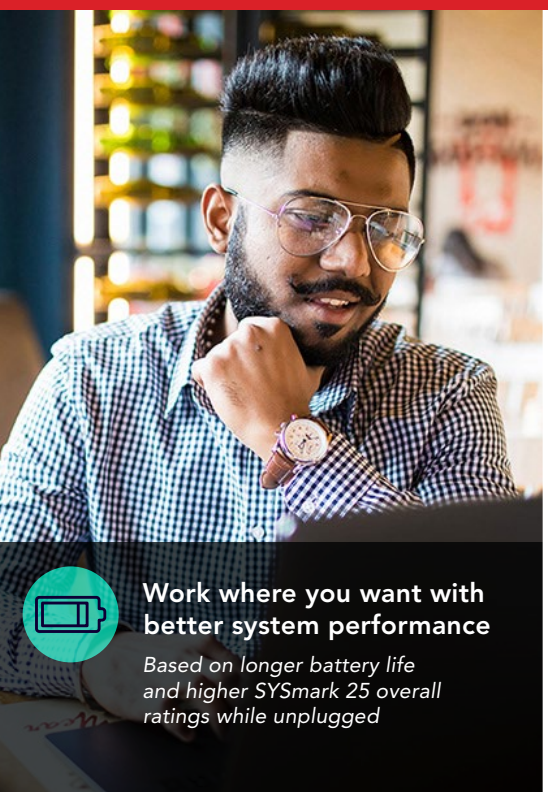
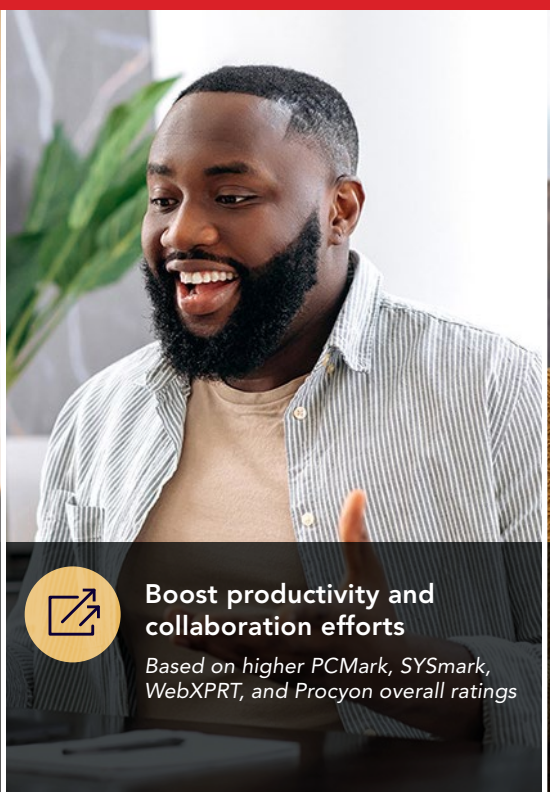


Work where you want with better system performance

Based on longer battery life and higher SYSmark 25 overall ratings while unplugged



Boost productivity and collaboration efforts

Based on higher PCMark, SYSmark, WebXPRT, and Procyon overall ratings

Be more comfortable with cool surface temperatures

Based on similar or lower thermal readings while operating under load

Improve your day-to-day experience with Windows 11 Pro laptops

A real-world battery life, performance, and thermal comparison of four current-gen laptops preloaded with Windows 11 Pro and four previous-gen laptops with Windows 10 Pro

Windows laptop users use them in a variety of contexts—so it makes sense to look at battery life and system performance from multiple angles. For this evaluation of the benefits mainstream users could expect by upgrading to current-gen laptops preloaded with Windows 11 Pro, we tested battery life in five different scenarios and ran a series of industry-standard benchmarks that measure productivity and content creation capabilities. We also captured surface temperatures under load.

Our results show that mainstream laptop users can improve their day-to-day experience by upgrading to current-gen Windows 11 Pro laptops powered by Intel® Core™ i5 or i7 processors. We found that these laptops delivered longer battery life, faster system responsiveness, and similar or lower surface temperatures while running a compute-intensive application.

This report presents our findings through the lens of eight fictional scenarios. Though we've made up the characters, their situations reflect real-world laptop user experiences.

For complete details on the PCs we tested and the tests we performed, see the science behind the report.

How we tested

We used battery life, performance, and thermal tests to explore real-world concerns for mainstream laptop users, whose needs are different from those of professional creatives or dedicated gamers.

We tested the following eight laptops:

Current-gen laptops preloaded with Windows 11 Pro:

- **HP ProBook 450 G8**
  with an Intel Core i5 processor, 16 GB of memory, 256 GB of storage, and a 45 Whr battery
- **HP EliteBook 850 G8**
  with an Intel Core i5 processor, 16 GB of memory, 256 GB of storage, and a 56 Whr battery
- **Lenovo® ThinkPad® X1 Yoga G6**
  with an Intel Core i5 processor, 8 GB of memory, 256 GB of storage, and a 57 Whr battery
- **Lenovo ThinkPad T14**
  with an Intel Core i7 processor, 16 GB of memory, 512 GB of storage, and a 50 Whr battery

Previous-gen laptops with Windows 10 Pro:

- **HP ProBook 450 G6**
  with an Intel Core i5 processor, 16 GB of memory, 256 GB of storage, and a 45 Whr battery
- **HP EliteBook 850 G5**
  with an Intel Core i5 processor, 16 GB of memory, 256 GB of storage, and a 56 Whr battery
- **Lenovo ThinkPad X1 Yoga G3**
  with an Intel Core i5 processor, 8 GB of memory, 256 GB of storage, and a 54 Whr battery
- **Lenovo ThinkPad T480**
  with an Intel Core i7 processor, 16 GB of memory, 256 GB of storage, and a 48 Whr battery

On all laptops, we first compared general battery life with the PCMark 10 benchmark. We also ran custom battery life use cases to measure local video playback, streaming video, Zoom video conferencing, and web browsing capabilities. Then, we compared general and specific use case system performance using PCMark 10, SYSmark®, 3DMark®, Cinebench R23, Blender, RedShift, WebXPRT 4, and Procyon® benchmarks on these devices. We also conducted an extra round of SYSmark 25 benchmark testing on the Windows 11 Pro laptops to determine how enabling the VBS feature affected performance. Finally, we compared surface temperatures while running a compute-intensive workload on all eight devices:

For these comparisons, we selected the closest generational matches available at the time of testing. Due to hardware available in the market and component changes from generation to generation, we could not match every component's specs.

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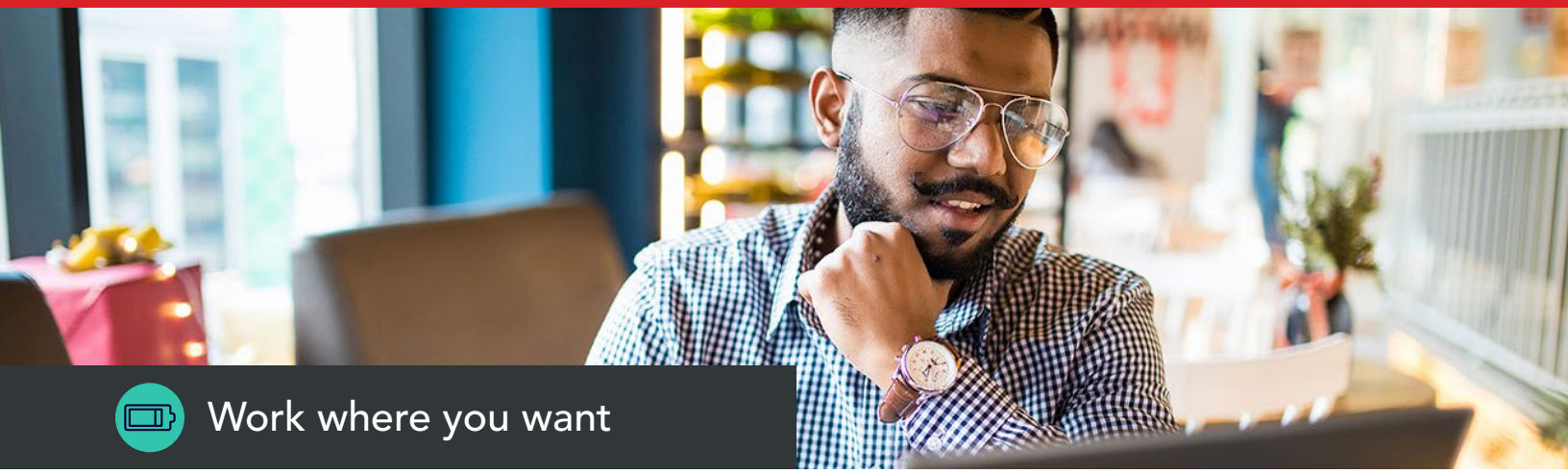
Jump directly to results by clicking the buttons below.



Work where you want

Battery life is one of the first things buyers look at when they're searching for any mobile device—but every laptop user has different day-to-day battery life stressors, so we measured battery life using a benchmark as well as with multiple real-world scenarios.

Note: We purchased used previous-gen laptops that were approximately five years old. We recognize that the batteries of those legacy laptops were likely experiencing degradation due to age and use. As such, we are not claiming that the previous-gen laptops, if new, would perform at these levels. Rather, we are saying that upgrading from heavily used laptops to current-gen laptops with new batteries could increase the time you can work unplugged. For more information and to see the full specs on each laptop, read the science behind the report.

Scenario 1: Get ahead while unplugged

Narayan, a senior financial analyst, is a strong contender for their dream position as the youngest CFO in their company's history. Part of the reason Narayan is so successful is that they use their HP EliteBook 850 G5 running Windows 10 Pro to keep current with multiple business news programs, interview industry experts, and watch history documentaries to better predict future events. Our tests show that after upgrading to the G8 running Windows 11 Pro, they should expect almost five additional hours of battery life watching downloaded videos on a cross-country flight.

WORK WHERE YOU WANT WITH LONGER BATTERY LIFE

PCMark 10 battery life

Time (hh:mm) | Higher is better

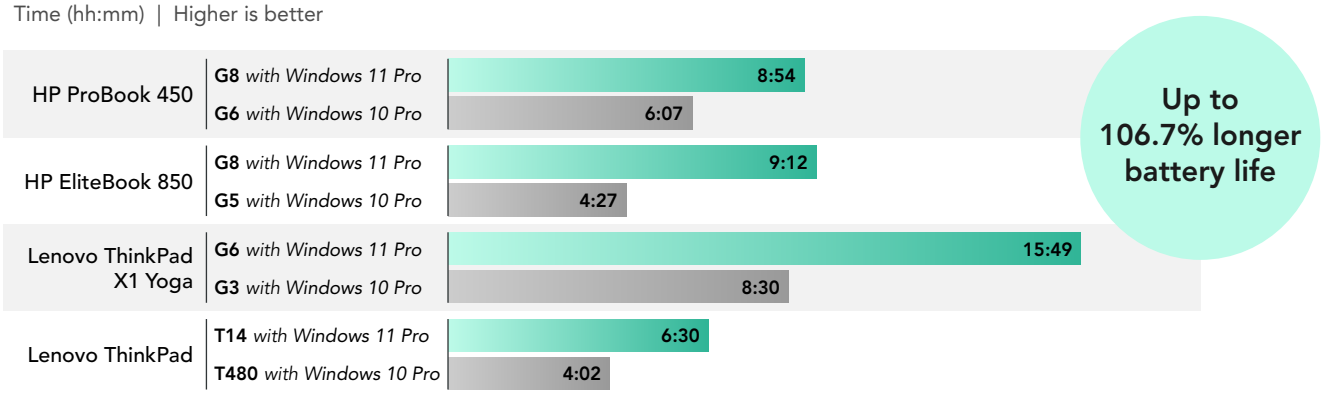


Figure 1: PCMark 10 battery life results. Higher is better. Source: Principled Technologies.

Local video playback while on battery

Time (hh:mm) | Higher is better

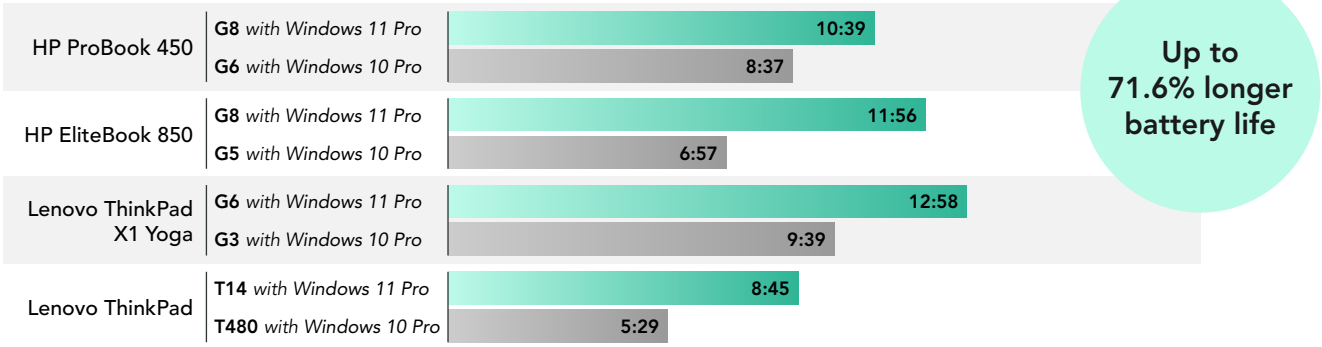


Figure 2: Local video playback battery life results. Higher is better. Source: Principled Technologies.

Streaming video while on battery

Time (hh:mm) | Higher is better

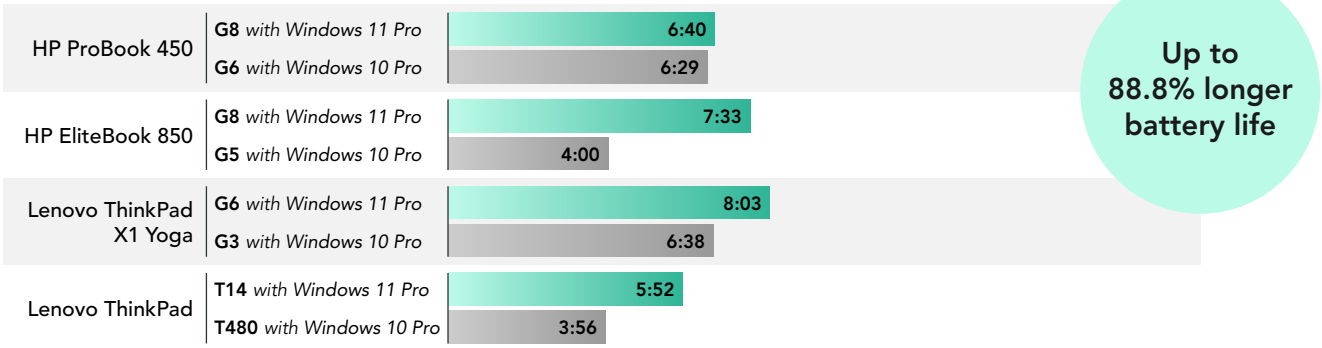


Figure 3: Streaming video battery life results. Higher is better. Source: Principled Technologies.

Scenario 2: Hit the ground running

Tansy, a newly promoted marketing manager at a consumer goods company, is excited about her new responsibilities. The first order of business is updating the aging Windows 10 Pro laptop she got when she first started with the company four years ago. Our test results show that, by making a gen-to-gen upgrade on any of the Windows laptops we tested, she could expect comparable or longer battery life for unplugged Zoom brainstorming meetings and marketing collateral reviews. She should also have more time to do market research during her outdoor lunch breaks or when she's watching her kids play soccer.

Zoom conference call while on battery

Time (hh:mm) | Higher is better

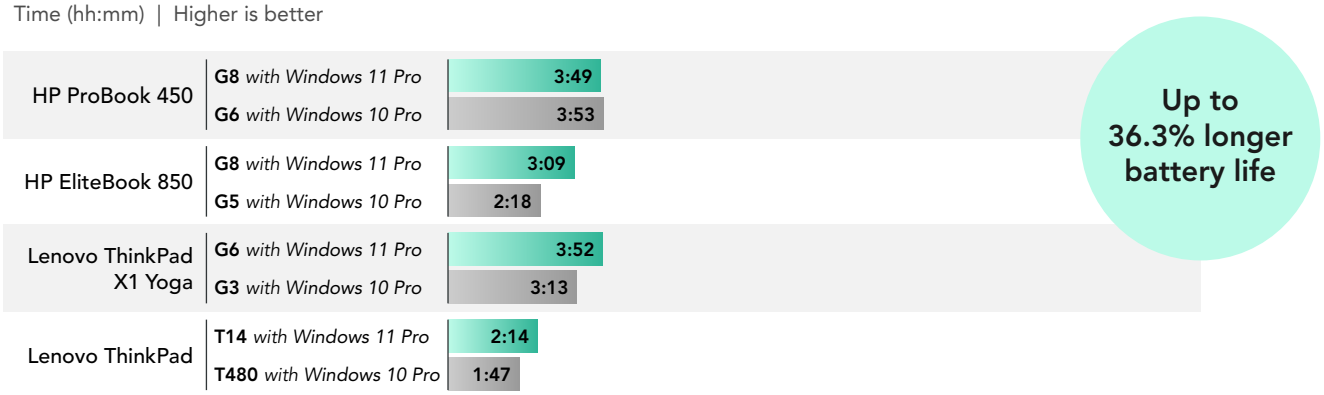


Figure 4: Zoom conference call battery life results. Higher is better. Source: Principled Technologies.

Web browsing while on battery

Time (hh:mm) | Higher is better

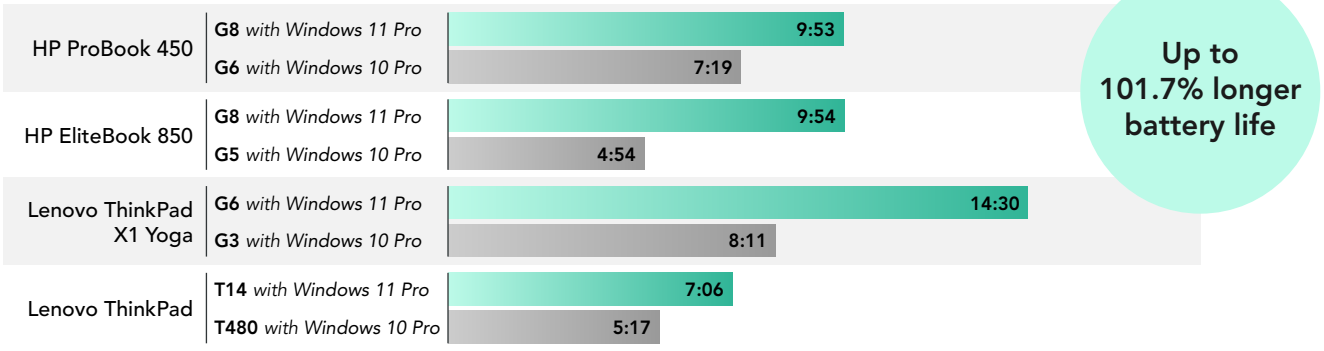
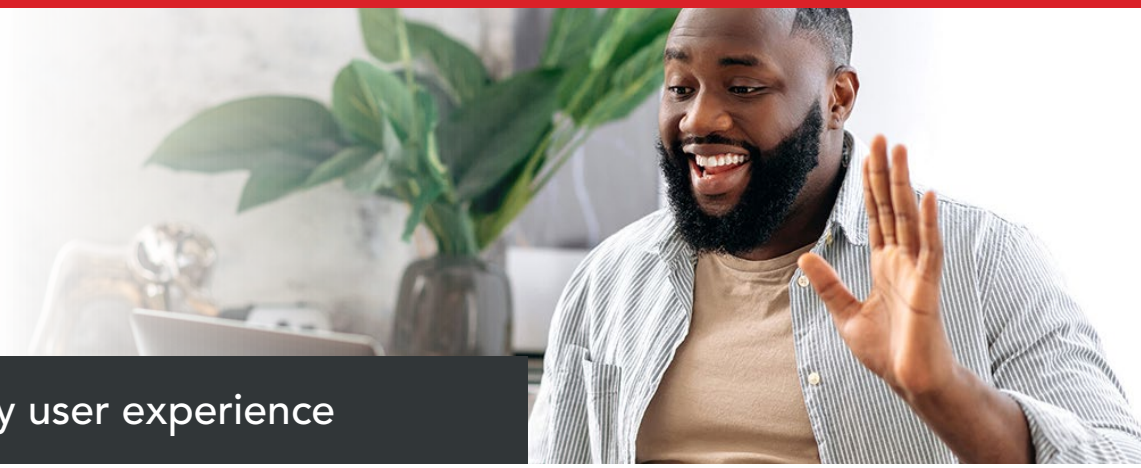


Figure 5: Web browsing battery life results. Higher is better. Source: Principled Technologies.



The day-to-day user experience

Every user has unique day-to-day requirements, so we looked at system performance and responsiveness from many angles. The general productivity benchmark results (pages 6 through 8) might seem like the only relatable results for non-creative professionals—but the digital content creation-focused benchmarks (pages 9 through 13) offer important insights whether you process images and edit videos or not. For example, higher multi-core scores here can translate to speedier response times on financial analysis tools, demanding productivity apps, product development and design software, 3D modeling and rendering programs, and graphics-intensive games.

Scenario 3: More time to chase down leads

Calvin is the inside sales manager for an up-and-coming technology service provider. He is responsible for executing strategic direction, development, and customer base expansion. His team relies on Microsoft 365 productivity tools, access to online courses, and a customer relationship management (CRM) system to keep on top of trends and collect and analyze customer information. Right now, they're doing this on five-year-old laptops running Windows 10 Pro. Our tests show that if Calvin and his team upgraded to current-gen laptops running Windows 11 Pro, they could expect faster system response times, which can translate to faster task completion, a better user experience, and more time to chase down leads.

BOOST PRODUCTIVITY AND EXPEDITE COLLABORATION EFFORTS

PCMark 10

Overall rating | Higher is better

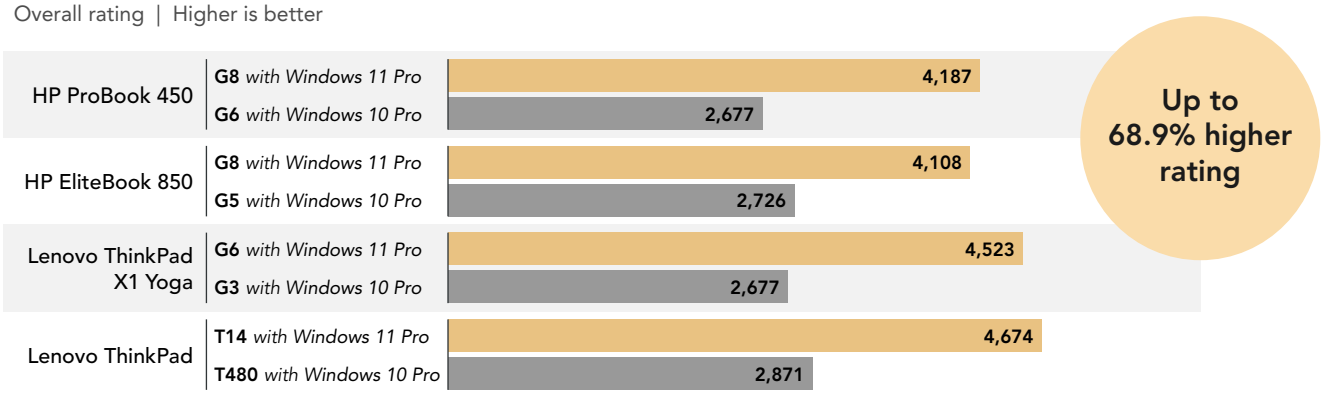


Figure 6: PCMark 10 overall ratings. Higher is better. Source: Principled Technologies.

Stick with what works—only better

While Microsoft is supporting Windows 10 until 2025, Windows 11 has some new tricks up its sleeve. These changes include "intuitive navigation" with easy-to-use organization and personalization tools; next-generation antivirus and malware protection; and more productivity, accessibility, and gaming features.[1]

PCMark 10 applications test

Overall rating | Higher is better

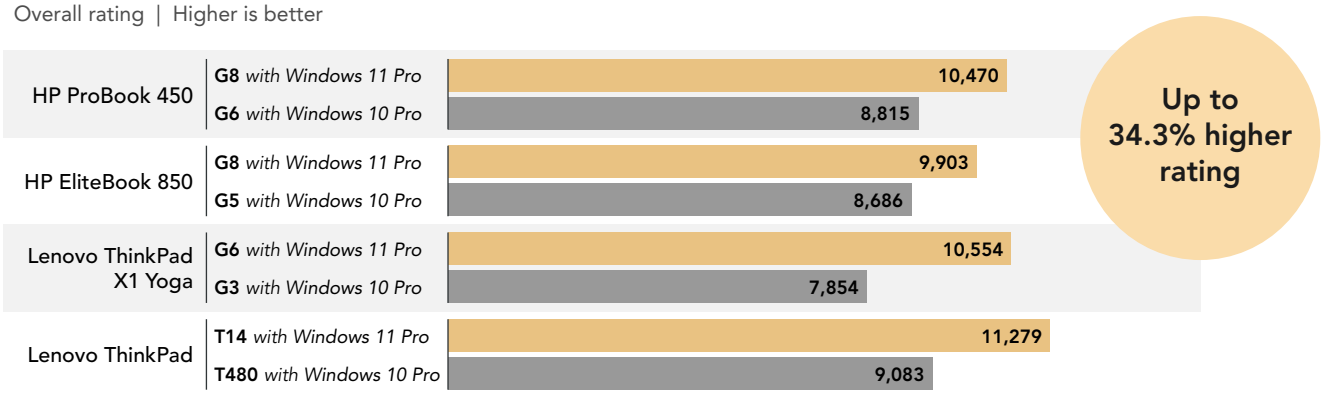


Figure 7: PCMark 10 application test overall ratings. Higher is better. Source: Principled Technologies.

SPEED DAY-TO-DAY ACTIVITIES

SYSmark 2018

Overall rating | Higher is better

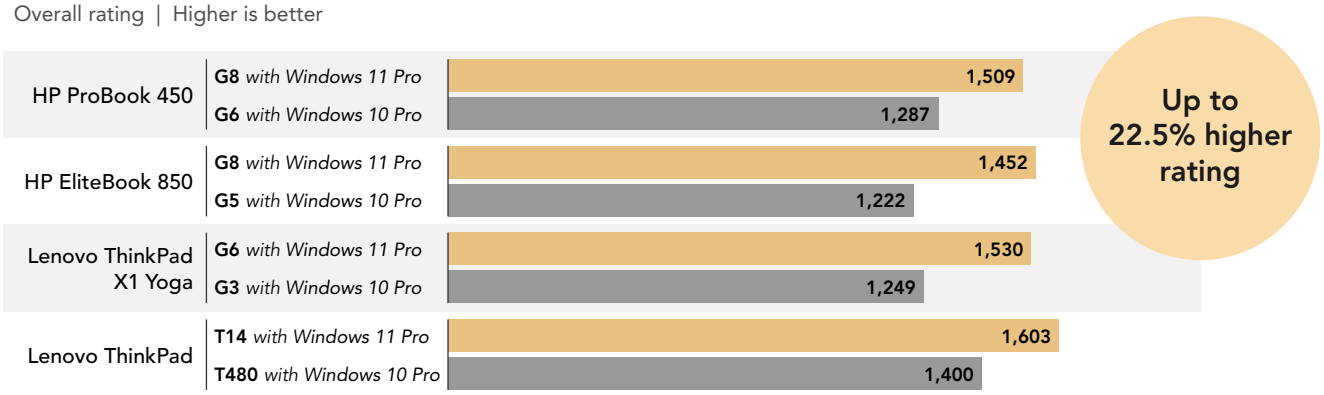


Figure 8: SYSmark 2018 overall ratings. Higher is better. Source: Principled Technologies.

GET A BETTER USER EXPERIENCE

SYSmark 25

Overall rating | Higher is better

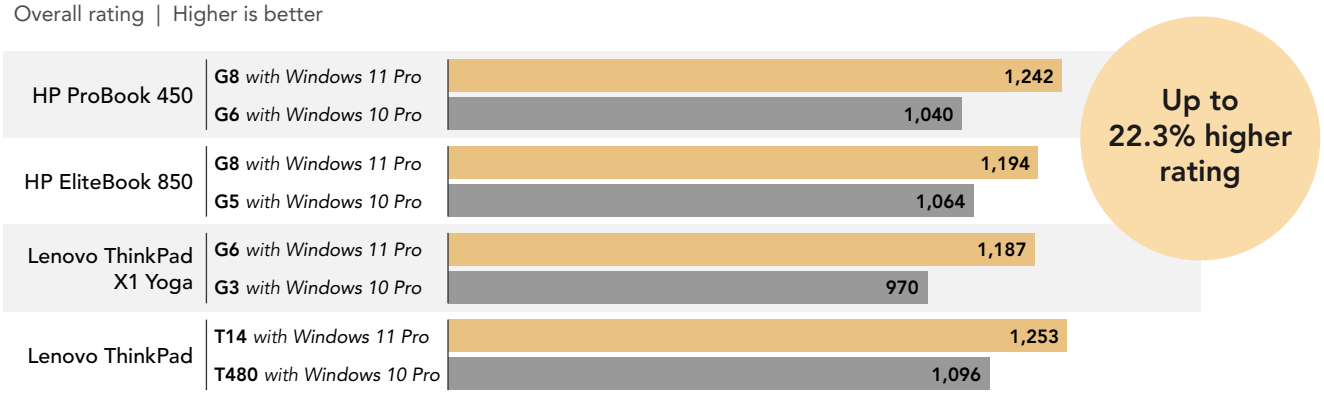


Figure 9: SYSmark 25 overall ratings. Higher is better. Source: Principled Technologies.

***PCMark 10** is a comprehensive set of tests that reflect the varied PC demands of the modern workplace.*[2]

***SYSmark 2018** is an application-based benchmark that is geared toward office-centric user activities and reflects the usage patterns of business users.*[3]

***SYSmark 25** measures the response time of business-oriented and media-centric tasks using real applications and simulated user input.*[4]

MAXIMIZE WEB-BROWSING CAPABILITIES

WebXPRT 4

Overall score on Microsoft Edge | Higher is better

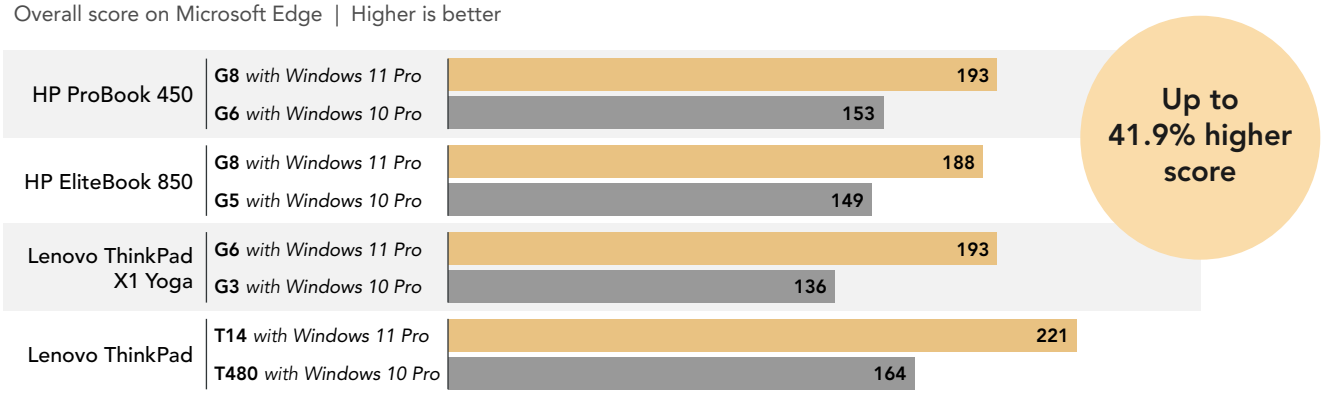


Figure 10: WebXPRT 4 overall scores. Higher is better. Source: Principled Technologies.

OPERATE TEAM PRODUCTIVITY TOOLS MORE EFFECTIVELY

Procyon Office Productivity Benchmark

Overall rating | Higher is better

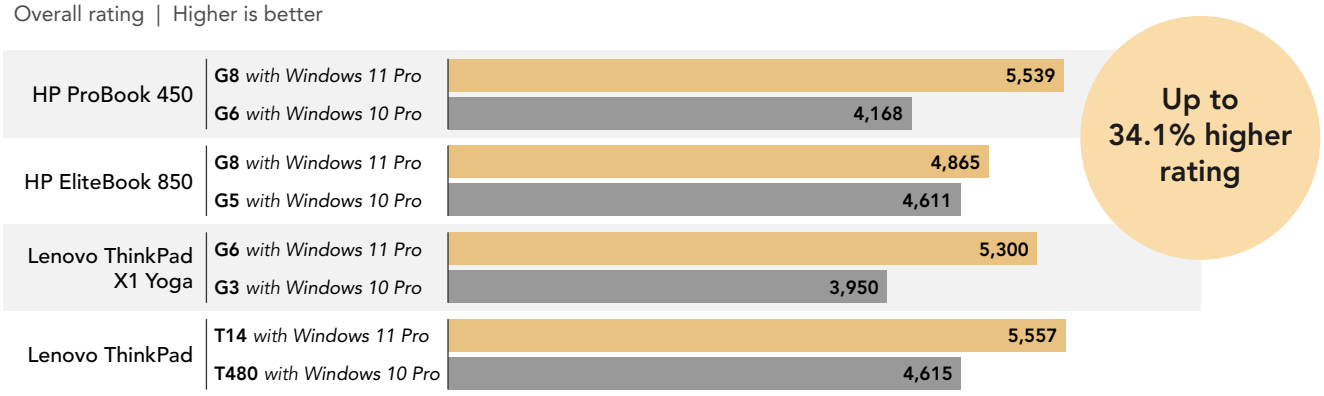
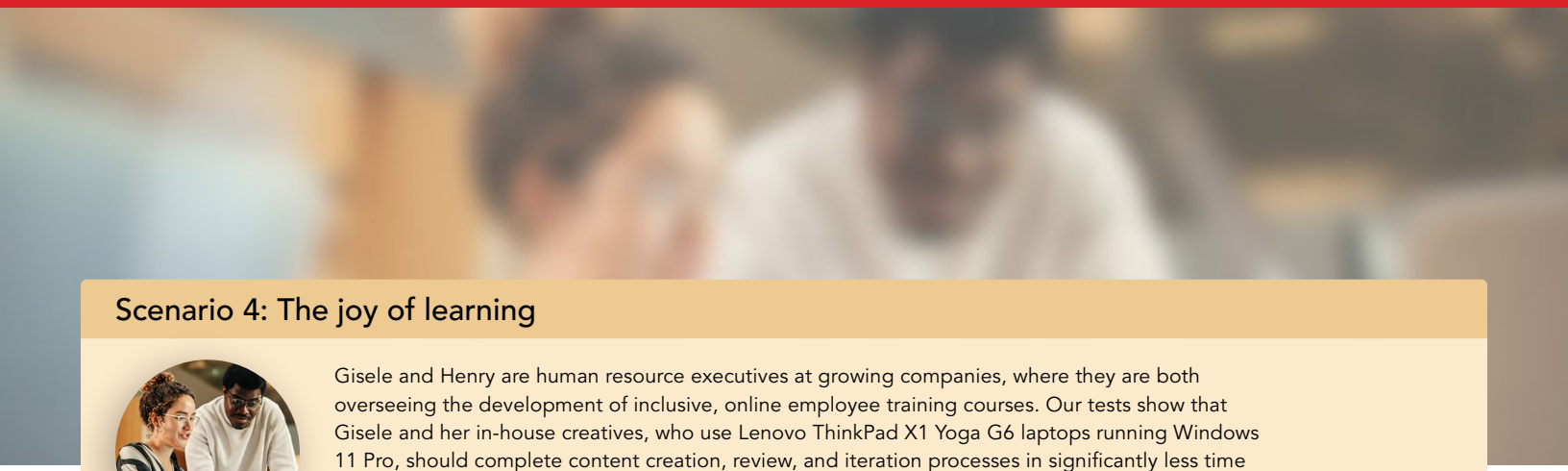


Figure 11: Procyon Office Productivity Benchmark overall ratings. Higher is better. Source: Principled Technologies.

***WebXPRT 4** is a browser benchmark that compares the performance of almost any web-enabled device.[5]*

***Procyon Office Productivity Benchmark** uses Microsoft 365 apps to measures aspects of day-to-day performance that affect the business user experience.[6]*



Scenario 4: The joy of learning

Gisele and Henry are human resource executives at growing companies, where they are both overseeing the development of inclusive, online employee training courses. Our tests show that Gisele and her in-house creatives, who use Lenovo ThinkPad X1 Yoga G6 laptops running Windows 11 Pro, should complete content creation, review, and iteration processes in significantly less time than Henry's team, who rely on Lenovo ThinkPad X1 Yoga G3 laptops running Windows 10 Pro.

BETTER HANDLE DEMANDING WORKLOADS

3DMark: Fire Strike

Overall rating | Higher is better

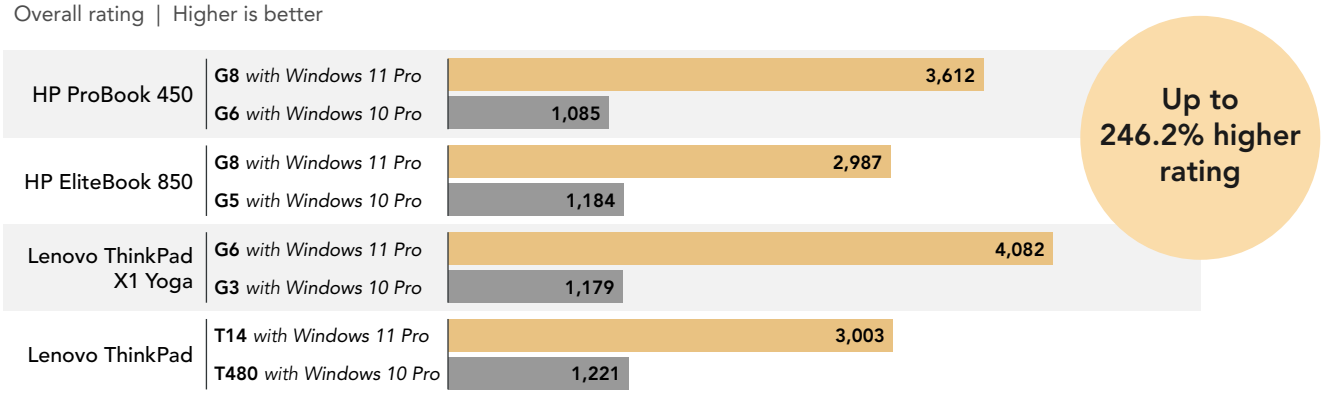


Figure 12: 3DMark Fire Strike overall ratings. Higher is better. Source: Principled Technologies.

3DMark: Time Spy

Overall rating | Higher is better

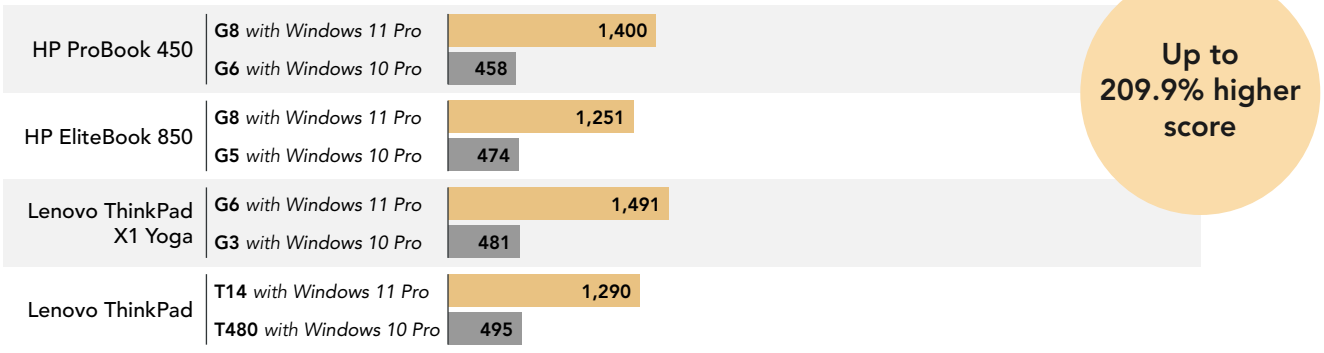


Figure 13: 3DMark Time Spy overall ratings. Higher is better. Source: Principled Technologies.

***3DMark* benchmark** *measures 3D graphic rendering and CPU workload processing capabilities.*

GET CREATIVE PROJECTS OUT THE DOOR FASTER

Cinebench R23 (single-core)

Score | Higher is better

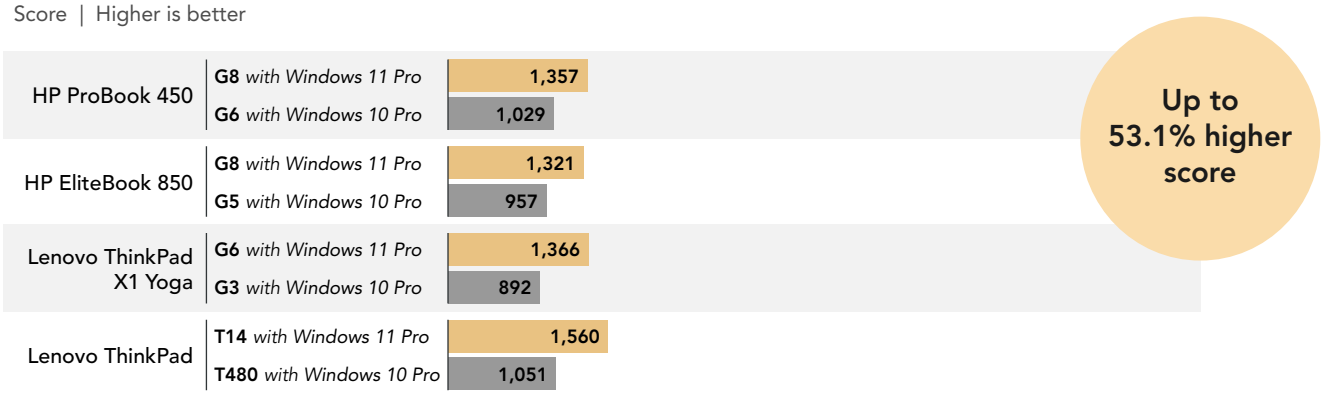


Figure 14: Cinebench R23 single-core scores. Higher is better. Source: Principled Technologies.

Cinebench R23 (multi-core)

Score | Higher is better

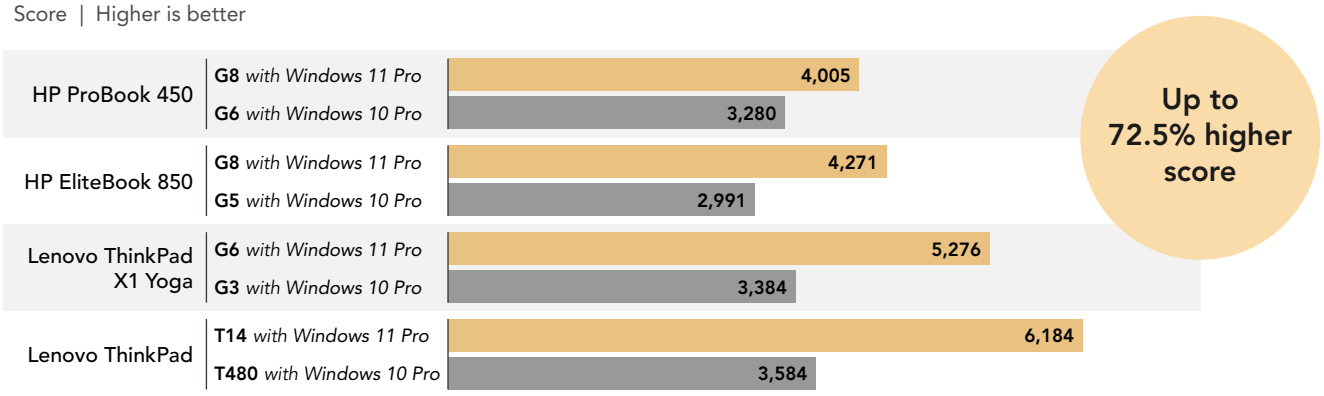


Figure 15: Cinebench R23 multi-core scores. Higher is better. Source: Principled Technologies.

***Cinebench R23** is a popular benchmark that measures a CPU's rendering performance.*

Scenario 5: Making ends meet in the gig economy

Kalia is a recent art college graduate who is freelancing while she explores the country and decides where she wants to settle down. She's debating whether she should keep using the Lenovo ThinkPad T480 her parents bought her when she started college—or spring for a new one. Our tests show Kalia could complete 3D video editing projects in less time if she upgraded to the ThinkPad T14 with a current-gen Intel Core i7 processor and Windows 11 Pro—an updated version of her beloved ThinkPad T480. This change could enable her to take on new work and earn more money.

SPEED SCENE RENDERS

Blender: Monster workload

Samples per minute | Higher is better

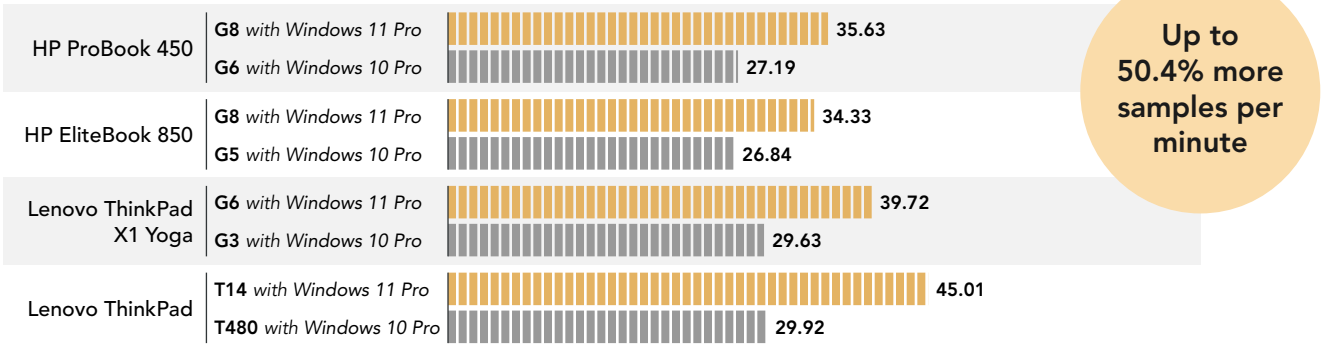


Figure 16: Blender Monster workload rendering results. Higher is better. Source: Principled Technologies.

Blender: Junkshop workload

Samples per minute | Higher is better

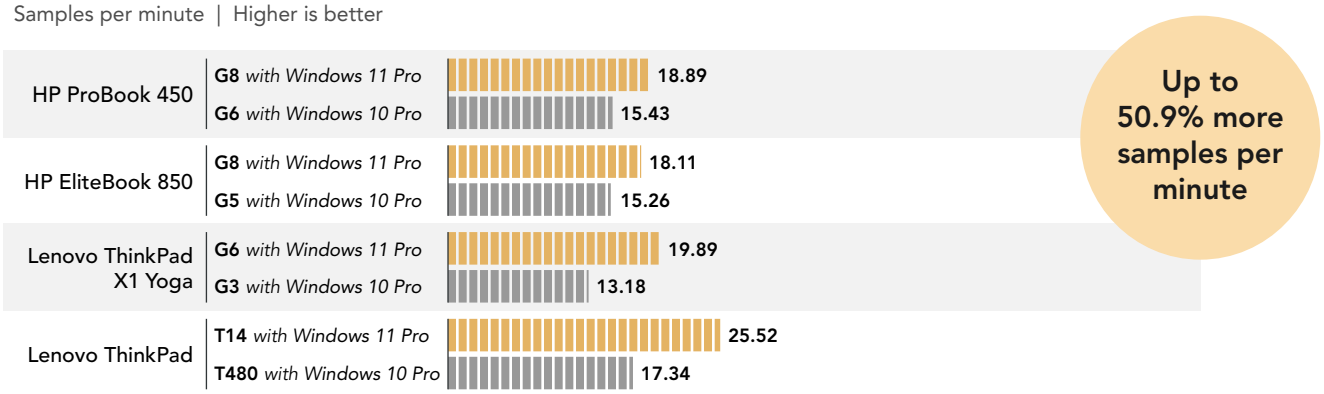


Figure 17: Blender Junkshop workload rendering results. Higher is better. Source: Principled Technologies.

***Blender** benchmark workloads measure processor and graphics rendering performance.*

Blender: Classroom workload

Samples per minute | Higher is better

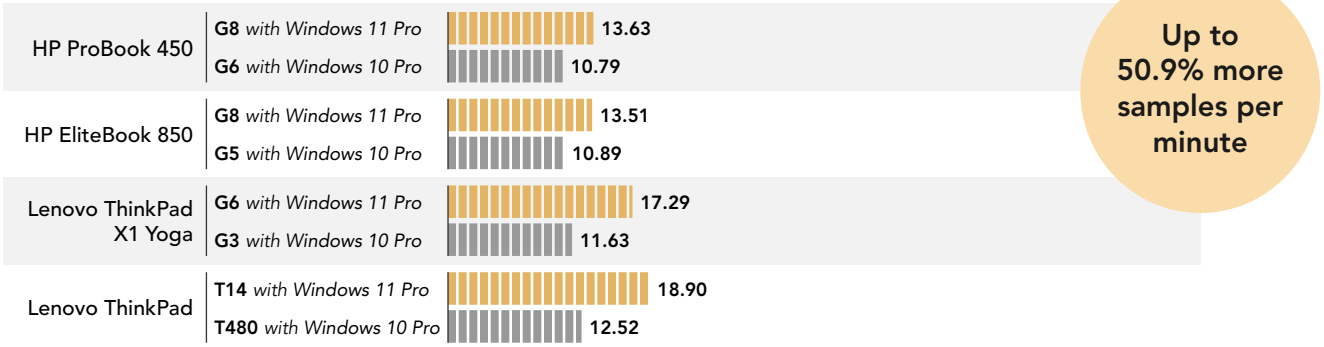


Figure 18: Blender Classroom workload rendering results. Higher is better. Source: Principled Technologies.

SPEED 3D RENDERS

Maxon Redshift 3D Render

Time (hh:mm) | Less time is better

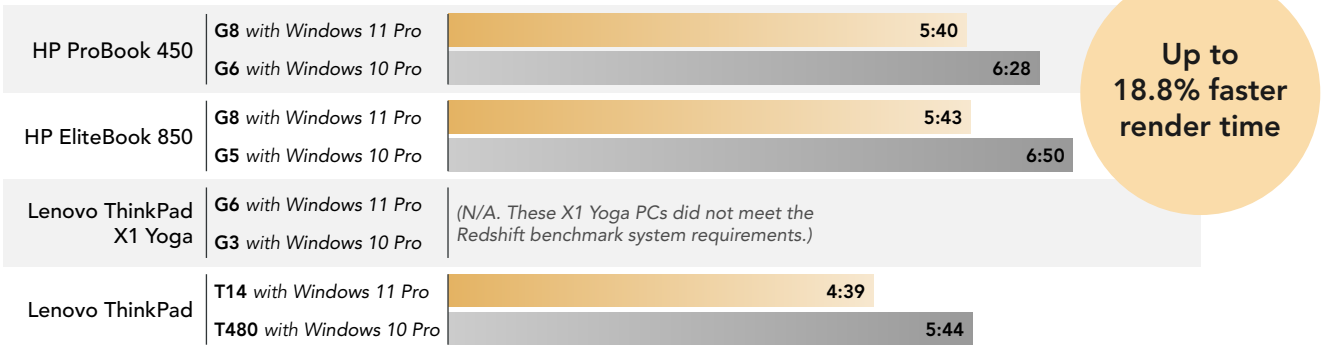
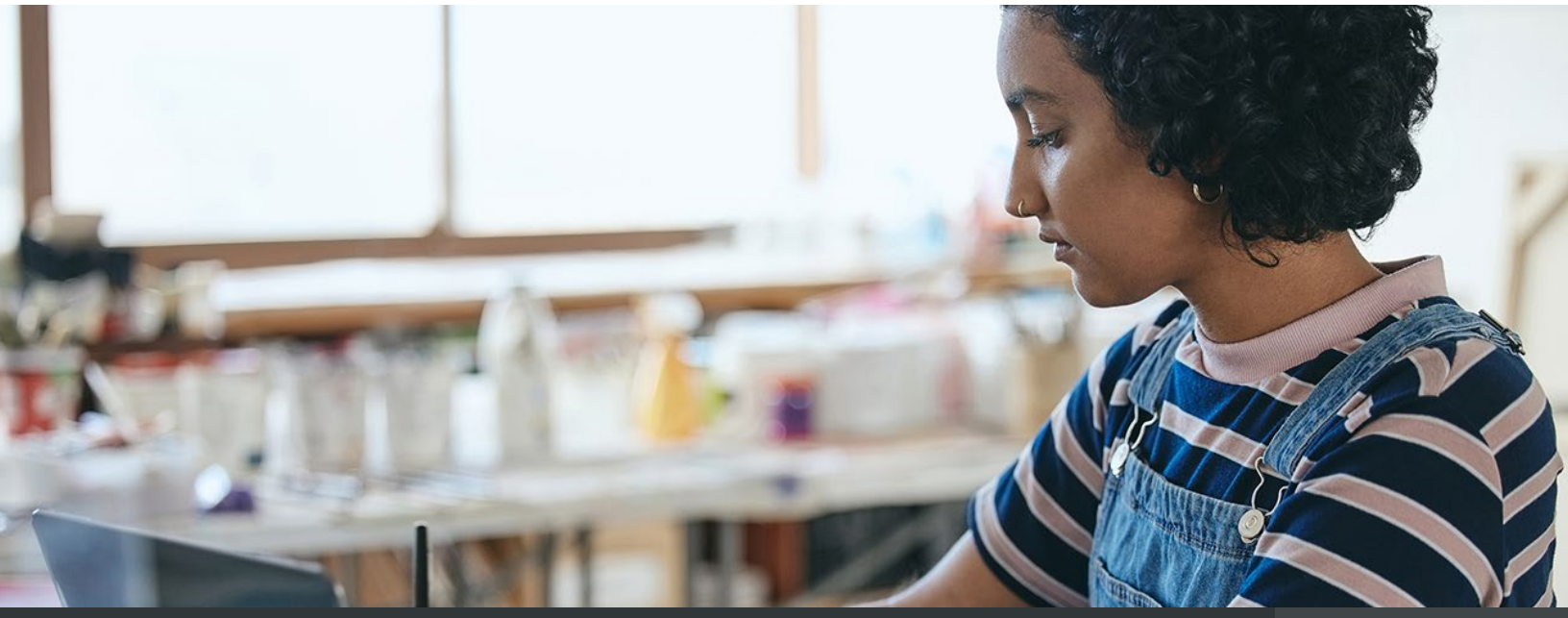


Figure 19: Maxon Redshift 3D Renderer benchmark scores. Higher is better. Source: Principled Technologies.



Redshift 3D Renderer *loads a scene, renders it, and measures the time it took to render, excluding certain CPU operations.*

Scenario 6: It's not easy being extra cheesy

Frankie and Johni are competing pizza shop owners with a long-standing social media rivalry. Johni has decided to up the ante (and boost audience engagement) with short, targeted video responses to everything Frankie posts. Our tests show that, in addition to the productivity application benefits we discuss earlier in this report, Johni could expect to render these potentially viral videos in far less time if they upgrade from their older HP ProBook 450 G6 running Window 10 Pro to the current-gen version running Windows 11 Pro.

COMPLETE CONTENT CREATION PROJECTS IN LESS TIME

Procyon Photo Editing Benchmark

Overall rating | Higher is better

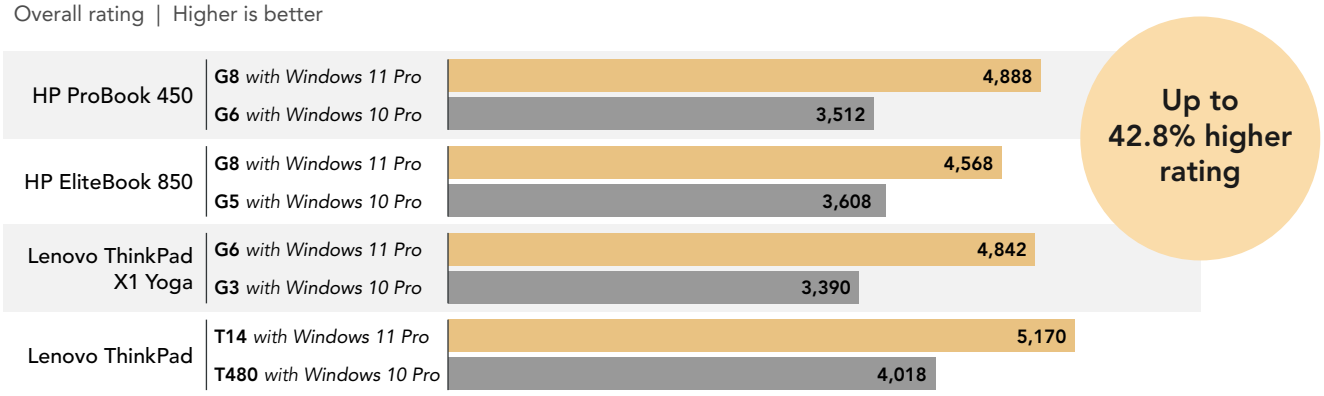


Figure 20: Procyon Photo Editing Benchmark overall ratings. Higher is better. Source: Principled Technologies.

Procyon Video Editing Benchmark

Overall rating | Higher is better

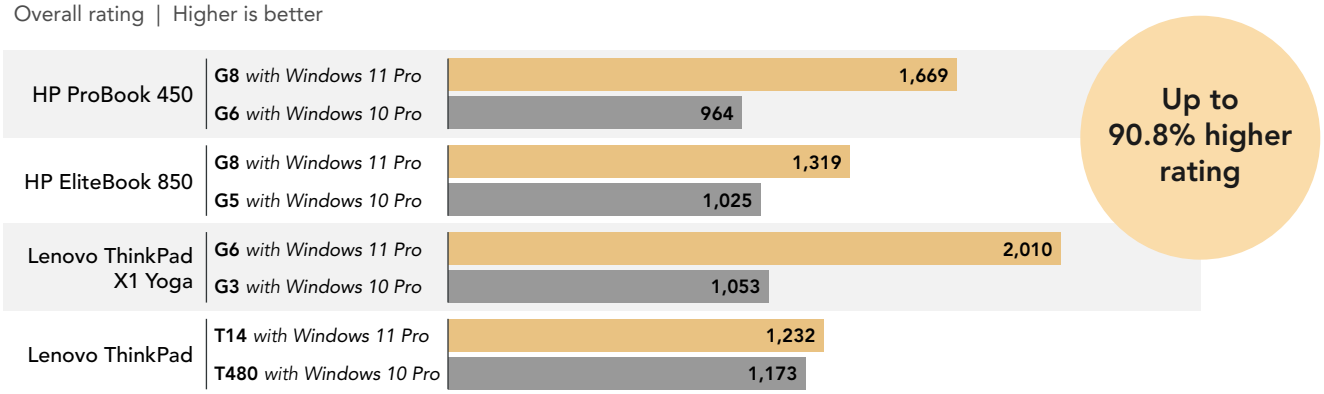


Figure 21: Procyon Video Editing Benchmark overall ratings. Higher is better. Source: Principled Technologies.

Procyon Photo Editing Benchmark *uses Adobe Lightroom and Adobe Photoshop to compare photo editing performance.*

Procyon Video Editing Benchmark *uses Adobe Premiere Pro to compare video editing performance.*

Improve malware resistance

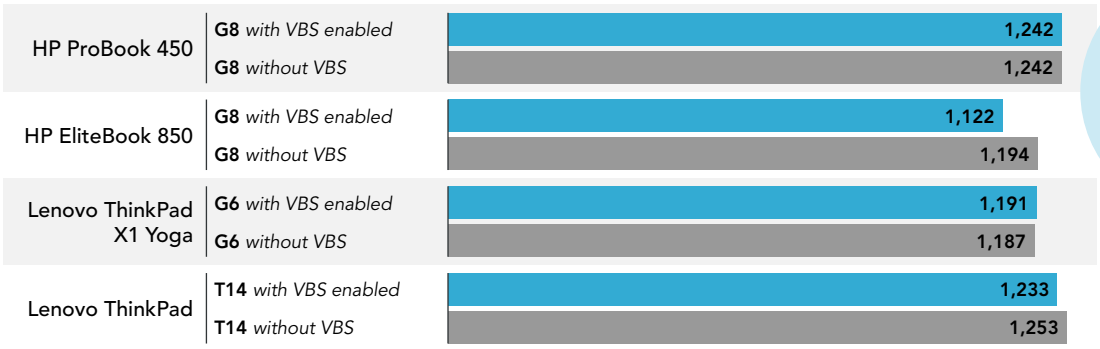
Pre-pandemic, when most employees worked in the office, IT departments may have found it easier to ensure company-issued laptops were free of spyware and malware during routine inspections and updates. Now that more people are remote, this kind of IT issue is harder to deal with. According to Mimecast's 2023 State of Email Security Report, 75 percent of the organizations surveyed experienced malware activity that spread from one employee to another in 2022.[7]

Scenario 7: Thwart malicious actors from gaining access without performance loss

Windows Virtualization-Based Security (VBS) adds an extra layer of protection against kernel-level attacks, so Johanna, who uses her system for confidential work, wants to enable this additional security feature on the new Windows laptop she's shopping for. However, her friend has warned her that enabling VBS will slow down her Windows 11 experience. What should she do? We found that enabling the VBS feature on the current-gen laptops running Windows 11 Pro minimally affected performance, which means Johanna can stop worrying about taking a performance hit and start trying out keyboards.

SYSmark 25 with and without VBS on Windows 11 Pro laptops

Overall rating | Higher is better

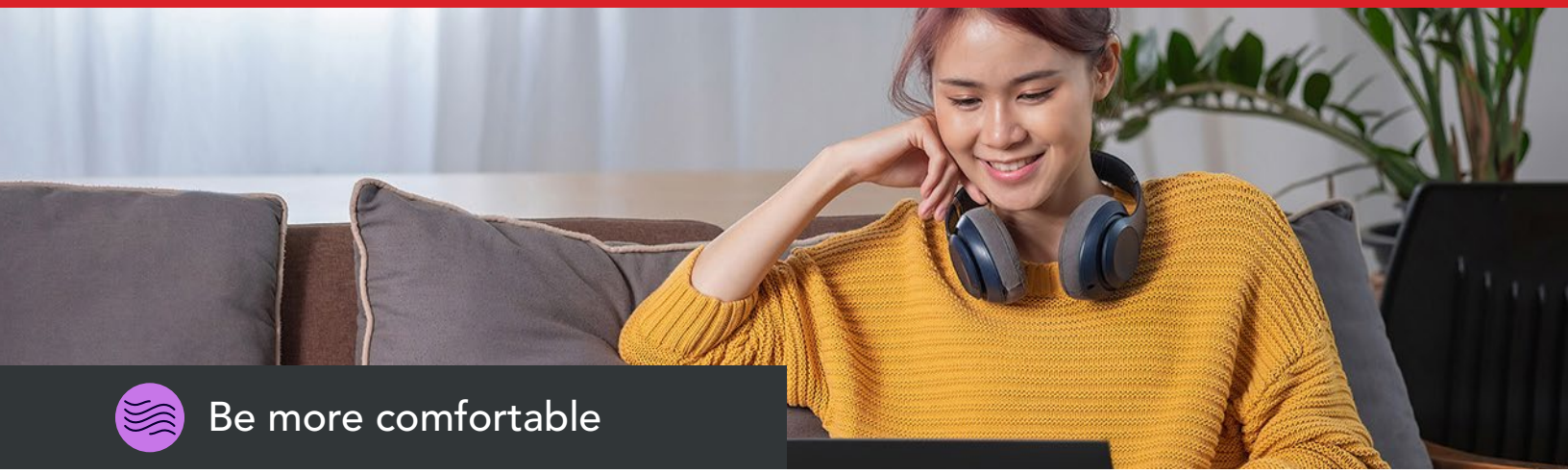


Improve malware resistance with little or no performance difference

Figure 22: SYSmark 25 overall rating with and without the VBS feature enabled. Higher is better. Source: Principled Technologies.

Extra data security

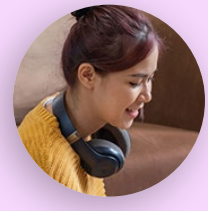
According to Microsoft, the Windows VBS feature provides stronger protections of vital system and operating resources from kernel viruses and malware. Windows can use this "virtual secure mode" to limit and contain threats in a secure region of memory separate from the normal operating system.[8]



Be more comfortable

Investing in laptops that contain higher-performing processors typically means your laptop can process more data, run more compute-intensive applications and programs, and keep more browser tabs open at once. However, one potential side effect is that the device generates more heat. For users who regularly rest their laptops on their laps while they're working, this can be uncomfortable. Plus, when laptops get too hot, their performance may suffer. To measure the thermal output of the laptops we tested, we took top and bottom temperature readings after we'd run the compute-intensive Cinebench R23 benchmark for 60 minutes on each laptop.

Scenario 8: Read before skipping this section



For this surface temperature comparison, we used the Cinebench R23 benchmark, which runs the Cinema 4D application to stress the laptop processors. Other compute-intensive applications that mainstream laptop users are more likely to use every day are demanding productivity apps, financial analysis tools, product development and design software, and scientific simulation programs—which is why these top surface (hand) and bottom surface (lap) temperatures should matter to everyone.

Hottest top surface point temperature

Temperature (°F | °C) | Lower temps are better

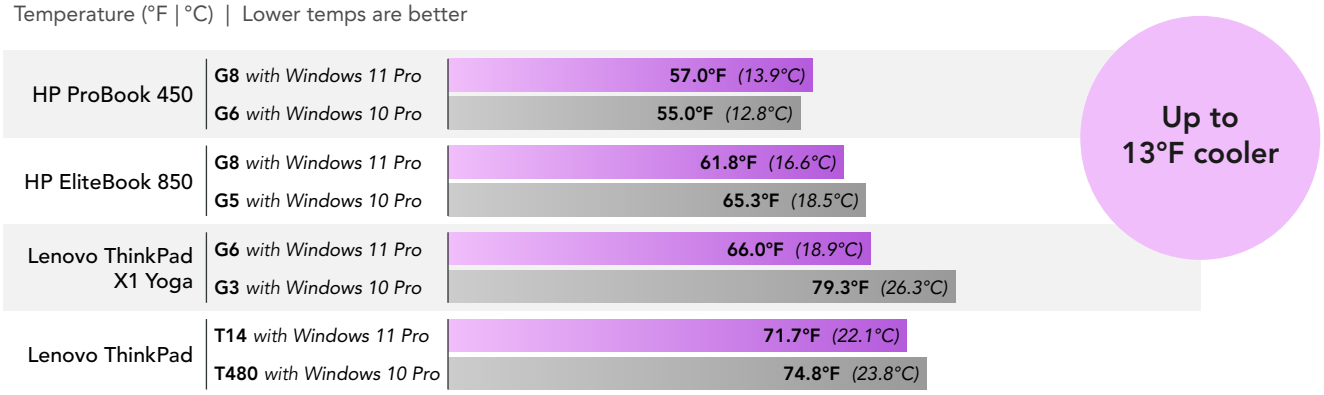


Figure 23: Average temperatures after running Cinebench R23 (multi-core) for 60 minutes. Lower temps are better. Source: Principled Technologies.

Hottest bottom surface point temperature

Temperature (°F | °C) | Lower temps are better

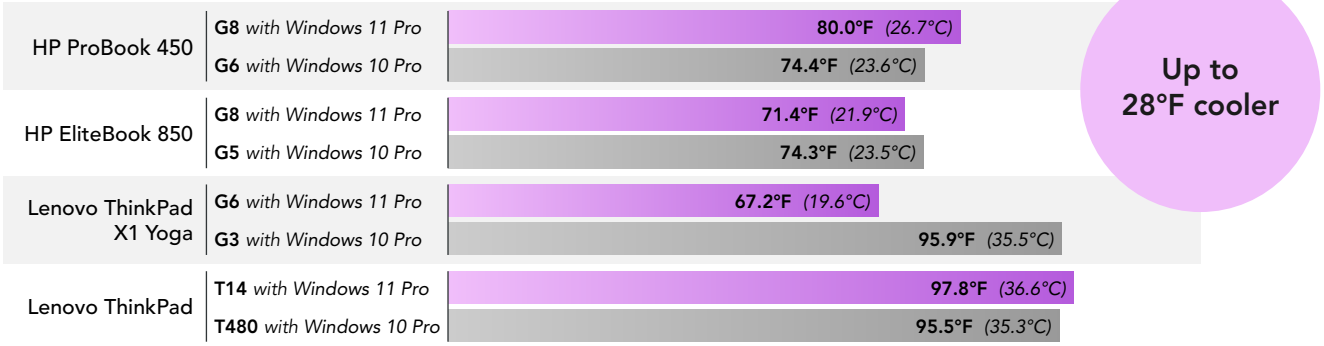
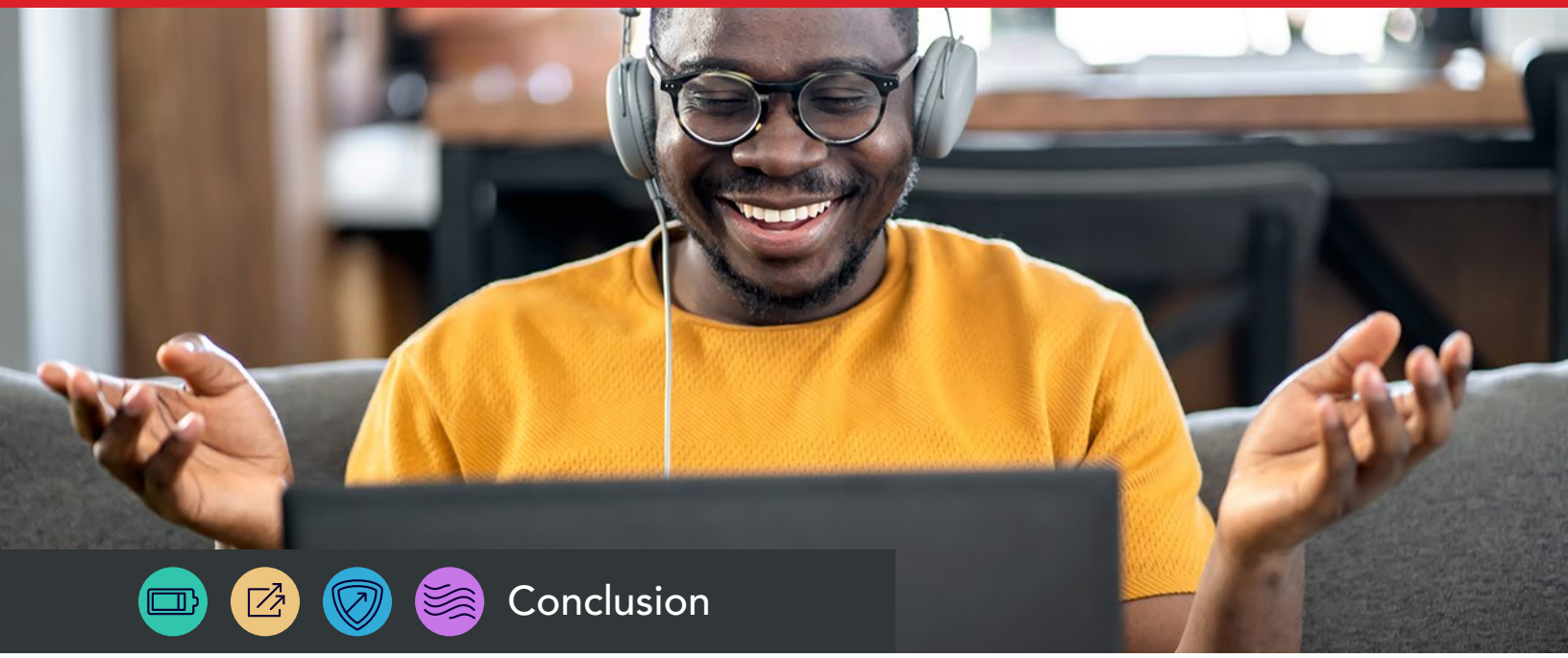


Figure 24: Average temperatures after running Cinebench R23 (multi-core) for 60 minutes. Lower temps are better. Source: Principled Technologies.



Conclusion

We saw consistent improvements in battery life, system responsiveness, and performance that support upgrading to current-gen versions of your favorite laptops preloaded with Windows 11 Pro and Intel Core i5 or i7 processors. Mainstream laptop users could potentially take advantage of longer battery life while working wherever they want, finish common and not so common tasks in less time, run compute-intensive applications without worrying about surface temperatures, and enable the VBS feature without stressing about a massive performance hit.

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Read the science behind this report at https://facts.pt/zDHm5Uy ▶

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