DEVICE COMPARISON WITH BENCHMARKS

Benchmarks give a representative view of device performance. When purchasing a device, consumers can use benchmark results that measure battery life, graphics performance, and processor power to better understand these important and varied capabilities. In our hands-on testing at Principled Technologies, we measured the performance of 20 devices: 16 devices were powered by an Intel® processor, 2 had a Samsung® Exynos® 5 Octa processor, and 2 had an Apple® processor. The devices were from multiple brands, and varied in display size and operating system: 4 running Android™, 2 running Apple iOS, and 14 running Microsoft® Windows® 8.1. We used an assortment of benchmarks to compare the devices.

DEVICES WE TESTED

For presenting our test results, we separated the devices into publicly available price-based categories. These prices are in US dollars. For detailed information about the devices we tested, see Appendix A. Figure 1 shows the devices we tested that range in price from $229 to $469.

	Processor	Operating system (OS)
Apple iPad mini™ 3	Apple A7	iOS 8
ASUS® Transformer Book T200TA	Intel Atom™ Z3795	Windows 8.1
Lenovo® Yoga™ Tablet 2 (8")	Intel Atom Z3745	Android 4.4
Lenovo Yoga Tablet 2 Pro	Intel Atom Z3745	Android 4.4
Samsung Galaxy Tab® S 8.4	Samsung Exynos 5 Octa	Android 4.4

Figure 1: General information about the devices we tested ranging in price from $229 to $469.

Figure 2 shows the devices we tested that range in price from $470 to $699.

	Processor	Operating system (OS)
Acer® Iconia® W7	Intel Core™ i3-3217U	Windows 8.1
Apple iPad Air™ 2	Apple A8X	iOS 8
Dell™ Venue™ 11 Pro 7000 Series	Intel Core M-5Y71	Windows 8.1
HP Split x2	Intel Core i3-4012Y	Windows 8.1
Lenovo Yoga 2 (13")	Intel Atom Z3745	Windows 8.1
Samsung Galaxy Note® Pro 12.2	Samsung Exynos 5 Octa	Android 4.4

Figure 2: General information about the devices we tested priced $470 to $699.

Figure 3 shows the devices we tested that range in price from $700 to $899.

	Processor	Operating system (OS)
ASUS Transformer Book Flip TP300LA	Intel Core i5-4210U	Windows 8.1
HP ElitePad 1000 G2	Intel Atom Z3795	Windows 8.1
HP Pro x2 410 G1	Intel Core i3-4012Y	Windows 8.1
Lenovo ThinkPad® Yoga	Intel Core i3-4010U	Windows 8.1

Figure 3: General information about the devices we tested priced $700 to $899.

Figure 4 shows the devices we tested that are priced from $900 and up.

	Processor	Operating system (OS)
Dell Latitude™ 13 7000 Series	Intel Core M-5Y10	Windows 8.1
HP Envy x2	Intel Core M-5Y71	Windows 8.1
Lenovo ThinkPad Helix 2	Intel Core M-5Y70	Windows 8.1
Lenovo Yoga 2 Pro	Intel Core i5-4210U	Windows 8.1
Lenovo Yoga 3 Pro	Intel Core M-5Y70	Windows 8.1

Figure 4: General information about the devices we tested priced $900 and up.

HOW WE COMPARED THE DEVICES

In addition to measuring the battery life of each device while browsing the Web, we ran the following benchmarks to test the devices:

- Futuremark® 3DMark®
- Geekbench 3, Single-core and Multi-core
- Basemark® OS II
- PassMark® PerformanceTest™ Mobile
- WebXPRT 2013

We ran each test three times and report the median of the runs. To learn about the benchmarks we used, see Appendix B, and to see detailed testing steps, see Appendix C.

Battery life

Many consumers consider battery life to be a crucial feature when purchasing a device. We measured battery life by running down the battery of each device while browsing the Internet with the default Web browser.

Futuremark 3DMark

Viewing graphics-heavy apps, large images, or running a graphics-heavy game can cause a device to run slowly. The 3DMark benchmark runs graphical and computational tests to generate a score for the tested device. The benchmark rates a system's graphics and virtual physics performance, and higher scores generally

demonstrate powerful hardware. Testing one or more parts with individual workloads creates each component score. Each workload focuses on a specific combination of effect and techniques.

Geekbench 3

The Geekbench 3 benchmark measures processor performance and has single-core and multi-core tests. Its workloads derive from real-world scenarios to help determine how a device will handle tasks and applications. The workloads are divided into the following four areas of performance:

- Integer performance (making heavy use of integer instructions)
- Floating-point performance (performing a variety of processor-intensive tasks especially important in video games, digital content creation, and high-performance computing applications)
- Memory performance (testing the memory hardware)
- Stream performance (measuring memory bandwidth)

The single-core test stresses only one core to produce a result. Many consumer applications run only one thread at a time, so this test is designed to serve as a real-world measure of common consumer workloads.

The multi-core test stresses multiple cores to produce a result, similar to the single-core test in procedure and environment. The key difference is the measure of multiple threads, which attempts to push the limits of the system and demonstrate maximum capabilities of the tested device.

WebXPRT 2013

WebXPRT 2013 measures Web-browsing performance of any Web-enabled device handling common Web tasks by simulating everyday usage scenarios. The benchmark times how long (in milliseconds) the tested device takes to complete tasks from four workloads. Then the benchmark uses the times to calculate a single-number overall score.

Basemark OS II

Basemark OS II is a system-level benchmark for measuring overall performance of smartphones and devices. As it is primarily a mobile device benchmark, Basemark OS II does not run on devices with Windows 8.1. The benchmark features a suite of tests that measure system, internal, and external memory; graphics; Web browsing; camera; battery; and CPU consumption.

PassMark PerformanceTest Mobile

PassMark PerformanceTest Mobile tests the speed and general performance of a mobile device. As it is primarily a mobile device benchmark, PassMark PerformanceTest Mobile does not run on devices with Windows 8.1. The standard test suite includes the following test categories:

- CPU, including mathematical operations, compression, and encryption
- 2D graphics, including drawing lines, bitmaps, fonts, text, and GUI elements
- 3D graphics, including DirectX® 3D graphics and animation elements
- Disk, including reading, writing, and seeking within disk files
- Memory, including allocating and accessing memory speed and efficiency

$229 TO $469 PRICE RANGE

Battery life

Figure 5 shows the results of the battery life test for devices ranging in price from $229 to $469. Both the Apple iPad mini 3 and the Intel Atom processor-powered Lenovo Yoga Tablet 2 (8") lasted over 9 hours in our test.
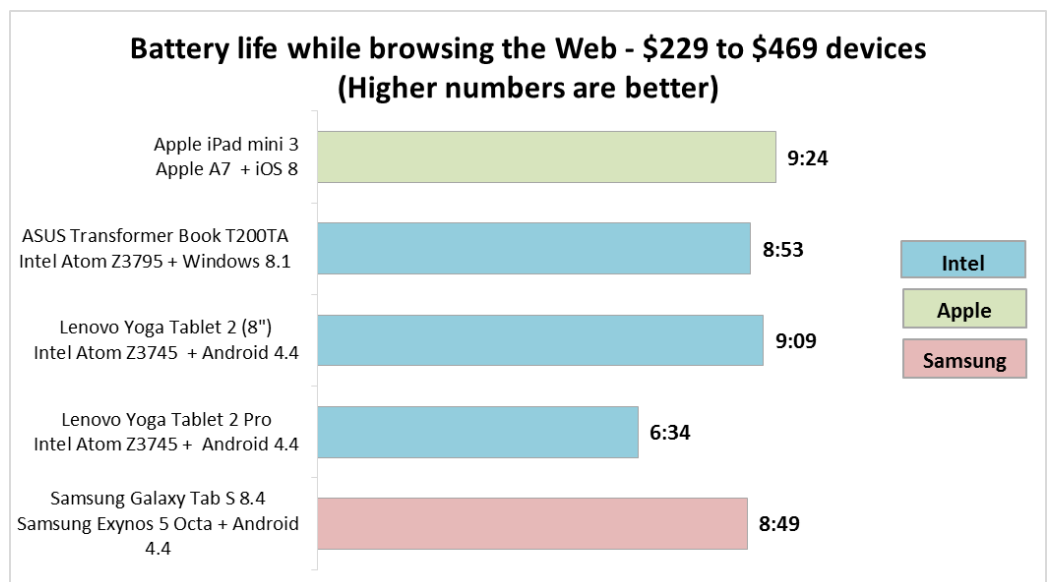
Figure 5: The Web browsing battery life in hours and minutes for each device ranging in price from $229 to $469.

Battery life while browsing the Web - $229 to $469 devices (Higher numbers are better)

Device	Time
Apple iPad mini 3 — Apple A7 + iOS 8	9:24
ASUS Transformer Book T200TA — Intel Atom Z3795 + Windows 8.1	8:53
Lenovo Yoga Tablet 2 (8") — Intel Atom Z3745 + Android 4.4	9:09
Lenovo Yoga Tablet 2 Pro — Intel Atom Z3745 + Android 4.4	6:34
Samsung Galaxy Tab S 8.4 — Samsung Exynos 5 Octa + Android 4.4	8:49

Legend: Intel, Apple, Samsung

Futuremark 3DMark

Figure 6 shows the results from our 3DMark testing for devices ranging in price from $229 to $469. Of these, the device with the highest score was the Intel Atom processor-powered ASUS Transformer Book T200TA at 18,058 and the device with the lowest score was the Samsung Galaxy Tab S 8.4 at 13,533.
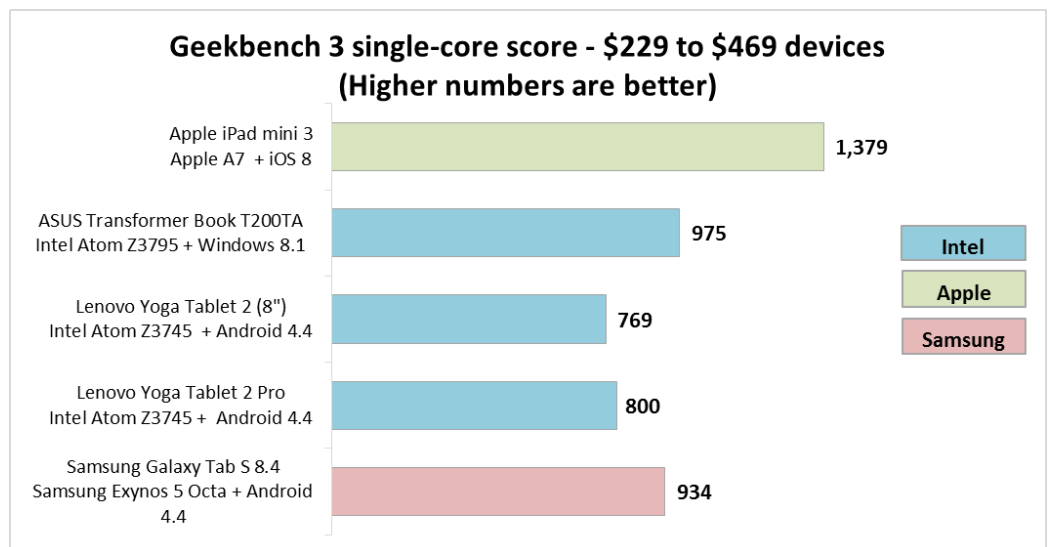
Figure 6: Graphics-based 3DMark scores for each device ranging in price from $229 to $469.
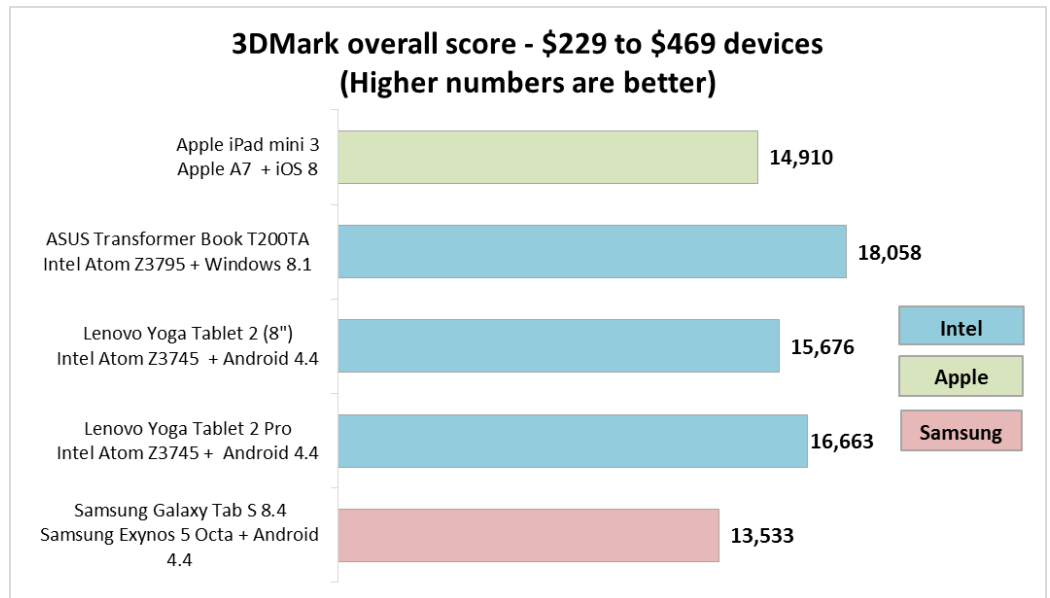
Geekbench 3
Single-core test

Figure 7 shows the results from our Geekbench single-core testing for devices ranging in price from $229 to $469. Of these, the Apple iPad mini 3 had the highest score at 1,379.
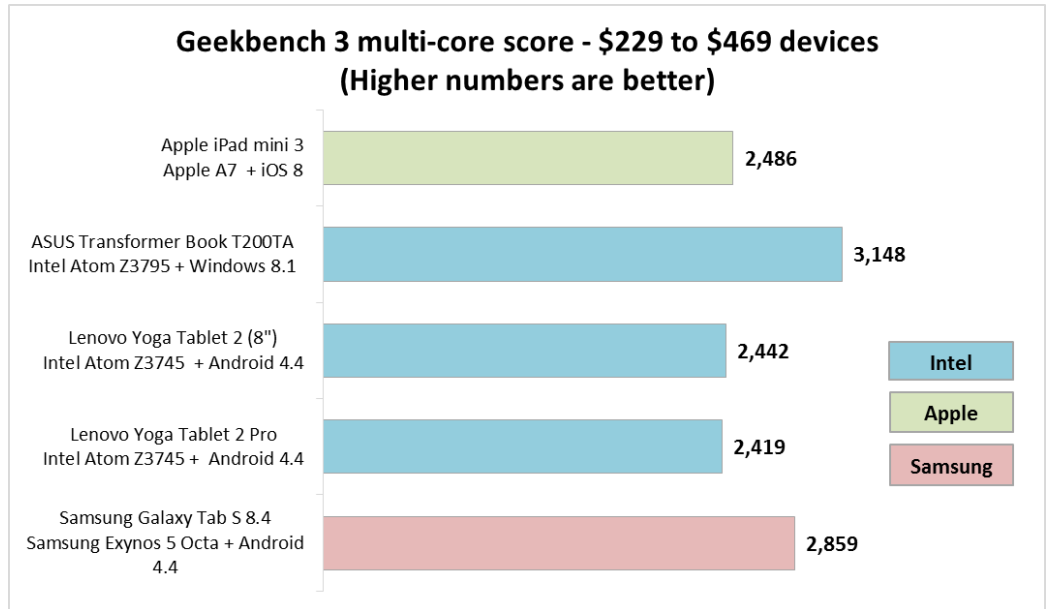
Figure 7: Single-core performance for each device ranging in price from $229 to $469.

Multi-core test

Figure 8 shows the results from our Geekbench multi-core testing for devices ranging in price from $229 to $469. Of these, the Intel Atom processor-powered ASUS Transformer Book T200TA had the highest score at 3,148.
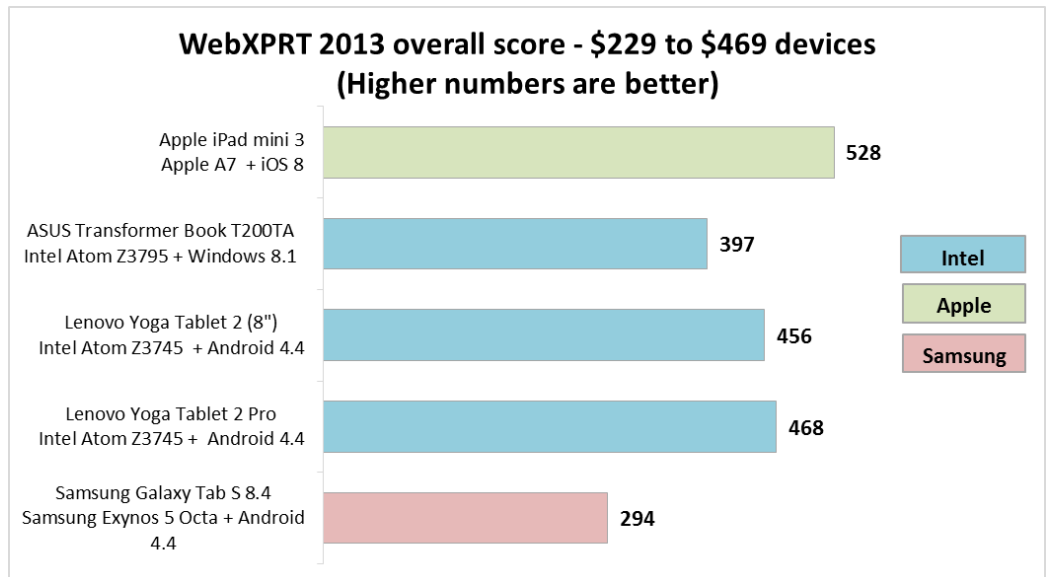
Figure 8: Multi-core performance for each device ranging in price from $229 to $469.

Geekbench 3 multi-core score - $229 to $469 devices
(Higher numbers are better)

Apple iPad mini 3
Apple A7 + iOS 8 — 2,486

ASUS Transformer Book T200TA
Intel Atom Z3795 + Windows 8.1 — 3,148

Lenovo Yoga Tablet 2 (8")
Intel Atom Z3745 + Android 4.4 — 2,442

Lenovo Yoga Tablet 2 Pro
Intel Atom Z3745 + Android 4.4 — 2,419

Samsung Galaxy Tab S 8.4
Samsung Exynos 5 Octa + Android 4.4 — 2,859

Intel / Apple / Samsung

WebXPRT 2013

Figure 9 shows the WebXPRT 2013 scores for the devices ranging in price from $229 to $469. Of these, the Apple iPad mini 3 had the highest score at 528 and the Samsung Galaxy Tab S 8.4 had the lowest score at 294.

Figure 9: Web browsing performance scores for each device ranging in price from $229 to $469.

WebXPRT 2013 overall score - $229 to $469 devices
(Higher numbers are better)

Apple iPad mini 3
Apple A7 + iOS 8 — 528

ASUS Transformer Book T200TA
Intel Atom Z3795 + Windows 8.1 — 397

Lenovo Yoga Tablet 2 (8")
Intel Atom Z3745 + Android 4.4 — 456

Lenovo Yoga Tablet 2 Pro
Intel Atom Z3745 + Android 4.4 — 468

Samsung Galaxy Tab S 8.4
Samsung Exynos 5 Octa + Android 4.4 — 294

Intel / Apple / Samsung

Basemark OS II

Figure 10 shows the overall Basemark OS II scores for the Android and iOS devices ranging in price from $229 to $469. Of these, the Apple iPad mini 3 had the highest score at 1,095, and the Samsung Galaxy Tab S 8.4 had the lowest score at 827.
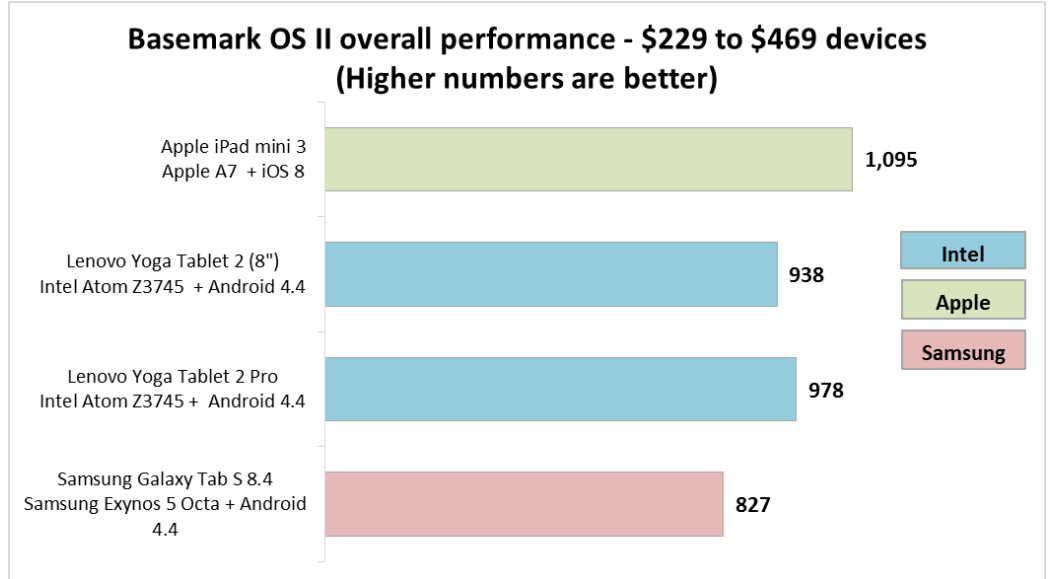
Figure 10: Performance scores for each device ranging in price from $229 to $469.

PassMark PerformanceTest Mobile

Figure 11 shows the PassMark PerformanceTest Mobile scores for the Android and iOS devices ranging in price from $229 to $469. Of these, the Intel Atom processor-powered Lenovo Yoga Tablet 2 Pro had the highest score at 5,736 and the Apple iPad mini 3 had the lowest score at 2,106.
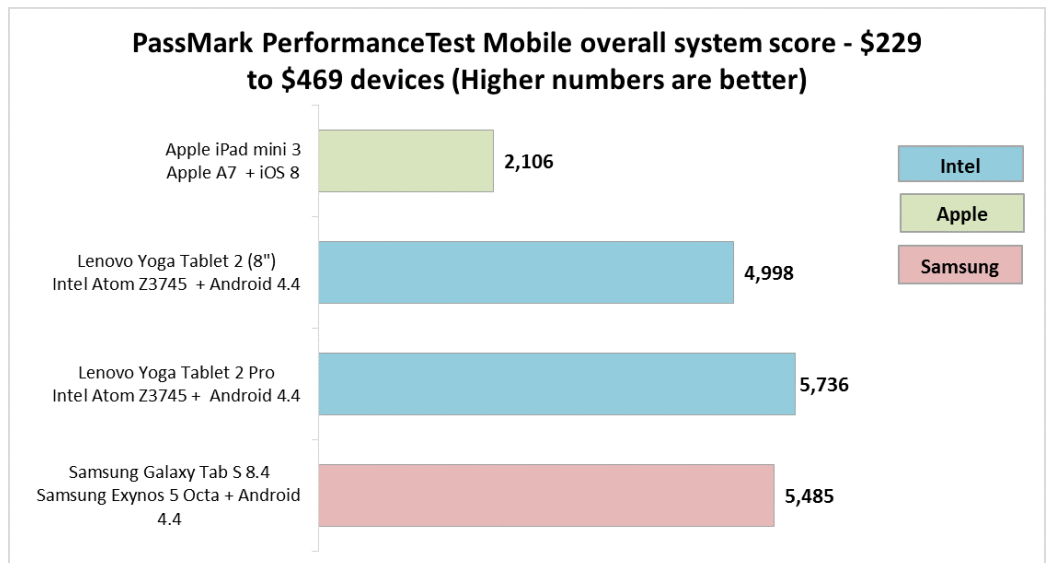
Figure 11: Performance scores for each device ranging in price from $229 to $469.

$470 TO $699 PRICE RANGE
Battery life

Figure 12 shows the results of the battery life test for devices that range in price from $470 to $699. Both the Intel Core M processor-powered Dell Venue 11 Pro 7000 Series and Intel Atom processor-powered Lenovo Yoga 2 (13") lasted over 9 hours in our test.
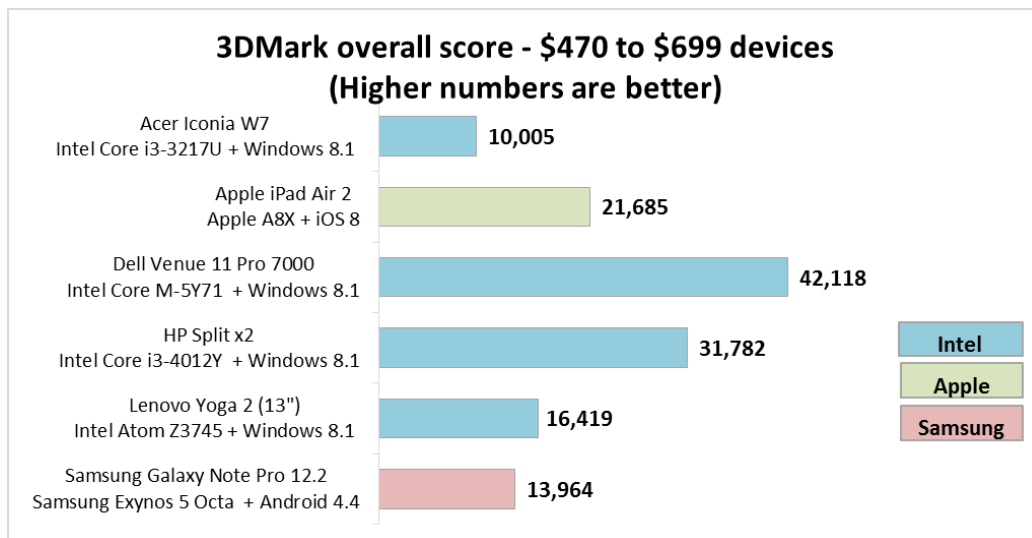
Figure 12: The Web browsing battery life in hours and minutes for each device ranging in price from $470 to $699.
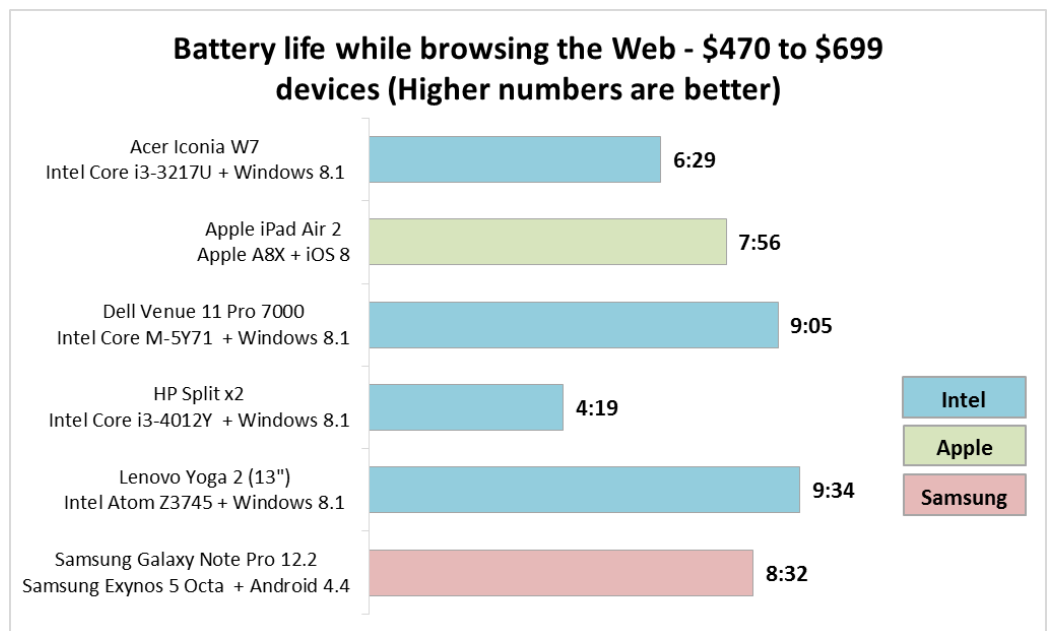
Futuremark 3DMark

Figure 13 shows the results from our 3DMark testing for devices that range in price from $470 to $699. Of these, the device with the highest score was the Intel Core M processor-powered Dell Venue 11 Pro 7000 Series at 42,118. (Note: When the Acer Iconia W7 is unplugged, the device by default downclocks its processor to conserve power.)
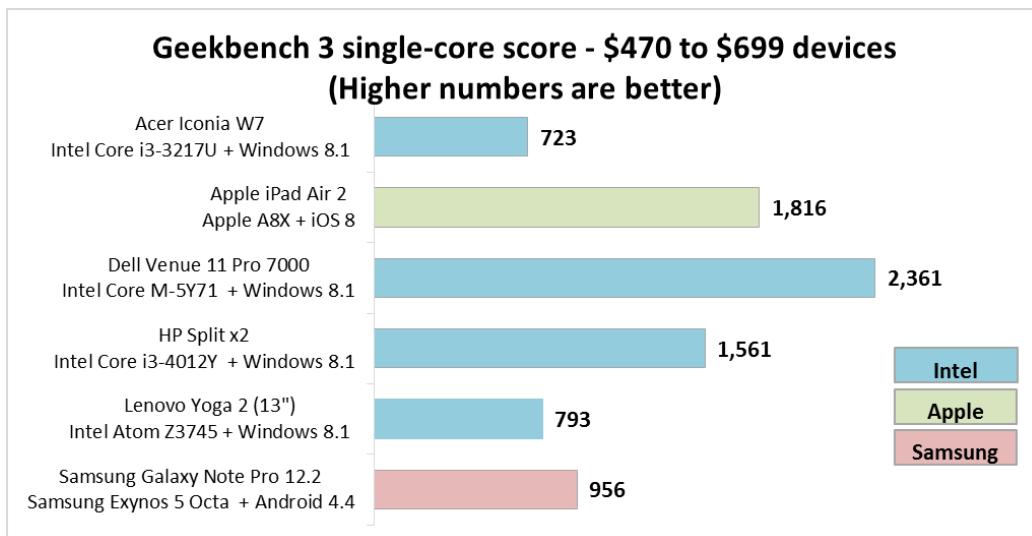
Figure 13: Graphics-based 3DMark scores for each device priced from $470 to $699.

3DMark overall score - $470 to $699 devices
(Higher numbers are better)

Device	Score
Acer Iconia W7 Intel Core i3-3217U + Windows 8.1	10,005
Apple iPad Air 2 Apple A8X + iOS 8	21,685
Dell Venue 11 Pro 7000 Intel Core M-5Y71 + Windows 8.1	42,118
HP Split x2 Intel Core i3-4012Y + Windows 8.1	31,782
Lenovo Yoga 2 (13") Intel Atom Z3745 + Windows 8.1	16,419
Samsung Galaxy Note Pro 12.2 Samsung Exynos 5 Octa + Android 4.4	13,964

Intel
Apple
Samsung

Geekbench 3
Single-core test

Figure 14 shows the results from our Geekbench single-core testing for devices that range in price from $470 to $699. Of these, the Intel Core M processor-powered Dell Venue 11 Pro 7000 Series had the highest score at 2,361.
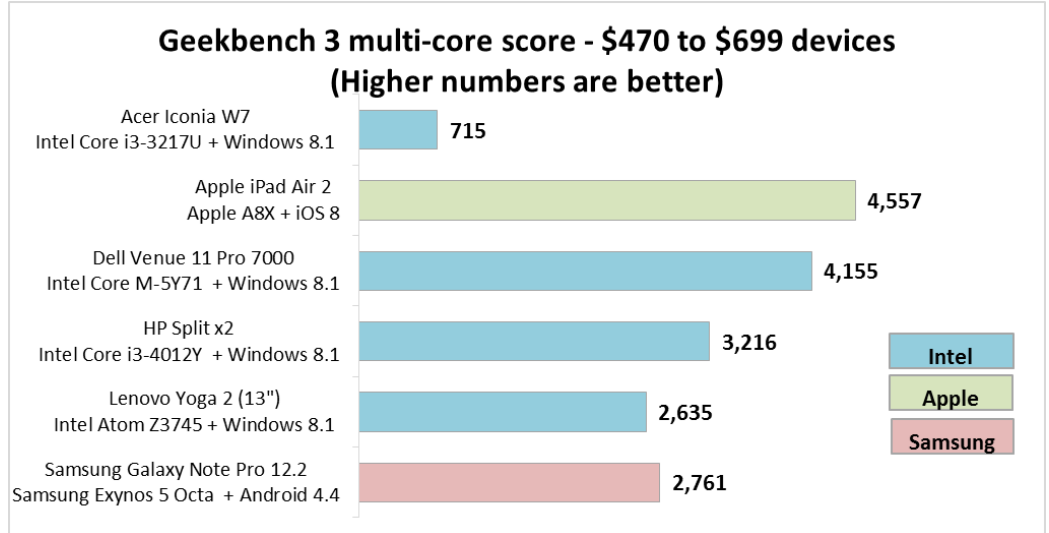
Figure 14: Single-core performance for each device priced from $470 to $699.

Geekbench 3 single-core score - $470 to $699 devices
(Higher numbers are better)

Device	Score
Acer Iconia W7 Intel Core i3-3217U + Windows 8.1	723
Apple iPad Air 2 Apple A8X + iOS 8	1,816
Dell Venue 11 Pro 7000 Intel Core M-5Y71 + Windows 8.1	2,361
HP Split x2 Intel Core i3-4012Y + Windows 8.1	1,561
Lenovo Yoga 2 (13") Intel Atom Z3745 + Windows 8.1	793
Samsung Galaxy Note Pro 12.2 Samsung Exynos 5 Octa + Android 4.4	956

Intel
Apple
Samsung

Multi-core test

Figure 15 shows the results from our Geekbench multi-core testing for devices that range in price from $470 to $699. Both the Apple iPad Air 2 and the Intel Core M processor-powered Dell Venue 11 Pro 7000 Series scored over 4,000.
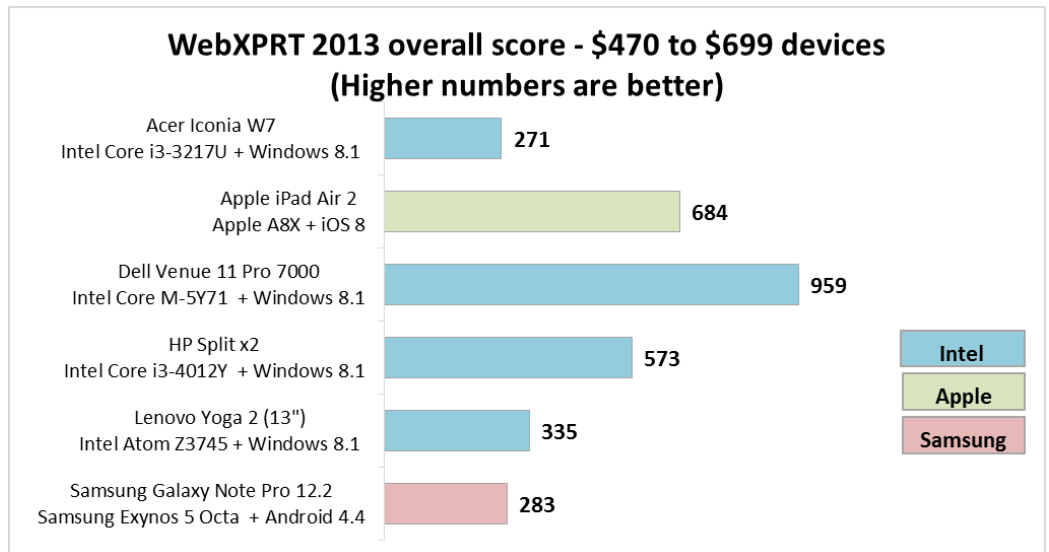
Figure 15: Multi-core performance for each device priced from $470 to $699.

Geekbench 3 multi-core score - $470 to $699 devices
(Higher numbers are better)

- Acer Iconia W7 / Intel Core i3-3217U + Windows 8.1 — 715
- Apple iPad Air 2 / Apple A8X + iOS 8 — 4,557
- Dell Venue 11 Pro 7000 / Intel Core M-5Y71 + Windows 8.1 — 4,155
- HP Split x2 / Intel Core i3-4012Y + Windows 8.1 — 3,216
- Lenovo Yoga 2 (13") / Intel Atom Z3745 + Windows 8.1 — 2,635
- Samsung Galaxy Note Pro 12.2 / Samsung Exynos 5 Octa + Android 4.4 — 2,761

Legend: Intel, Apple, Samsung

WebXPRT 2013

Figure 16 shows the WebXPRT 2013 scores for the devices that range in price from $470 to $699. Of these, the Intel Core M processor-powered Dell Venue 11 Pro 7000 Series had the highest score at 959.

Figure 16: Web browsing performance scores for each device priced from $470 to $699.

WebXPRT 2013 overall score - $470 to $699 devices
(Higher numbers are better)

- Acer Iconia W7 / Intel Core i3-3217U + Windows 8.1 — 271
- Apple iPad Air 2 / Apple A8X + iOS 8 — 684
- Dell Venue 11 Pro 7000 / Intel Core M-5Y71 + Windows 8.1 — 959
- HP Split x2 / Intel Core i3-4012Y + Windows 8.1 — 573
- Lenovo Yoga 2 (13") / Intel Atom Z3745 + Windows 8.1 — 335
- Samsung Galaxy Note Pro 12.2 / Samsung Exynos 5 Octa + Android 4.4 — 283

Legend: Intel, Apple, Samsung

Basemark OS II

Figure 17 shows the overall Basemark OS II scores with the Android and iOS devices ranging in price from $470 to $699. Of these, the Apple iPad Air 2 had the higher score at 1,882, and the Samsung Galaxy Note Pro 12.2 had the lower score at 825.

Figure 17: Performance scores for each device priced from $470 to $699.
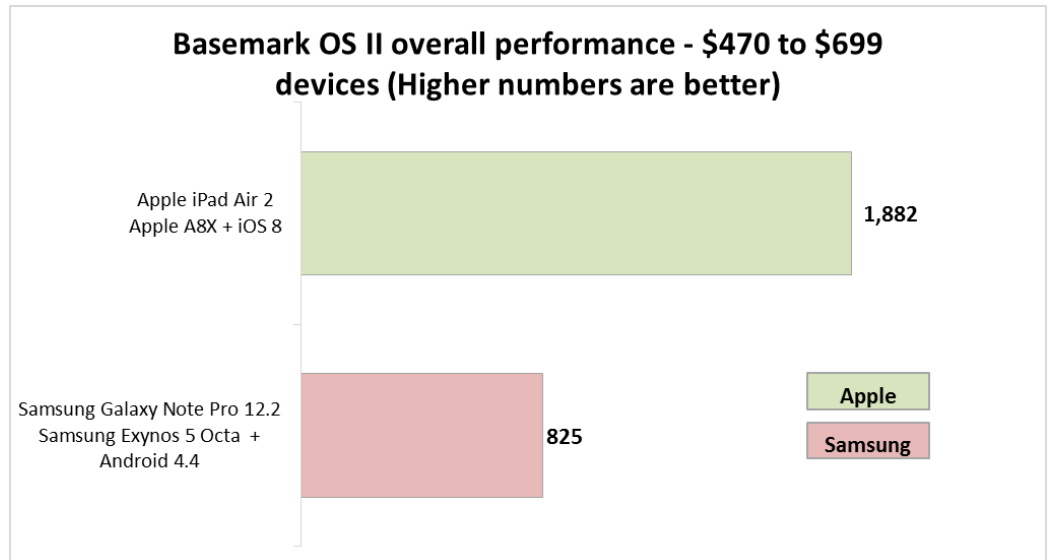
PassMark PerformanceTest Mobile

Figure 18 shows the PassMark PerformanceTest Mobile scores for the Android and iOS devices ranging in price from $470 to $699. Of these, the Samsung Galaxy Note Pro 12.2 had the higher score at 5,525, and the Apple iPad Air 2 had the lower score at 3,970.

Figure 18: Performance scores for each device $470 to $699.
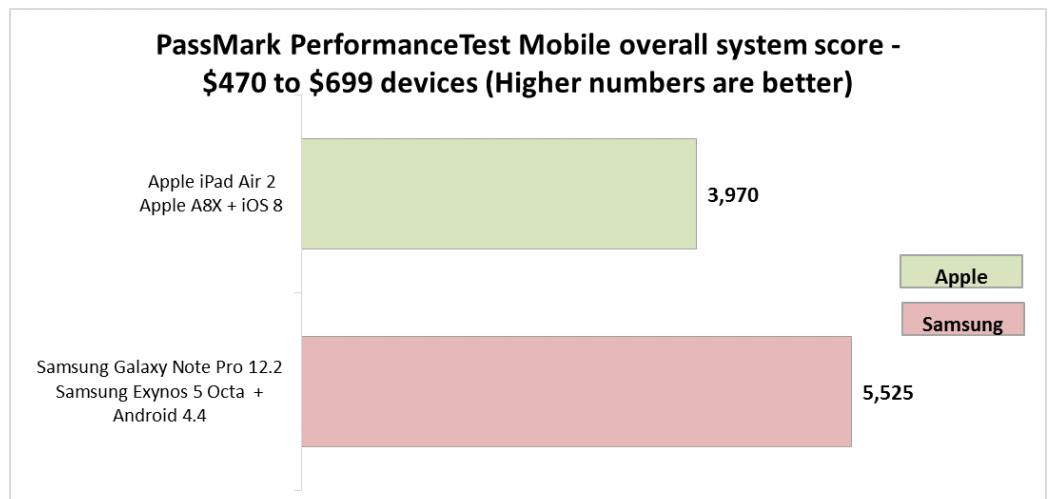
$700 TO $899 PRICE RANGE
Battery life

Figure 19 shows the results of the battery life test for devices that range in price from $700 to $899. The Intel Atom processor-powered HP ElitePad 1000 G2 had the longest battery life at just over 8 hours.

Figure 19: The Web browsing battery life in hours and minutes for each device ranging in price from $700 to $899.
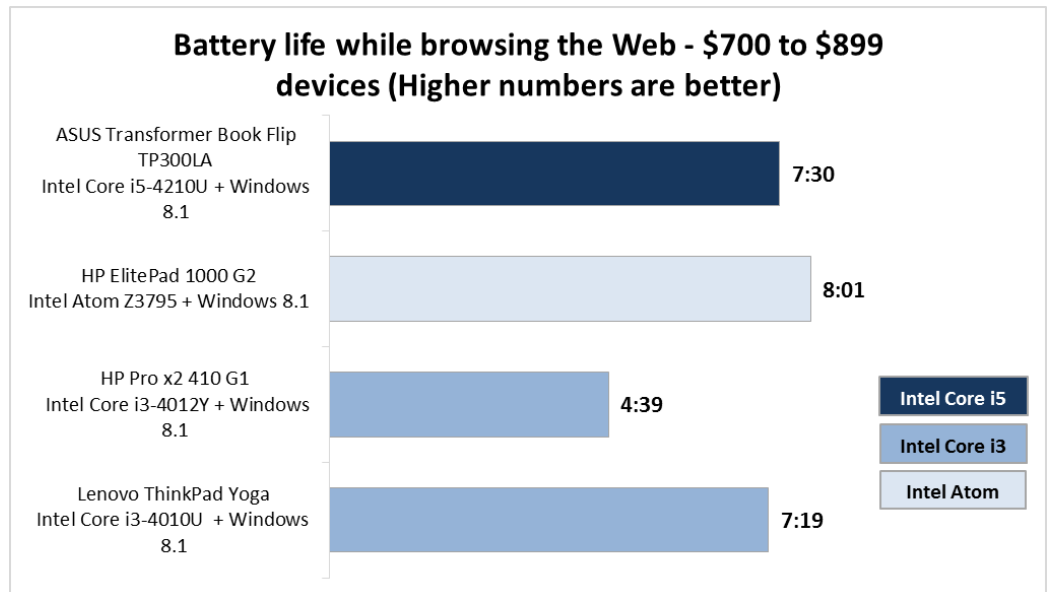
Futuremark 3DMark

Figure 20 shows the results from our 3DMark testing for devices that range in price from $700 to $899. Of these, the device with the highest score was the Intel Core i5 processor-powered ASUS Transformer Book Flip TP300LA at 42,331.

Figure 20: Graphics-based 3DMark scores for each device priced from $700 to $899.
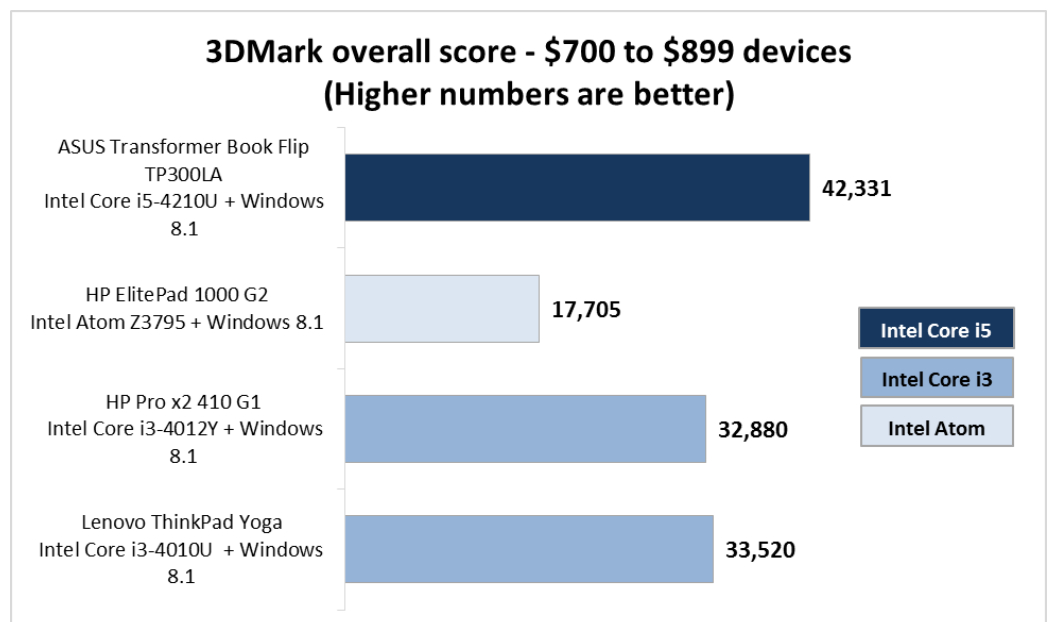
Geekbench 3
Single-core test

Figure 21 shows the results from our Geekbench single-core testing for devices that range in price from $700 to $899. Of these, the Intel Core i5 processor-powered ASUS Transformer Book Flip TP300LA had the highest score at 2,563.

Figure 21: Single-core performance for each device priced from $700 to $899.
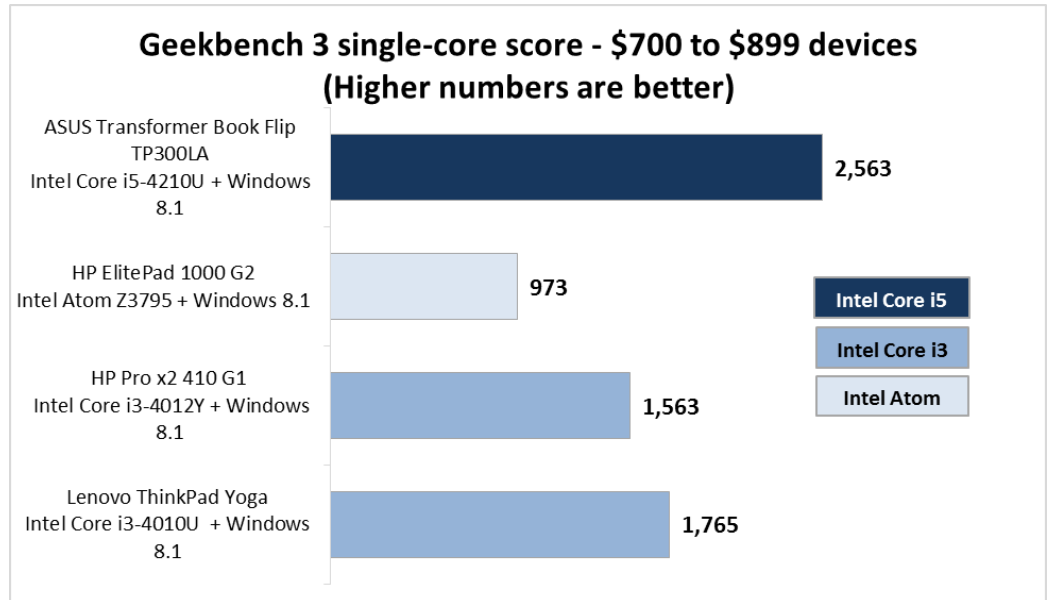
Multi-core test

Figure 22 shows the results from our Geekbench multi-core testing for devices that range in price from $700 to $899. Of these, the Intel Core i5 processor-powered ASUS Transformer Book Flip TP300LA had the highest score at 4,915.

Figure 22: Multi-core performance for each device priced from $700 to $899.
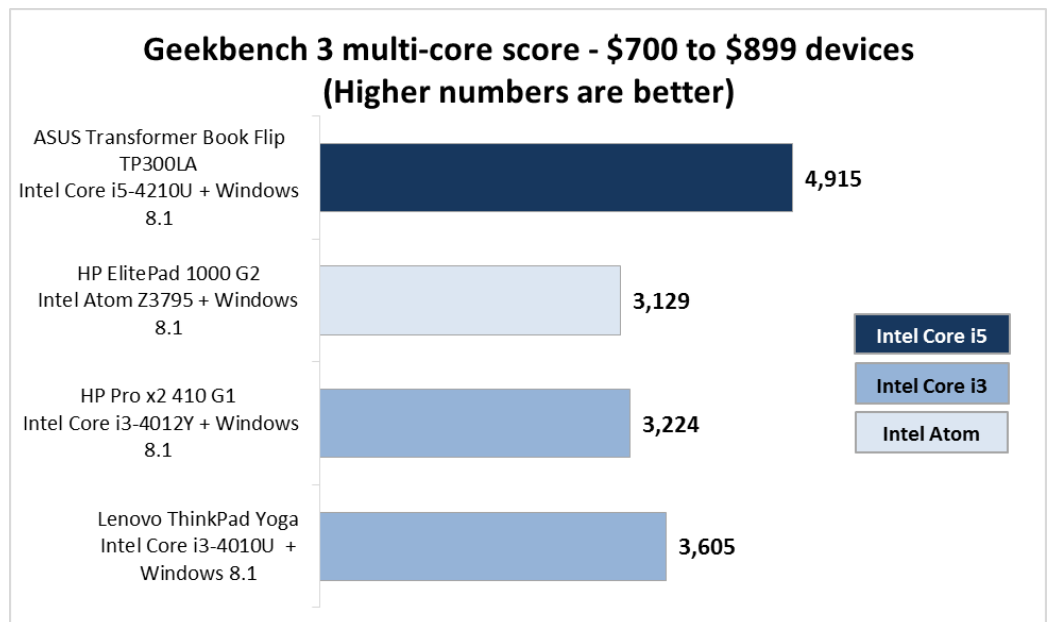
WebXPRT 2013

Figure 23 shows the WebXPRT 2013 scores for the devices that range in price from $700 to $899. Of these, the Intel Core i5 processor-powered ASUS Transformer Book Flip TP300LA had the highest score at 865.

Figure 23: Web browsing performance scores for each device priced from $700 to $899.
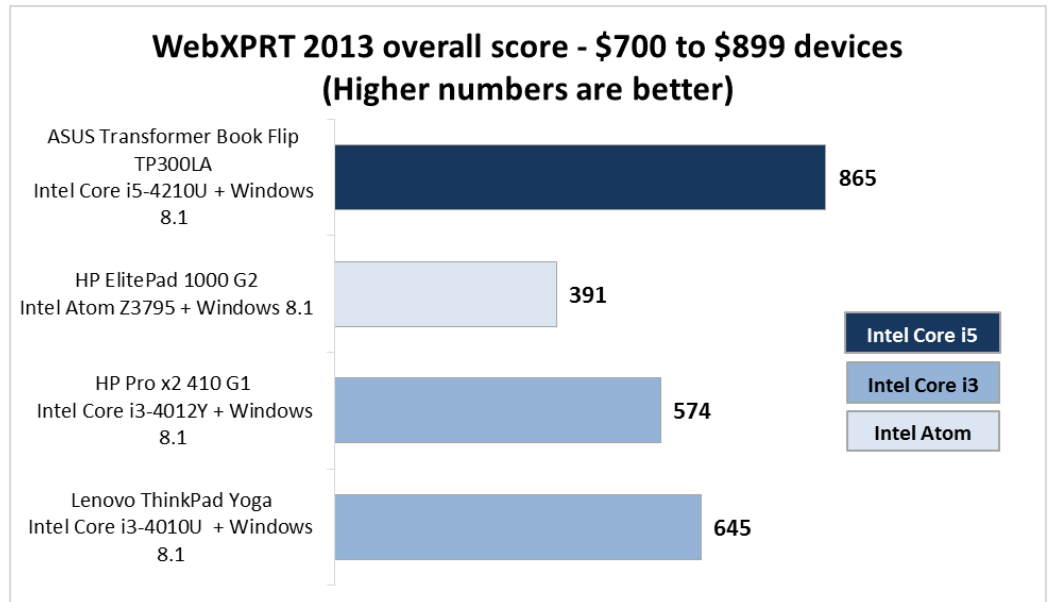

Basemark OS II

All of the devices we tested in this price range—ASUS Transformer Book Flip TP300LA, HP ElitePad 1000 G2, HP Pro x2 410 G1, and Lenovo ThinkPad Yoga—have Windows 8.1 as their operating system, and could not run Basemark OS II.

PassMark PerformanceTest Mobile

All of the devices we tested in this price range—ASUS Transformer Book Flip TP300LA, HP ElitePad 1000 G2, HP Pro x2 410 G1, and Lenovo ThinkPad Yoga—have Windows 8.1 as their operating system, and could not run PassMark PerformanceTest Mobile.

$900 AND UP PRICE RANGE
Battery life

Figure 24 shows the results of the battery life test for devices that range in price from $900 and up. The Intel Core M processor-powered Lenovo ThinkPad Helix 2 had the longest battery life at 8 hours and 23 minutes.

Figure 24: The Web browsing battery life in hours and minutes for each device priced at $900 or more.
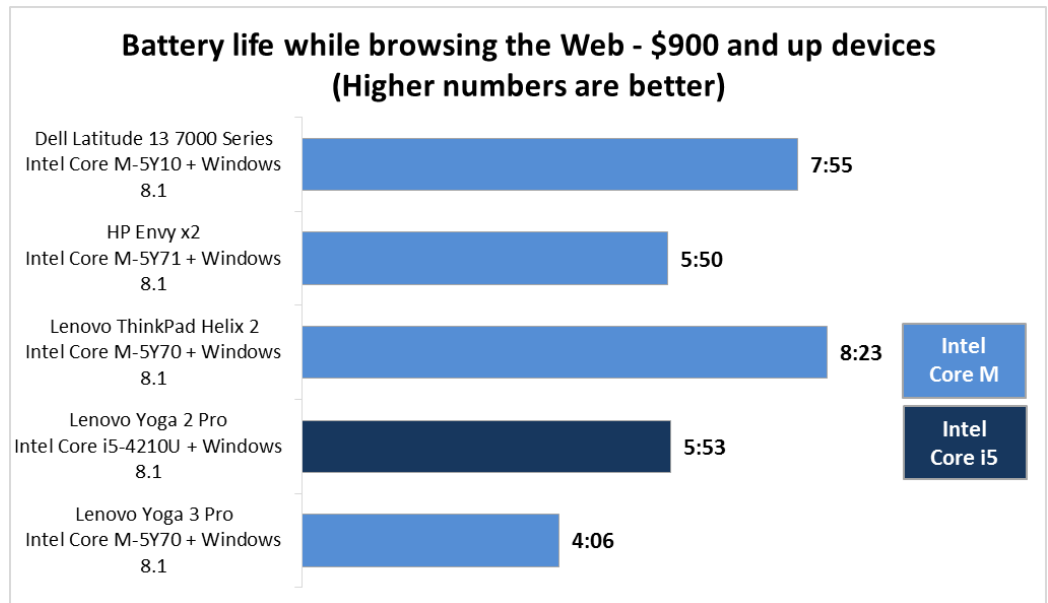
Futuremark 3DMark

Figure 25 shows the results from our 3DMark testing for devices that range in price from $900 and up. Of these, the device with the highest score was the Intel Core i5 processor-powered Lenovo Yoga 2 Pro at 43,086.
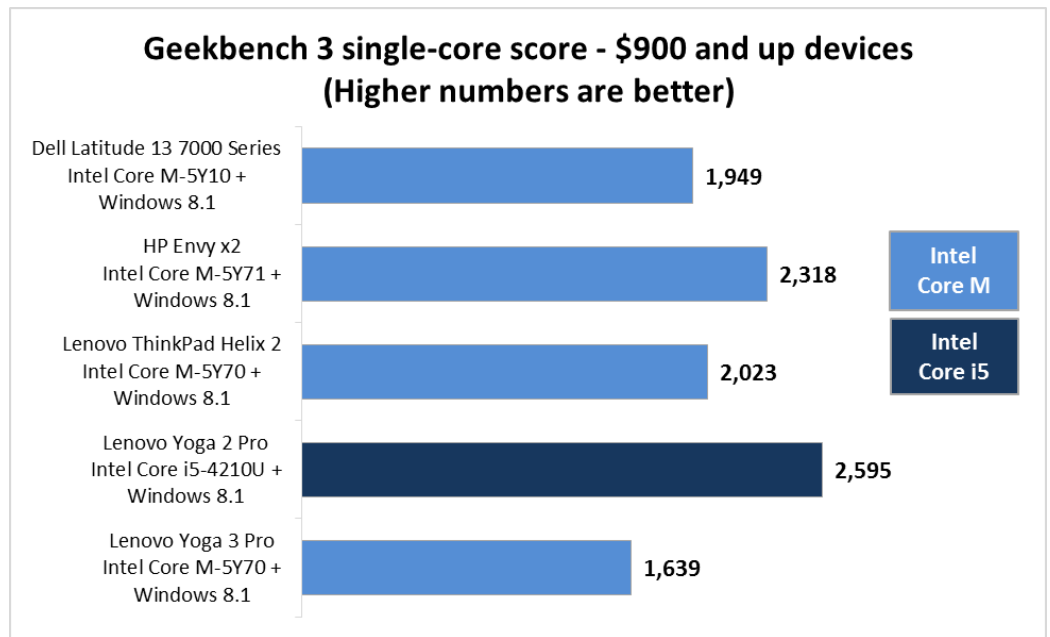
Figure 25: Graphics-based 3DMark scores for each device priced at $900 or more.
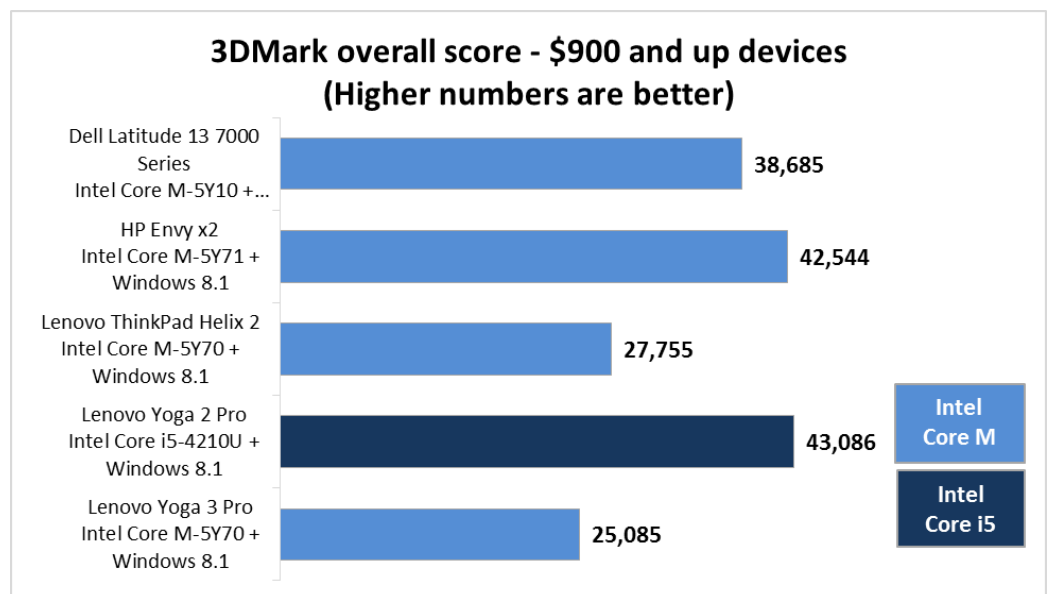
Geekbench 3
Single-core test

Figure 26 shows the results from our Geekbench single-core testing for devices that range in price from $900 and up. Of these, the Intel Core i5 processor-powered Lenovo Yoga 2 Pro had the highest score at 2,595.
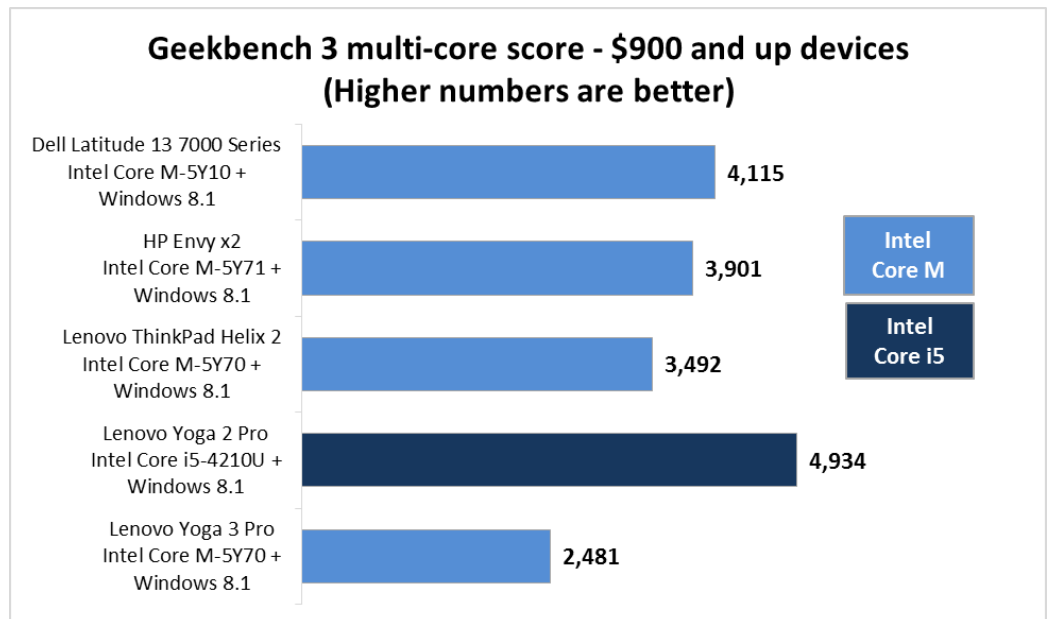
Figure 26: Single-core performance for each device priced at $900 or more.

Multi-core test

Figure 27 shows the results from our Geekbench multi-core testing for devices that range in price from $900 and up. Of these, the Intel Core i5 processor-powered Lenovo Yoga 2 Pro had the highest score at 4,934.

Figure 27: Multi-core performance for each device priced at $900 or more.

WebXPRT 2013

Figure 28 shows the WebXPRT 2013 scores for the devices that range in price from $900 and up. Of these, the Intel Core M processor-powered HP Envy x2 had the highest score at 1,030.
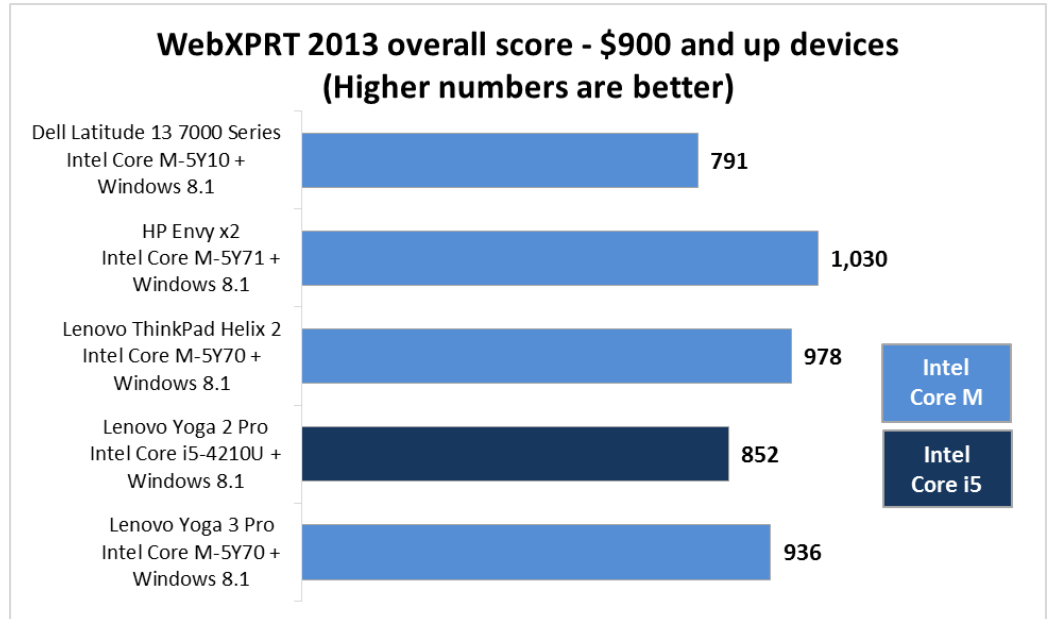
Figure 28: Web browsing performance scores for each device priced at $900 or more.

Basemark OS II

All of the devices we tested in this price range—the Dell Latitude 13 7000 Series, HP Envy x2, Lenovo ThinkPad Helix 2, Lenovo Yoga 2 Pro, and Lenovo Yoga 3 Pro—have Windows 8.1 as their operating system, and could not run Basemark OS II.

PassMark PerformanceTest Mobile

All of the devices we tested in this price range—the Dell Latitude 13 7000 Series, HP Envy x2, Lenovo ThinkPad Helix 2, Lenovo Yoga 2 Pro, and Lenovo Yoga 3 Pro—have Windows 8.1 as their operating system, and could not run PassMark PerformanceTest Mobile.

CONCLUSION

When consumers want to purchase devices, the two biggest factors they consider are battery life and performance. We used a variety of benchmark tests to evaluate these two factors for 20 publicly available tablets. The Intel Atom-powered Lenovo Yoga 2 (13") lasted the longest in our Web browsing battery life test—9 hours and 34 minutes. For performance, the Intel Core i5 processor-powered Lenovo Yoga 2 Pro had the highest score on three benchmarks—Futuremark 3DMark, Geekbench single-core, and Geekbench multi-core. The Intel Core M processor-powered HP Envy x2 had the highest score on WebXPRT 2013.

APPENDIX A – THE DEVICES WE TESTED

Figures 29 through 33 present detailed specifications for the devices we tested.

$229 to $469 price range

System information	Apple iPad mini 3	Asus Transformer Book T200TA	Lenovo Yoga Tablet 2 (8")	Lenovo Yoga Tablet 2 Pro	Samsung Galaxy Tab S 8.4
Screen size (inches)	7.9	11.6	8	13.3	8.4
Screen size (mm)	200.66	294.64	203.2	337.82	213.36
Display resolution	2048 × 1536	1366 × 768	1920 × 1200	2560 × 1440	2560 × 1600
PPI	324.05	135.09	283.02	220.84	359.39
Dimensions (inches)	7.9 × 5.3 × 0.31	11.9 × 7.6 × 0.47 (tablet) 11.9 × 7.9 × 1.1 (tablet + dock)	8.3 × 5.9 × 0.82	13.1 × 8.8 × 0.91	8.4 × 5.0 × 0.27
Dimensions (mm)	200.0 × 134.6 × 7.8	304.3 × 194.0 × 12.0 (tablet) 304.3 × 200.4 × 28.9 (tablet + dock)	210.3 × 149.0 × 20.7	331.6 × 223.9 × 23.0	213.0 × 126.2 × 6.9
Weight (lbs.)	0.73	1.73 (tablet) 3.40 (tablet + dock)	0.96	2.2	0.65
Weight (grams)	329.8	785.3 (tablet) 1,541.0 (tablet + dock)	434	998.2	296
CPU	Apple A7 dual-core @ 1.3GHz	Intel Atom Z3795 quad-core @ 2.39GHz	Intel Atom Z3745 quad-core @ 1.86GHz	Intel Atom Z3745 quad-core @ 1.86GHz	Samsung Exynos 5 Octa 5420 @ 1.9GHz
Storage	16 GB	64 GB	16 GB	32 GB	16 GB
Browser	Safari®	Internet Explorer®	Chrome™	Chrome	Chrome
OS	iOS 8.1.3	Windows 8.1 x64	Android 4.4.2	Android 4.4.2	Android 4.4.2
RAM	1 GB	4 GB	2 GB	2 GB	3 GB
Price as of 2-11-15 (USD)	$399.00	$459.00	$229.00	$469.00	$349.00

Figure 29: Detailed information for the devices we tested ranging in price from $229 to $469.

$470 to $699 price range

System information	Acer Iconia W7	Apple iPad Air 2	Dell Venue 11 Pro 7000 Series
Screen size (inches)	11.6	9.7	10.8
Screen size (mm)	294.64	246.38	274.32
Display resolution	1920 × 1080	2048 × 1536	1920 × 1080
PPI	189.91	263.92	203.97
Dimensions (inches)	11.6 × 7.5 × 0.48	9.4 × 6.7 × 0.25	11.0 × 6.9 × 0.46
Dimensions (mm)	295.7 × 191.2 × 12.3	239.9 × 169.4 × 6.3	280.2 × 176.8 × 11.6
Weight (lbs.)	2.07	0.96	1.58
Weight (grams)	940.3	436.2	715.7
CPU	Intel Core i3-3217U dual-core @ 1.8GHz	Apple A8X tri-core @ 1.5GHz	Intel Core M-5Y71 dual-core @ 2.9GHz
Storage	64 GB	16 GB	64 GB
Browser	Internet Explorer	Safari	Internet Explorer
OS	Windows 8.1 x64	iOS 8.1.3	Windows 8.1 Pro x64
RAM	4 GB	1 GB	4 GB
Price as of 2-11-15 (USD)	$699.00	$499.00	$699.00

Figure 30: Detailed information for the devices we tested ranging in price from $470 to $699.

System information	HP Split x2	Lenovo Yoga 2 (13")	Samsung Galaxy Note Pro 12.2
Screen size (inches)	13.3	13.3	12.2
Screen size (mm)	337.82	337.82	309.88
Display resolution	1366 × 768	2650 × 1440	2560 × 1600
PPI	117.83	220.84	247.45
Dimensions (inches)	12.9 × 8.6 × 0.53 (tablet) 12.9 × 9.9 × 0.94 (tablet + dock)	12.6 × 8.7 × 0.91	11.6 × 8.0 × 0.32
Dimensions (mm)	327.6 × 217.5 × 13.5 (tablet) 327.6 × 252.4 × 23.8 (tablet + dock)	320.9 × 221.1 × 22.9	295.4 × 204.0 × 8.1
Weight (lbs.)	2.47 (tablet) 4.39 (tablet + dock)	2.3	1.64
Weight (grams)	1,121.8 (tablet) 1,992.5 (tablet + dock)	1043.4	746.1
CPU	Intel Core i3-4012Y dual-core @ 1.5GHz	Intel Atom Z3745 quad-core @ 1.86GHz	Samsung Exynos 5 Octa 5420 @ 1.9GHz
Storage	500 GB	64 GB	32 GB
Browser	Internet Explorer	Internet Explorer	Chrome
OS	Windows 8.1 x64	Windows 8.1 x32	Android 4.4.2
RAM	4 GB	2 GB	3 GB
Price as of 2-11-15 (USD)	$549.00	$599.99	$599.00

Figure 31: Detailed information for the devices we tested ranging in price from $470 to $699.

$700 to $899 price range

System information	ASUS Transformer Book Flip TP300LA	HP ElitePad 1000 G2	HP Pro x2 410 G1	Lenovo ThinkPad Yoga
Screen size (inches)	13.3	10.1	11.6	12.5
Screen size (mm)	337.82	256.54	294.64	317.5
Display resolution	1920 × 1080	1920 × 1200	1366 × 768	1366 × 768
PPI	165.63	224.17	135.09	125.37
Dimensions (inches)	12.7 × 9.2 × 0.88	10.3 × 7.0 × 0.36	11.9 × 7.6 × 0.47 (tablet) 11.9 × 8.1 × 0.95 (tablet + dock)	12.4 × 8.7 × 0.85
Dimensions (mm)	323.34 × 233.9 × 22.3	260.7 × 177.6 × 9.2	303.1 × 192.7 × 11.9 (tablet) 303.1 × 206.1 × 24.2 (tablet + dock)	316.6 × 220.0 × 21.5
Weight (lbs.)	3.93	1.43	1.83 (tablet) 3.50 (tablet + dock)	3.54
Weight (grams)	1783	650.8	829.6 (tablet) 1,589.9 (tablet + dock)	1606.4
CPU	Intel Core i5-4210U dual-core @ 2.7GHz	Intel Atom Z3795 quad-core @ 2.39GHz	Intel Core i3-4012Y dual-core @ 1.5GHz	Intel Core i3-4010U dual-core @ 1.7GHz
Storage	500 GB	64 GB	128 GB	500 GB
Browser	Internet Explorer	Internet Explorer	Internet Explorer	Internet Explorer
OS	Windows 8.1 x64	Windows 8.1 x64	Windows 8.1 x64	Windows 8.1 x64
RAM	8 GB	4 GB	4 GB	4 GB
Price as of 2-11-15 (USD)	$729.00	$739.00	$829.00	$854.00

Figure 32: Detailed information for the devices we tested ranging in price from $700 to $899.

$900 and up price range

System information	Dell Latitude 13 7000 Series	HP Envy x2	Lenovo ThinkPad Helix 2	Lenovo Yoga 2 Pro	Lenovo Yoga 3 Pro
Screen size (inches)	13.3	13.3	11.6	13.3	13.3
Screen size (mm)	337.82	337.82	294.64	337.82	337.82
Display resolution	1920 × 1080	1920 × 1080	1920 × 1080	3200 × 1800	3200 × 1800
PPI	165.63	165.63	189.91	276.05	276.05
Dimensions (inches)	12.4 × 8.1 × 0.47 (tablet) 12.4 × 9.0 × 0.85 (tablet + dock)	13.9 × 8.5 × 0.54 (tablet) 13.9 × 8.9 × 0.77 (tablet + dock)	11.9 × 7.6 × 0.37 (tablet) 11.9 × 8.5 × 1.0 (tablet + dock)	12.9 × 8.7 × 0.65	12.7 × 8.9 × 0.52
Dimensions (mm)	315.8 × 206.1 × 11.9 (tablet) 315.8 × 229.2 × 21.6 (tablet + dock)	354.1 × 216.1 × 13.8 (tablet) 354.1 × 226.5 × 19.6 (tablet + dock)	301.1 × 192.5 × 9.5 (tablet) 301.1 × 216.8 × 26.4 (tablet + dock)	327.9 × 220.2 × 16.5	322.3 × 228.4 × 13.4
Weight (lbs.)	1.96 (tablet) 3.64 (tablet + dock)	2.71 (tablet) 3.88 (tablet + dock)	1.71 (tablet) 2.91 (tablet + dock)	3.05	2.58
Weight (grams)	887.3 (tablet) 1,650.9 (tablet + dock)	1.230.5 (tablet) 1,759.3 (tablet + dock)	776.9 (tablet) 1,318.6 (tablet + dock)	1382.4	1170.6
CPU	Intel Core M-5Y10 dual-core @ 2.0GHz	Intel Core M-5Y71 dual-core @ 2.9GHz	Intel Core M-5Y70 dual-core @ 2.6GHz	Intel Core i5-4210U dual-core @ 2.7GHz	Intel Core M-5Y70 dual-core @ 2.6GHz
Storage	128 GB	128 GB	256 GB	256 GB	256 GB
Browser	Internet Explorer	Internet Explorer	Internet Explorer	Internet Explorer	Internet Explorer
OS	Windows 8.1 Pro x64	Windows 8.1 x64	Windows 8.1 Pro x64	Windows 8.1 x64	Windows 8.1 x64
RAM	4 GB	8 GB	8 GB	8 GB	8 GB
Price as of 2-11-15 (USD)	$1,199.00	$1,049.00	$1,399.00	$1,187.00	$1,199.00

Figure 33: Detailed information for the devices we tested priced $900 and up.

APPENDIX B – THE BENCHMARKS WE USED FOR TESTING

About 3DMark

3DMark is a benchmark that uses 3D graphics and physics simulations to evaluate the graphics capabilities as well as the general performance of a system. For more information about 3DMark, visit www.futuremark.com/benchmarks/3dmark/all.

About Geekbench 3

According to Primate Labs, Geekbench 3 is a processor benchmark with a "new scoring system that separates single-core and multi-core performance, and new workloads that simulate real-world scenarios." For more information on Geekbench 3, visit www.primatelabs.com/geekbench/.

About WebXPRT 2013

WebXPRT 2013 uses scenarios created to mirror the tasks you do every day to compare the performance of almost any Web-enabled device. It contains four HTML5- and JavaScript-based workloads: Photo Effects, Face Detect, Stocks Dashboard, and Offline Notes. From these workloads, the benchmark calculates a composite Overall Score for easy comparison. For more information about WebXPRT, visit www.webxprt.com.

About Basemark OS II

According to Rightware®, "Basemark OS II is a system-level All-In-One benchmarking tool designed for measuring overall performance of smartphones and devices from all platforms, including Android, iOS, and Windows Phone® 8.

"The benchmark features a comprehensive suite of tests and produces an objective overall score as well as a breakdown of each tested area, including system, internal and external memory, graphics, web browsing, camera, battery and CPU consumption."

For more information on Basemark OS II, visit www.rightware.com/consumer/basemark-os-ii/.

About PassMark PerformanceTest Mobile

According to PassMark, PerformanceTest Mobile is designed for "Android device speed testing and benchmarking. PassMark PerformanceTest Mobile allows you to objectively benchmark an Android device using a variety of different speed tests and compare the results to others." For more information about PassMark PerformanceTest Mobile, visit www.passmark.com/products/pt_mobile.htm.

APPENDIX C – HOW WE TESTED

Battery life test

We ran a Web browsing battery life rundown test in which a Web site that frequently updates is displayed until the battery fully discharges. Each device started fully charged and set at identical brightness settings (~200 nits). A timer in the background and a video camera captured each run.

Measuring battery life while browsing a Web site

Setting up the test

1. Open the default Web browser on each device, and bookmark the www.msn.com Web site.
2. Set the displays to as close as possible to 200 nits.
3. Plug the chargers into a power strip.
4. Make sure the batteries are all 100% charged.
5. Make sure the displays will not automatically turn off during the test.
    a. For iOS devices:
        i. Go to Settings→General→Auto-Lock→Never.
    b. For Windows devices:
        i. Right-click on the desktop→Select Personalize→Screensaver→Change power settings→Change plan settings→Set all options to Never.
    c. For Android devices, install the RedEye Stay Awake app from the Google Play™ Store.
6. Set the devices on a stand with a clock nearby.

Running the test

1. Start the video camera.
2. Open the default Web browser on each phone, and go to the bookmarked Web site.
3. Verify that there is only one tab open in each browser.
4. Unplug the devices and note the time.
5. After the devices have fully discharged, review the video to determine when each device powers off.
6. Fully charge the devices.
7. Complete steps 1 through 6 two more times.

3DMark

Setting up the test

1. Install 3DMark.
    a. Download 3DMark from the appropriate App Store.
    b. To begin the installation, click Install.
    c. After the installation is complete, click Open.
    d. Press OK, Let's go.
    e. Press Install to install the Ice Storm benchmark.
    f. Close 3DMark.

Setup is complete.

Running the test

1. Launch 3DMark by pressing the 3DMark icon.

2. Press the drop-down arrow to display the different benchmark options.

3. Press Ice Storm Unlimited to start the benchmark.

4. When the test completes, record the results.

5. Complete steps 1 through 4 two more times.

6. Report the median of the three runs.

Geekbench 3

Setting up the test

1. Install Geekbench 3.

    a. Download Geekbench 3 from the appropriate App Store.

    b. To begin the installation, click Install.

    c. After the installation is complete, close the App Store.

Setup is complete.

Running the test

1. Launch Geekbench 3 by pressing the Geekbench 3 icon.

2. Press Run Benchmarks.

3. When the test completes, record the results.

4. Complete steps 1 through 3 two more times.

5. Report the median of the three runs.

WebXPRT 2013

Running the test

1. Open the default Web browser and go to www.principledtechnologies.com/benchmarkxprt/webxprt/.

2. Click Run WebXPRT 2013.

3. At the Ready to test your browser screen, click Continue.

4. Click Start.

5. When the test completes, record the results.

6. Complete steps 1 through 5 two more times.

7. Report the median of the three runs.

Basemark OS II

Setting up the test

1. Install Basemark OS II.

    a. Download Basemark OS II from the appropriate App Store.

    b. To begin the installation, click Install.

    c. After the installation is complete, close the App Store.

Setup is complete.

Running the test

1. Launch Basemark OS II by pressing the Basemark OS II icon.

2. Press Run Benchmark.

3. When the test completes, record the results.

4. Complete steps 1 through 3 two more times.

5. Report the median of the three runs.

PassMark PerformanceTest Mobile
Setting up the test

1. Install PassMark PerformanceTest Mobile.

    a. Download PassMark PerformanceTest Mobile from the appropriate App Store.

    b. To begin the installation, press Install.

    c. Press Accept to accept the license agreement.

    d. After the installation is complete, close the App Store.

    Setup is complete.

Running the test

1. Launch PassMark PerformanceTest Mobile by pressing the PassMark PerformanceTest Mobile icon.

2. Touch the Screen to continue.

3. Press Run Benchmark to start the benchmark.

4. When the test completes, record the results.

5. Complete steps 1 through 4 two more times.

6. Report the median of the three runs.

ABOUT PRINCIPLED TECHNOLOGIES

Principled Technologies®

Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.