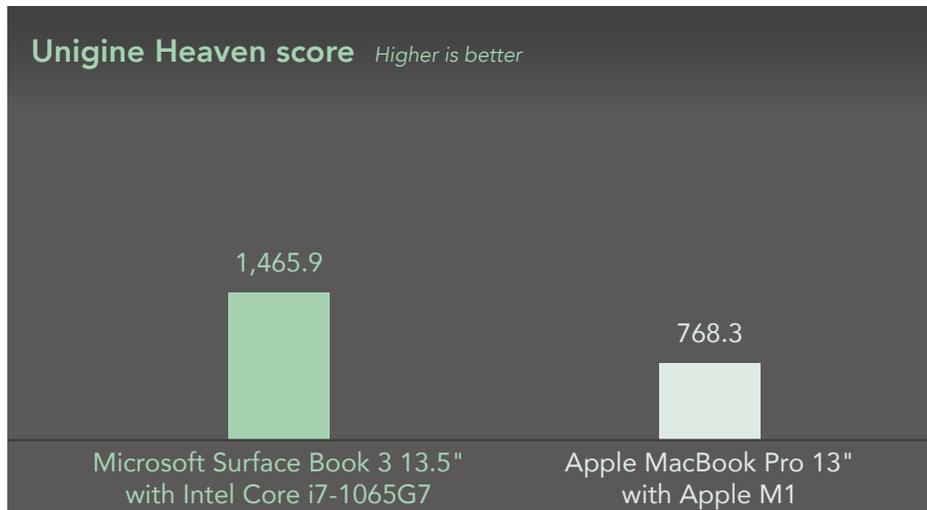


Figure 2: Benchmark scores for Unigine Heaven 2009 v4.0. Higher is better. Source: Principled Technologies.

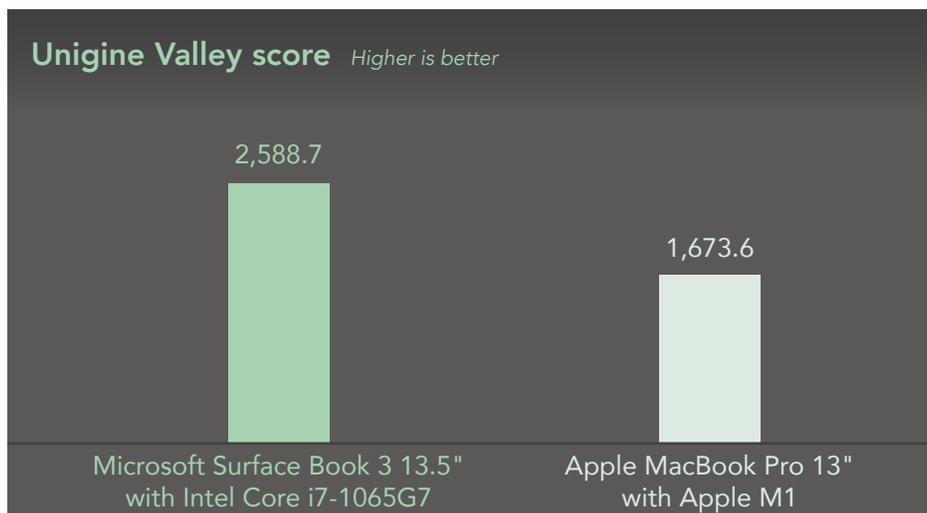


Figure 3: Benchmark scores for Unigine Valley 2013 v1.0. Higher is better. Source: Principled Technologies.

The Basemark GPU benchmark evaluates graphics performance using an advanced game-like scene, with multiple content quality assessments. As Figures 4 and 5 show, the Microsoft Surface Book 3 13.5" outperformed the Apple MacBook Pro 13" with M1 chip in both High and Medium Content quality, by 45.8 percent and 22.2 percent, respectively.

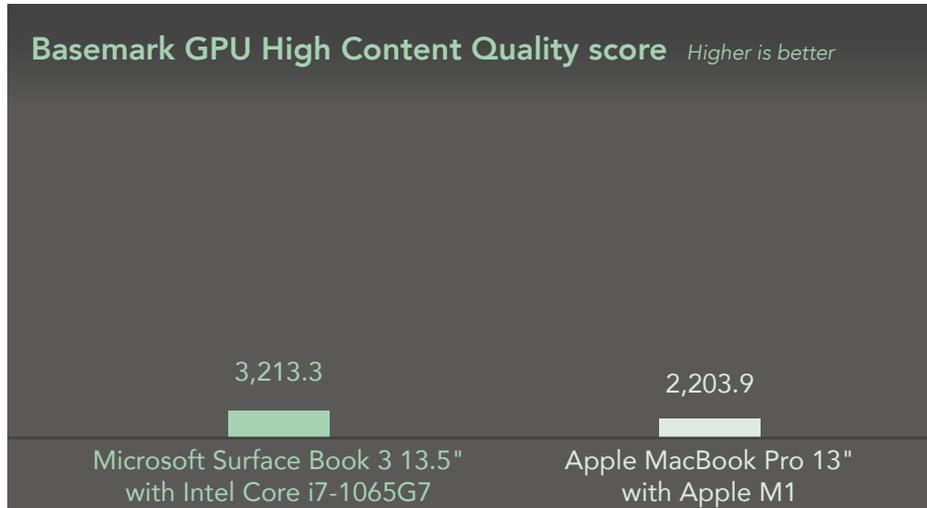


Figure 4: Benchmark scores for Basemark GPU v1.2.3 High Content Quality. Higher is better. Source: Principled Technologies.

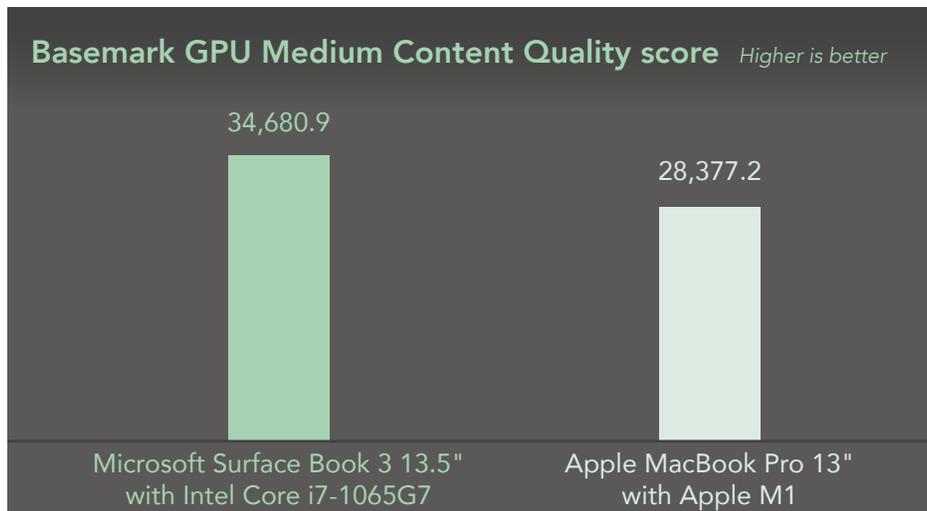


Figure 5: Benchmark scores for Basemark GPU v1.2.3 Medium Content Quality. Higher is better. Source: Principled Technologies.

## Do faster work in AI-based photo enhancement apps on the Microsoft Surface Book 3 13.5"

While everyone's work is a little different, looking at demanding tasks can give you a sense of how your laptop will handle your toughest challenges. Figure 6 shows the time it took to enlarge an image by 6x using Topaz Labs Gigapixel AI, an application that uses machine learning to enhance images. The Microsoft Surface Book 3 13.5" completed the task in a fraction of the time of the Apple device, shaving over 5 minutes off the image enhancement time of the Apple MacBook Pro 13" with M1 chip. Professional photo editors or consumers who frequently enhance images using this tool could save significant time on these tasks with the Microsoft Surface Book 3 13.5".

Another Topaz Labs application that uses machine learning to edit images, DeNoise AI, removes visual noise and recovers details via machine learning to deliver better image quality. Using this application to remove noise from a sample image, the Microsoft Surface Book 3 13.5" lowered noise reduction time by 79.2 percent compared to the Apple MacBook Pro 13" with M1 chip (see Figure 7), making it much quicker for photo editors or consumers to recover details in their images.

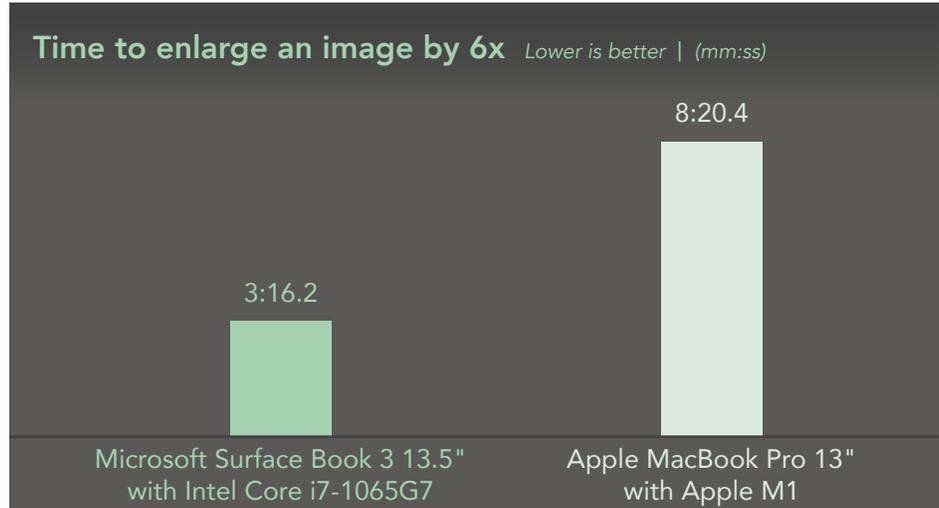


Figure 6: Time, in minutes and seconds, to upscale/enlarge a 4284x2844 resolution image by 6x to 25704x17064 resolution in Topaz Labs Gigapixel AI. Lower is better. Source: Principled Technologies.

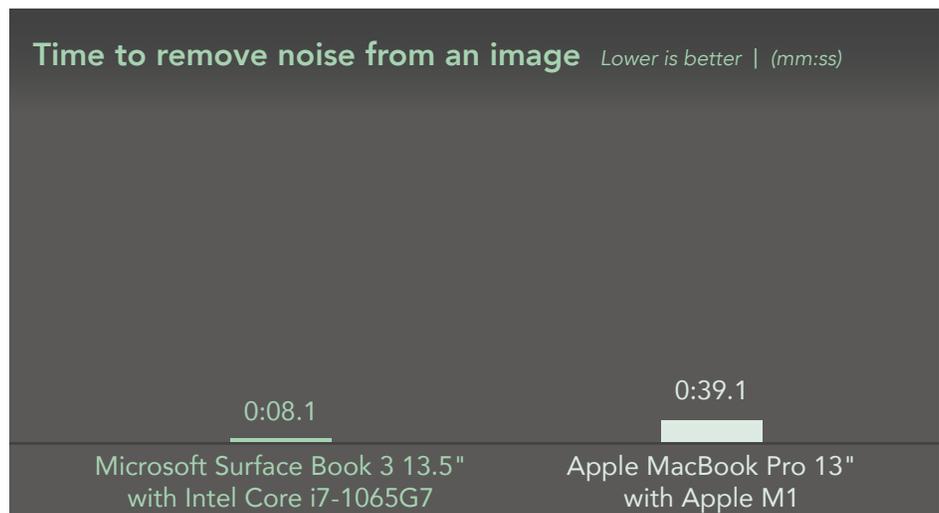


Figure 7: Time, in seconds, to reduce noise from an image using Topaz Labs DeNoise AI. Lower is better. Source: Principled Technologies.

Table 1: Compatibility with the top 50 games on Steam, taken from <https://steamcharts.com/top> on April 20, 2021. Source: Principled Technologies.

Steam Charts Top 50 Games 04/20/2021	Windows 10 compatible	macOS compatible	Apple Silicon M1 compatible
Counter-Strike: Global Offensive	✓	✓	✓
Dota 2	✓	✓	✓
PLAYERUNKNOWN'S BATTLEGROUNDS	✓	✗	✗
Apex Legends	✓	✗	✗
Team Fortress 2	✓	✓	✓
Grand Theft Auto V	✓	✗	✗
Path of Exile	✓	✓	✗
Tom Clancy's Rainbow Six Siege	✓	✗	✗
Warframe	✓	✗	✗
Rust	✓	✓	✓
Football Manager 2021	✓	✓	✓
Wallpaper Engine	✓	✗	✗
The Binding of Isaac: Rebirth	✓	✓	✓
ARK: Survival Evolved	✓	✓	✗
Valheim	✓	✗	✗
Rocket League	✓	✗	✗
PAYDAY 2	✓	✗	✗
The Forest	✓	✗	✗
Dead by Daylight	✓	✗	✗
Destiny 2	✓	✗	✗
Stellaris	✓	✓	✓
Monster Hunter: World	✓	✗	✗
Sid Meier's Civilization VI	✓	✓	✓
Unturned	✓	✓	✓
War Thunder	✓	✓	✗
Euro Truck Simulator 2	✓	✓	✓
Black Desert Online	✓	✗	✗
Hearts of Iron IV	✓	✓	✓
OUTRIDERS	✓	✗	✗
Terraria	✓	✓	✓
Garry's Mod	✓	✓	✗
Tale of Immortal	✓	✗	✗
World of Tanks Blitz	✓	✓	✓
Stardew Valley	✓	✓	✓
The Elder Scrolls Online	✓	✓	✓
The Witcher 3: Wild Hunt	✓	✗	✗
Total War: WARHAMMER II	✓	✓	✓
Space Wars	✓	✗	✗
Cities: Skylines	✓	✓	✓
Farming Simulator 19	✓	✓	✓
7 Days to Die	✓	✓	✓
Sea of Thieves	✓	✗	✗
Sid Meier's Civilization V	✓	✓	✓
Satisfactory	✓	✗	✗
DayZ	✓	✗	✗
Battlefield V	✓	✗	✗
NBA 2K21	✓	✗	✗
Brawhalla	✓	✓	✗
Forza Horizon 4	✓	✗	✗
Mount & Blade II: Bannerlord	✓	✗	✗

## Play more than two times the Steam games you want—including Sea of Thieves—on the Microsoft Surface Book 3 13.5"

If you or a family member want to use your laptop for gaming, choose a system that offers broad compatibility with today's popular games, or you may find yourself out of luck. The Microsoft Surface Book 3 13.5" offers compatibility with all of the top 50 games on Steam, while the Apple MacBook Pro 13" with Apple M1 processor would be unable to run 62 percent of the most popular games on the list, including Grand Theft Auto and Sea of Thieves. Please note that we did not install and test these games on each system; rather we clicked through the Top 50 list available at <https://steamcharts.com/top> and clicked each game to a purchase page that noted compatibility with Windows and/or macOS. For every macOS-compatible game, we then went to <https://applesilicongames.com/games> to verify if the game works on systems with Apple M1 processors. Table 1 shows the top 50 games on Steam and their compatibility with each system.





## Conclusion

Consumers staying at home and seeking a new laptop may want to find the right balance of graphics, overall performance, versatility, and user-friendly features such as touch screens and two 1080p HD video cameras (front and rear-facing) to reduce challenges. We found that the Microsoft Surface Book 3 13.5" offered better graphics and AI performance in benchmark tests than the Apple MacBook Pro 13" with Apple M1 chip, which could mean a better, faster experience for graphics-intensive apps and use cases, in an all-in-one form factor that transforms from a laptop to a tablet to give you more options to choose how you work.

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1 Gartner, Inc., "Gartner Says Worldwide PC Shipments Grew 10.7% in Fourth Quarter 2020 and 4.8% for the Year," accessed March 11, 2021, <https://www.gartner.com/en/newsroom/press-releases/2021-01-11-gartner-says-worldwide-pc-shipments-grew-10-point-7-percent-in-the-fourth-quarter-of-2020-and-4-point-8-percent-for-the-year>.

We concluded our hands-on testing on February 22, 2021. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on January 11, 2021 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

## Our results

To learn more about how we have calculated the wins in this report, go to <http://facts.pt/calculating-and-highlighting-wins>. Unless we state otherwise, we have followed the rules and principles we outline in that document.

Table 2: Results of our testing.

	Microsoft Surface Book 3 13.5"	Apple® MacBook Pro® 13"
Geekbench 5 v5.3.1 OpenCL Compute score for graphics performance		
Average - score	37693.6	19502.7
Minimum average - score	37214.7	19367.7
Maximum average - score	37991.3	19663.3
Unigine Heaven Benchmark 2009 v4.0 score for graphics performance		
Average - score	1465.9	768.3
Minimum average - score	1458.0	763.3
Maximum average - score	1469.7	771.0
Unigine Valley Benchmark 2013 v1.0 score for graphics performance		
Average - score	2588.7	1673.6
Minimum average - score	2578.0	1667.3
Maximum average - score	2595.0	1681.3
BaseMark GPU v1.2.3 High Content Quality score for graphics performance		
Average- score	3213.3	2203.9
Minimum average - score	3203.7	2202.3
Maximum average - score	3218.3	2205.3
BaseMark GPU v1.2.3 Medium Content Quality score for graphics performance		
Average - score	34680.9	28377.2
Minimum average - score	34523.0	28262.3
Maximum average - score	34857.0	28499.0
Upscale/enlarge a 4284x2844 resolution image by 6x to 25704x17064 resolution		
Average - sec	196.2	500.4
Minimum average - sec	188.9	499.0
Maximum average - sec	203.0	502.1

	Microsoft Surface Book 3 13.5"	Apple® MacBook Pro® 13"
Removing noise from an image		
Average - sec	8.1	39.1
Minimum average - sec	8.0	39.0
Maximum average - sec	8.3	39.3

Table 3 presents the pricing data for the configurations we tested, but Microsoft and Apple both offer many configuration options for their respective systems. As of April 1, 2021, the retail price of the Microsoft Surface Book 3 ranges from \$1,599.99 - \$2,699.99, according to the Microsoft website. As of April 1, 2021, the Apple MacBook Pro 13" with M1 chip ranges in price from \$1,299.00 - \$2,299.00, according to the Apple website.

Table 3: Pricing, in USD, as of March 29, 2021 from Microsoft and Apple websites.

	Microsoft Surface Book 3 13.5"	Apple MacBook Pro 13"
Price	\$1,999.99	\$1,499.00

## System configuration information

Table 4: Detailed information on the system we tested.

System configuration information	Microsoft Surface Book 3 13.5"	Apple MacBook Pro 13"
Processor		
Vendor	Intel®	Apple
Name	Core™ i7-1065G7	M1
Core frequency (GHz)	1.3 – 3.9	3.2
Number of cores	4	8
Memory		
Amount (GB)	16	16
Type	LPDDR4X	Unified
Graphics		
Vendor	NVIDIA®	Apple
Model number	GeForce® GTX 1650 with Max-Q Design	M1 8 core GPU
Storage		
Amount (GB)	256	256
Type	SSD	SSD
Connectivity/expansion		
Wireless internet	Wi-Fi 6 802.11ax	802.11ax Wi-Fi 6
Bluetooth	5.0	5.0
USB	1 x USB-C USB 3.1 Gen 2 Port 2 x USB-A USB 3.1 Gen 2 Ports 2 x Surface Connect ports 1 x Full-size SDXC card reader	2 x Thunderbolt / USB 4 ports
Battery		
Type	Integrated Lithium-polymer	Integrated Lithium-polymer
Rated capacity (mAh)	74.4 Whr (combined)	58.2 Whr
Display		
Size (in.)	13.5"	13.3"
Resolution	2,256 x 1,504	2,560 x 1,600
Operating system		
Vendor	Microsoft	Apple
Name	Windows 10 Home	macOS® Big Sur
Build number or version	19042.804	11.2.1
BIOS		
BIOS name and version	Microsoft 9.101.140	N/A

System configuration information	Microsoft Surface Book 3 13.5"	Apple MacBook Pro 13"
Dimensions		
Height (in)	0.59 – 0.90"	0.61"
Width (in)	12.3"	11.97"
Depth (in)	9.14"	8.36"
Weight (lbs.)	3.62 lbs.	3.0 lbs.

# How we tested

## Assessing graphics performance

### Geekbench 5 OpenCL Compute

#### Setting up the test (both Windows and macOS systems)

1. Download and install Geekbench 5 from <https://www.geekbench.com/download/>.

#### Running the test (both Windows and macOS systems)

1. Launch Geekbench.
2. Click Compute.
3. Record the result.
4. Wait 5 minutes before re-running the test.
5. Repeat steps 1 through 4 twice more.

### Unigine Valley benchmark

#### Setting up the test (both Windows and macOS systems)

1. Download and install the Valley benchmark from <https://benchmark.unigine.com/valley>.

#### Running the test (both Windows and macOS systems)

1. Launch the Valley benchmark.
2. We used the following identical settings that were supported by both systems.
  - Preset: Custom
  - API: OpenGL
  - Quality: High
  - Stereo 3D: Disabled
  - Monitor: Single
  - Anti-aliasing: Off
  - Full screen: Enabled
  - Resolution: 1440 x 900
3. Click Run.
4. Click Benchmark.
5. Record the result.
6. Wait 5 minutes before re-running the test.
7. Repeat steps 1 through 6 twice more.

### Unigine Heaven benchmark

#### Setting up the test (both Windows and macOS systems)

1. Download and install the Heaven benchmark from <https://benchmark.unigine.com/heaven>.

#### Running the test (both Windows and macOS systems)

1. Launch the Heaven benchmark.
2. We used the following identical settings that were supported by both systems.
  - Preset: Custom
  - API: OpenGL
  - Quality: Ultra
  - Stereo 3D: Disabled
  - Monitor: Single
  - Anti-aliasing: 4x
  - Tessellation: Extreme
  - Full screen: Enabled
  - Resolution: 1440 x 900

3. Click Run.
4. Click Benchmark.
5. Record the result.
6. Wait 5 minutes before re-running the test.
7. Repeat steps 1 through 6 four more times.

## Basemark GPU benchmark

### Setting up the test (both Windows and macOS systems)

1. Download and install the Basemark GPU benchmark from <https://basemark.com/benchmarks/basemark-gpu/>.

### Running the High Content Quality test (both Windows and macOS systems)

1. Launch the Basemark GPU benchmark.
2. Under the official tab, ensure that the Content Quality option is set to High and leave all other options default.
3. Click Run Official Test.
4. Wait 5 minutes before re-running the test.
5. Repeat steps 1 through 4 four more times.

### Running the Medium Content Quality test (both Windows and macOS systems) (Windows & MacOS)

1. Launch the Basemark GPU benchmark.
2. Under the official tab, ensure that the Content Quality option is set to Medium and leave all other options default.
3. Click Run Official Test.
4. Wait 5 minutes before re-running the test.
5. Repeat steps 1 through 4 four more times.

## Assessing AI performance

### Gigapixel AI

We recorded how long it took to upscale/enlarge a 4,284x2,844 image to a 25,704x17,064 (6x) image. To complete this test, you need the Topaz Labs Gigapixel AI v5.4.4 application and a stopwatch.

### Setting up the test (both Windows and macOS systems)

1. Register, download, and install the Topaz Labs Gigapixel AI free trial from <https://topazlabs.com/gigapixel-ai/>.
2. Launch Gigapixel AI, and enter the username and password to start the free trial.
3. Close Gigapixel AI.

### Running the test (both Windows and macOS systems)

1. Launch Gigapixel AI.
2. Click Browse and select the test image.
3. Under the Scale tab select 6x.
4. Click Save Image. Verify that the image format is JPG and that the quality is set to the maximum of 10.
5. Simultaneously start the stopwatch and click Save.
6. Stop the stopwatch when the checkmark appears with the message All images processed.
7. Record the result.
8. Wait 5 minutes before performing the next run.
9. Repeat steps 1 through 8 four more times.

## DeNoise AI

We recorded how long it took to remove noise from an image, using the Topaz Labs DeNoise AI v2.4.2 application.

### Setting up the test (both Windows and macOS systems)

1. Register, download, and install the Topaz Labs Gigapixel AI free trial from <https://topazlabs.com/denoise-ai-2/>.
2. Launch DeNoise AI and enter the username and password to start the free trial.
3. Close DeNoise AI.

### Running the test (both Windows and macOS systems)

1. Launch DeNoise AI.
2. Click Browse, and select the test image.
3. Under the DeNoise AI tab, select the following settings:
  - Remove Noise= 40
  - Enhance Sharpness= 22
  - Recover Original Detail= 20
  - Color Noise Reduction= 0
4. Click Save Image. Verify that the image format is JPG, and that the quality is set to the maximum of 10.
5. To start the DeNoise process, click Save.
6. Once the DeNoise process has been completed, record the time that appears in the box located at the bottom of the screen.
7. Wait 5 minutes before performing the next run.
8. Repeat steps 1 through 7 four more times.

This project was commissioned by Microsoft.



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