

Mobile Device Hardware

Core 1 Objective 1.1:

Given a scenario, monitor mobile device hardware and use appropriate replacement techniques.

Mobile devices outsell other PC types, so, as an IT technician, you'll be responsible for maintaining, monitoring, and upgrading them. We'll look at three major types of mobile devices: laptops, smartphones, and tablets.

Laptops include the same categories of components as desktop computers but offer portability, allowing users to take their work with them as they travel around the world. *Smartphones* and *tablets* offer somewhat more limited functionality but provide a smaller, more convenient form factor.

In this chapter, you will learn everything you need about A+ Core 1 Objective 1.1, including the following topics:

- ▶ **Battery**
- ▶ **Keyboard/Keys**
- ▶ **Random-Access Memory (RAM)**
- ▶ **Hard Disk Drive (HDD)/Solid-State Drive (SSD)**
- ▶ **Wireless Cards**
- ▶ **Physical Privacy and Security Components**

- ▶ Wi-Fi Antenna Connector/Placement
- ▶ Camera/Webcam
- ▶ Microphone

EXPLORING MOBILE DEVICES

As you work with users, you'll encounter a wide variety of devices that they use to carry out their job functions. These include laptops, smartphones, and tablets.

Laptops

A traditional laptop is a portable computer with a built-in display that folds on top of the base unit. A laptop has the same categories of components as a desktop computer but uses parts with smaller form factors for portability. Figure 1.1 shows a typical laptop: a MacBook Air.

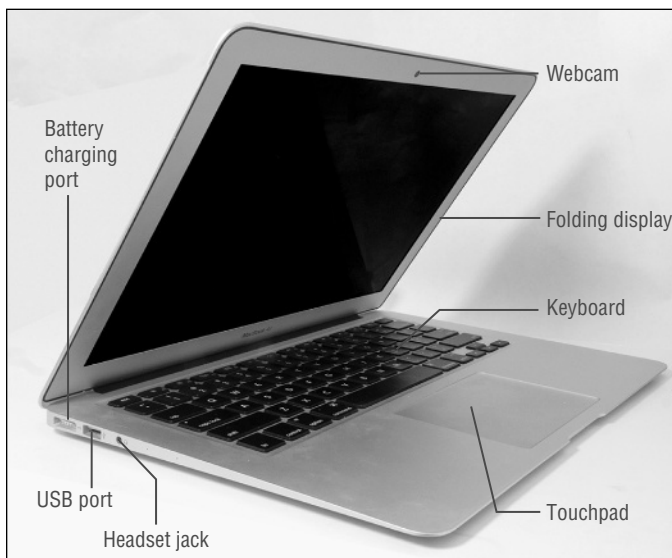


FIGURE 1.1 A typical laptop

A laptop also differs from a desktop in having a built-in keyboard, webcam, microphone, speakers, touchpad, battery power, and display. Most of these components are identified in Figure 1.1.

Although laptops are much smaller and typically have smaller storage and memory capacities than high-end desktops, laptops can perform almost any job a desktop can do, from lightweight web surfing to photo and video editing and 3D gaming.

EXAM TIP

The A+ Core 1 exam likes to use drag-and-drop simulations for system assembly and troubleshooting, so be sure to study the equipment and troubleshooting examples in this book carefully.

Smartphones

These days, almost everyone carries a smartphone around with them as they work and during their leisure time. These devices are small computers and, in fact, they're much *more* powerful than the laptop and desktop computers of a decade ago!

Figure 1.2 shows two smartphones—an Apple iPhone on the left and an Android device on the right. These are the two most common smartphones on the market today. We'll talk more about how smartphones connect to the network in Chapter 2, "Mobile Device Accessories and Connectivity" and Chapter 3, "Mobile Device Network Connectivity and Application Support."



FIGURE 1.2 Two common smartphones: (a) an Apple iPhone, and (b) an Android device

Tablets

Tablets are portable devices that fill the gap between smartphones and laptops, combining the portability of a smartphone with the larger screen size and functionality of a laptop. These devices are typically flat, slate-shaped computers that rely on touchscreens as the primary input method. They are popular for tasks such as web browsing, reading ebooks, streaming videos, and even light productivity work like editing documents and managing spreadsheets.

Figure 1.3 shows a user interacting with a typical tablet device. Tablets can range in size from 7 to 13 inches, with some larger options available for specialized use cases.

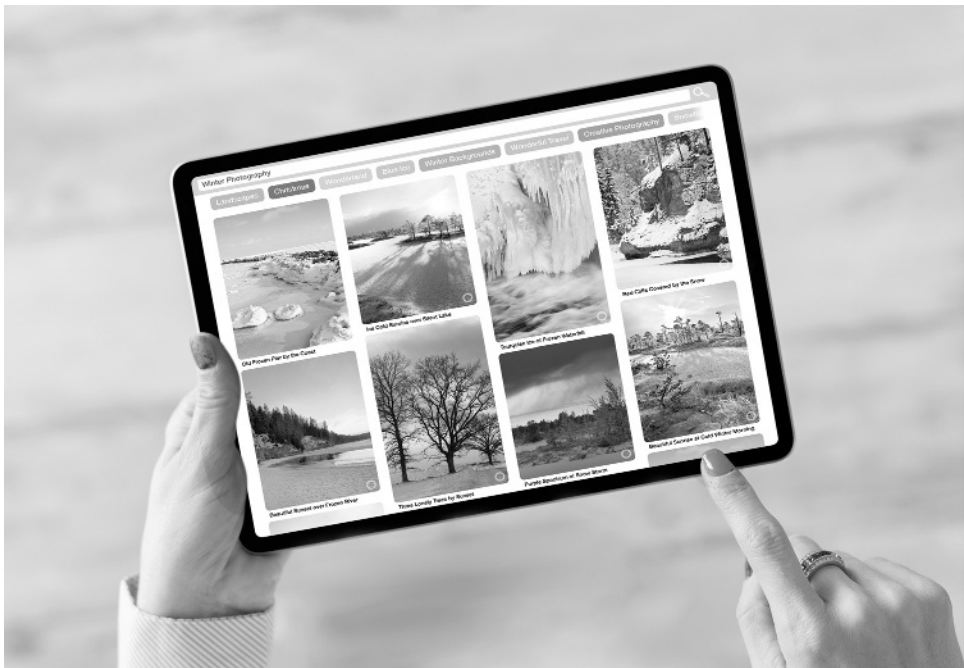


FIGURE 1.3 Tablet user interacting with photographs

Tablets are designed for portability and ease of use. Unlike laptops, they often lack a physical keyboard and instead rely on virtual keyboards or external accessories, such as detachable keyboards or stylus pens. They typically have built-in cameras, speakers, microphones, and wireless connectivity, including Wi-Fi and Bluetooth, and many models offer cellular capabilities for Internet access on the go.

Tablets can run a variety of operating systems, the most common being Apple's iPadOS and Android. Some tablets, such as Microsoft Surface devices, run a full desktop operating system like Windows, providing even greater flexibility. This makes tablets versatile tools for both personal and professional use.

EXAM TIP

Be familiar with the different features and functions of tablets, such as touch screen gestures and operating system differences. You should also understand common troubleshooting steps for these devices. The A+ Core 1 exam may include scenarios where you'll need to identify or resolve issues with these devices.

BATTERIES AND POWER SUPPLIES

One of the key features of all mobile devices is their capability to run off both battery power and AC electricity. As users travel, they use the battery. When they return to their desk, home, or another temporary location, they can plug in the device and operate from normal AC power while the battery recharges. Some laptops offer user-replaceable batteries, such as the one shown in Figure 1.4. The user or a technician can remove this battery by sliding a switch on the bottom of the unit to release the retaining mechanism.



FIGURE 1.4 A user-replaceable battery after being removed from a laptop

Other laptops, as well as most smartphones and tablets, have internal batteries that require a trip to the repair shop for replacement. For example, a laptop with a built-in battery might require a near-complete teardown to access the battery. These batteries are often directly wired to the laptop motherboard.

WARNING

Before replacing a battery or any other internal component, be sure to shut down the unit and disconnect it from AC power.

KEYBOARDS

Laptop keyboards typically have layouts similar to desktop keyboards, although the positioning and size of arrow keys may differ, and some keyboards lack a dedicated number pad. However, the biggest difference between laptop keyboards and desktop keyboards is the presence of special laptop keys. There are no standards for the number and positions of laptop keys, so different laptops might feature different combinations of some of the following (see Figure 1.5 for an example):

- ▶ Volume controls
- ▶ Play/pause/forward/rewind media controls
- ▶ Switch to external display
- ▶ Enable/disable on-board Wi-Fi
- ▶ Display brightness
- ▶ Display contrast



FIGURE 1.5 The top and bottom rows of a typical Windows laptop keyboard. Use the Fn key to activate the special laptop keys

These keys are usually combined with other keys, such as function (F1–F12) keys. Switching to the secondary key assignment is done by pressing and holding the Fn key and then pressing the other key. Depending upon the laptop model, the primary key assignment might be the function keys, or it might be the laptop keys.

Laptop keyboards are often more fragile than desktop keyboards and are thus more likely to suffer broken keys. Replacements are model-specific. To replace a laptop keyboard, follow this basic procedure:

1. Consult the laptop's service manual to determine whether the laptop keyboard is fastened to the bottom of the laptop base. If it is, remove the necessary screws.
2. Gently remove the plastic molding around the edge of the keyboard using special case-removal tools.
3. Pry open the laptop carefully until the interface cable is visible. It is typically a flat cable.

4. Carefully disconnect the interface cable (see Figure 1.6) from the motherboard.
5. Lift the keyboard out of the system.
6. Connect the new keyboard's interface cable to the motherboard and snap the keyboard into place.
7. Replace the plastic molding around the keyboard.
8. Fasten the keyboard back into place with the necessary screws.
9. Reconnect the laptop to power and check the keyboard.

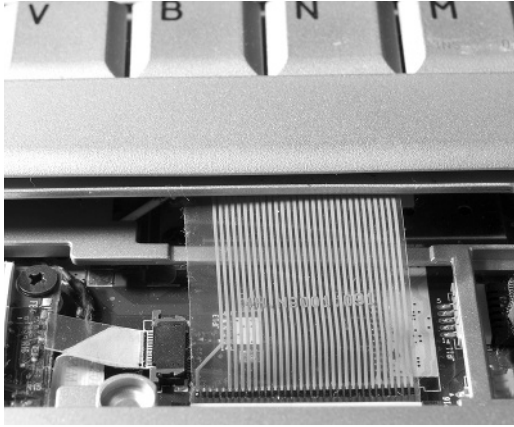


FIGURE 1.6 Preparing to disconnect the keyboard interface cable from a typical laptop motherboard

EXAM TIP

Laptops vary from manufacturer to manufacturer, and most manufacturers provide service manuals to assist technicians in performing maintenance and upgrades. It's always a good idea to consult the service manual before starting an unfamiliar project!

MEMORY

Random access memory (RAM) is your computer's short-term memory—it stores data that the CPU may need to access quickly as it processes tasks. Laptops use a smaller type of RAM called *SO-DIMM (small outline dual-inline memory module)*. These are compact versions of the RAM sticks used in desktop computers, designed to fit into a laptop's limited space.

Modern laptops typically use DDR5 or DDR4 SO-DIMMs, which are fast and efficient. However, if you're working with an older laptop, you might come across DDR3 SO-DIMMs instead. Figure 1.7 shows examples of the different types of SO-DIMM modules, while

Table 1.1 provides some key differentiating characteristics for each type, including the number of pins and the location of the small keying notch that appears in those pins.

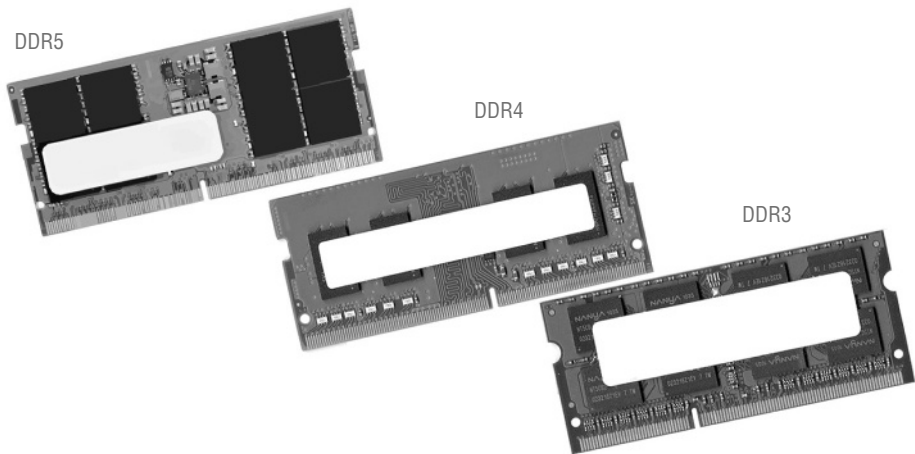


FIGURE 1.7 From left to right, typical DDR5, DDR4, and DDR3 SO-DIMM modules

TABLE 1.1 SODIMM characteristics

SODIMM Type	Pins	Keying Notch Location
DDR3	204	Left
DDR4	260	Center
DDR5	262	Center

EXAM TIP

When adding RAM to a laptop, be sure to determine the supported type, speeds, and sizes for that particular laptop model. If it’s not compatible, it probably won’t work properly! Many memory vendors have online system checkers or databases you can use to find compatible modules for a given system.

Some laptops offer easy access to RAM sockets for upgrading. In the example shown in Figure 1.8, a panel on the bottom of the laptop is removed to provide access to RAM. Some laptops have separate panels for access to other user-upgradeable components such as mass storage or wireless cards, while others use a single larger panel to cover multiple components.

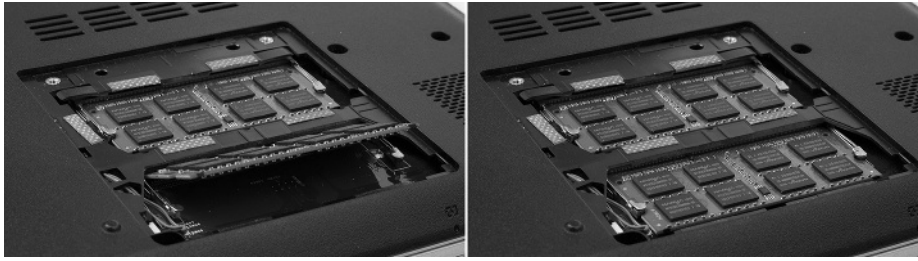


FIGURE 1.8 Inserting an SODIMM module into place (left) and after it has been locked into position (right)

By contrast, other laptops require that the system be dismantled to the motherboard level to provide access to the memory modules. With systems like this, it is necessary to remove the keyboard, mass storage devices, and other components before memory can be upgraded or replaced.

The memory upgrade/installation process follows this basic outline:

1. After consulting the service manual, remove the cover or other components necessary to access the module sockets.
2. If you need to remove one or more existing modules to make room for other modules, push the spring-loaded holders out of the way until the module pops out, and carefully remove it. Place it in an anti-static bag or container.
3. Insert the new module into the connector at about a 20-degree angle and push it down so it is horizontal to the motherboard and locks into place.
4. Close up the laptop, reattach power, restart it, and check memory for proper operation.

You'll learn more about memory in Chapter 15, "Random Access Memory (RAM)".

STORAGE

Storage drives provide the long-term storage that allows mobile devices to store and retrieve data even after they have been powered off. If RAM is the short-term memory of the computer, storage is the long-term memory.

Laptops use two different types of primary storage. *Hard disk drives (HDDs)* are an older technology that uses magnetic platters that spin at high speeds to store data. *Solid-state drives (SSDs)* are a newer, more expensive technology that uses high-speed, high-capacity flash memory to store data. HDDs come in two sizes: 3.5 inches and 2.5 inches, while SSDs come only in the 2.5-inch size as well as the even smaller M.2 form factor. Figure 1.9 shows these four device form factors side-by-side.



FIGURE 1.9 Four storage devices: a 3.5-inch HDD, a 2.5-inch HDD, a 2.5-inch SSD, and an M.2 SSD

You'll learn more about storage in Chapter 16, "Storage Devices."

WIRELESS CONNECTIVITY

All mobile devices have onboard Wi-Fi and Bluetooth interfaces for mobile connectivity, and some also feature cellular radios. Older laptops use the mini-PCIe interface (Figure 1.10), while current laptops use an M.2 interface (Figure 1.11) that is keyed for add-on cards instead of storage devices.



FIGURE 1.10 A wireless network card using the mini-PCIe interface

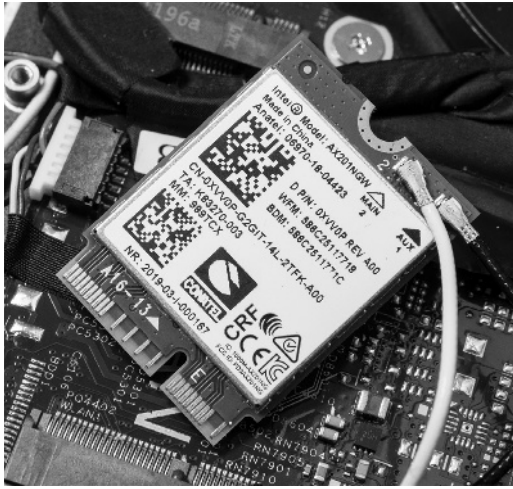


FIGURE 1.11 A wireless network card using the M.2 interface

EXAM TIP

M.2 is the current standard for wireless cards. However, the M.2 connector used for wireless cards is not the same M.2 connector used for SSDs.

Because wireless cards are built especially for certain systems, you must make sure to purchase a compatible card if the onboard wireless hardware fails or needs to be upgraded.

To gain access to a wireless card, you must shut off power to the laptop, disconnect its battery, and remove the back panel and other components.

Before removing a wireless card, make sure the antenna wires are disconnected from the existing card. Note which connection is used for a particular wire. After installing the new card, reconnect the antenna wires in the proper positions.

SECURITY AND PRIVACY COMPONENTS

Mobile devices use two main types of physical privacy and security components to control access: biometrics and near-field scanners.

Biometrics

Biometrics refers to using physical attributes such as fingerprints or face recognition to verify a user's identity. Mobile devices use two main forms of biometric devices to confirm user identities:

- ▶ Fingerprint reader, such as the laptop shown in Figure 1.12
- ▶ Infrared camera for facial recognition



FIGURE 1.12 Fingerprint reader on a laptop computer

Windows Hello supports both of these biometrics methods. To add either type of biometric support to a Windows laptop, you can plug in the appropriate device into the laptop's USB port and configure it with Windows Hello.

MacBook devices support fingerprint biometrics through Apple's TouchID technology, while iPhones and iPads support facial recognition through FaceID technology.

Near-Field Scanners

Near-field scanners are devices that enable near-field communications (NFC). This technology is used for extremely short distance authentication and data transfer. NFC enables contactless payment systems, device pairing, file transfers, gaming, access control, and location-based operations.

Near-field scanners are incorporated into many modern mobile devices. Because near-field scanners in mobile devices have the potential to reveal users' location and share information they might not want to share, it's important to know how to configure them.

Near-field scanners are typically defined as network devices, so the network dialog in Windows or other operating systems can be used to enable or disable them.

WI-FI ANTENNA PLACEMENT

As you saw earlier in this chapter, the Wi-Fi antenna wires are connected to the wireless card in a typical laptop. The wires are connected to the antennas on either side of the display panel.

If the display panel can be removed from the display subassembly, the wires are routed separately from the subassembly into the laptop base unit (refer to Figure 1.13). However, if the display panel is not designed for component-level replacement, the antenna wires are part of the display subassembly that connects to the laptop base unit.

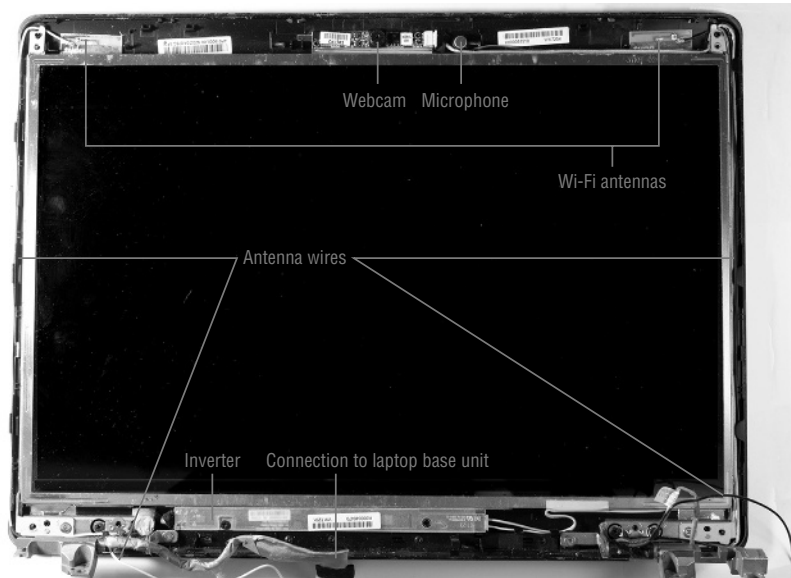


FIGURE 1.13 An LCD panel with individually serviceable components

CAMERA/WEBCAM

Almost all laptops, tablets, and smartphones include built-in front-facing and/or rear-facing cameras/webcams that support video and still images. The front-facing camera is used for video chatting and selfies.

On laptops that use a display panel with removable components, the webcam can be replaced if it fails. Figure 1.14 shows a close-up view of the webcam from the computer in Figure 1.13. Its cable runs alongside one of the Wi-Fi antenna wires. If the display panel is not designed for component disassembly, you'll need to replace the entire panel if a webcam or other component fails.

MICROPHONES

Microphones for recording audio or chatting are usually built into the top or bottom of the display panel. A typical microphone is shown next to the webcam in Figure 1.14. Depending upon the laptop, the webcam and microphone might be a single subassembly.

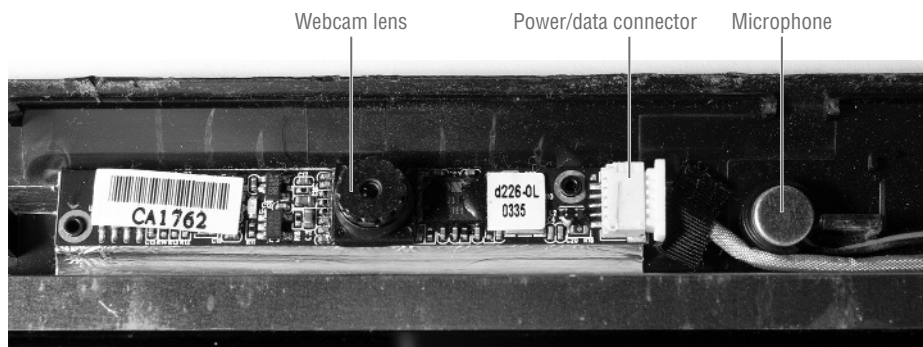


FIGURE 1.14 This microphone and webcam can be easily replaced if they fail

NOTE

If you need to replace the camera/webcam or microphone, you might not need to remove the display panel from the base unit. On some laptops, all that is necessary is to remove the front bezel from the display panel to gain access to these components.

CERTMIKE EXAM ESSENTIALS

- ▶ Laptops, smartphones, and tablets provide an important mobile computing experience for end users.
- ▶ Laptop components such as RAM, mechanical and solid-state storage, and wireless adapters work similarly to those used in desktop computers, but their form factors are smaller, and the installation process can be much more difficult than with desktop computers.
- ▶ Because many different standards exist for these parts, be sure to verify installation methods and parts compatibility before you dive in.
- ▶ Laptops vary widely in their built-in components and provisions for upgrades, so researching the particular models a client is considering is key to assuring short-term and long-term satisfaction with a given laptop.

Practice Question 1

To speed up a laptop, you have a request from a client for the following upgrades: upgrade RAM to 8 GB and replace the existing 500 GB hard disk with a 1 TB SSD.

Which of the following should you do FIRST before you can quote a price and time frame for this job?

- A. Perform a price comparison for drive options.
 - B. Identify the location of the drive bay.
 - C. Review the contents of the service manual.
 - D. Purchase appropriate memory modules.
-

Practice Question 2

You need to replace the built-in webcam on a user's laptop. Which one of the following statements is correct?

- A. You may be able to remove the bezel and replace the webcam easily.
 - B. Replacing an internal webcam always requires returning the device to the manufacturer.
 - C. Removing the webcam requires specialized software to recalibrate the display.
 - D. Internal webcams are integrated into the motherboard and cannot be replaced separately.
-

Practice Question 1 Explanation

Reviewing the contents of the service manual should be done first because it provides critical information about the laptop's specifications, compatibility, and upgrade procedures, ensuring you can determine whether the upgrades are feasible and what components are required.

Performing a price comparison for drive options is premature without confirming compatibility and upgrade requirements. Identifying the location of the drive bay is useful for installation but not necessary before quoting. Purchasing memory modules should not occur until compatibility is verified and the client approves the quote.

Correct Answer: C. Review the contents of the service manual.

Practice Question 2 Explanation

You may be able to remove the bezel and replace the webcam easily because most laptop webcams are modular components located in the display assembly, making them relatively straightforward to replace after removing the bezel.

Returning the device to the manufacturer is not always necessary, as many laptop designs allow for user-serviceable webcam replacements. Specialized software is not required to recalibrate the display when replacing a webcam, as it is a hardware component unrelated to display calibration. Internal webcams are not integrated into the motherboard but are typically separate components, allowing for replacement without replacing the entire motherboard.

Correct Answer: A. You may be able to remove the bezel and replace the webcam easily.
