13 Fun Projects!

Raspberry Pi FOR KIDS

- Get your Raspberry Pi up and running
- Learn to program with Scratch and Python
- Write games, build websites, and make art

Richard Wentk

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Raspberry Pi For Kids For Dummies®

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Introduction

How much do you know about computers? Most people can play games, watch videos, listen to music, and explore the Internet without knowing much at all. The computer just works, and that's all they care about.

Do you want to know more? What really happens when you click a mouse, press a key on a keyboard, click a link on a website, or launch an app?

And more — how do you make a website? How do you make an app? Or a game?

Are these interesting questions? If not, that's totally fine. Not everyone gets excited about making things.

But if you do, here's a bigger question: How can you find the answers? A book like this one can help you get started, but figuring out how to find your own answers will get you further than reading someone else's ideas.

Understanding computers teaches you that it's good to be able to solve puzzles, understand math, write code, and build things that are clever and useful. But it's even better for helping you to know that *you can learn* how to do all these things.

Even if you don't really care about code, you can use coding as a way to check how good you are at learning something new.

Being able to find answers is more than half the problem. After you've researched a problem, you can add something of your own to the work everyone else has done. Sharing what you make helps everyone else, too.

Don't think of this book as a set of school problems. It's not about passing or failing. A lot of the projects are suggestions and ideas to get you started. They're not so much like step-by-step guides you can follow without understanding what's happening. For some of them, you need to break out of the book and find your own answers online.

Some of the projects are hard. If they're too hard for you, it's fine to think of simpler projects of your own and maybe come back to the hard projects later.

Or not. It doesn't matter as long as *you* are having fun and doing stuff you think is cool. Especially if you surprise yourself with what you can do.

So don't give up when you find something hard or decide you're stupid and should be doing something else. Here's a big secret: Everyone who writes code feels like that at least some of the time. No exceptions.

And here's another big secret: When you discover you can do something amazing, it's totally worth it.

About This Book

Raspberry Pi For Kids For Dummies introduces you to the world of the tiny Raspberry Pi computer.

Some people will tell you the Raspberry Pi was designed for kids and is easy to use. This isn't untrue, but it's not totally true, either. In some ways, the Pi is very easy to use. In others, it can be harder than a Mac or a PC.

But the Pi is really good for learning how computers work on the inside and for building simple software and hardware projects. It's also good for learning more about learning, which means finding out how to do your own research on the Internet.

With this book as your guide, you will discover

- What a Raspberry Pi is
- How the different versions of the Pi have changed over time
- What extra parts you need and how much they cost
- Where to find the extra parts if you don't already have them
- How to connect them to your Pi
- What to do to download and install the latest software for a Pi
- How to power up a Pi
- Everything about working with the most important settings
- Why you need to power down a Pi safely
- The ins and outs of the Linux operating system
- How to use the Pi's Linux desktop
- How to find files using the desktop File Manager
- What the different Linux directories do
- The difference between an ordinary user and the Linux god-user
- How to type Linux commands from the keyboard
- What you can do with Scratch, a simple programming system
- How to start creating a simple game in Scratch
- Why the Sonic Pi music programming system is a ton of fun
- How you can create art with a program called TuxPaint

- How to write code and draw pictures using the popular Python language
- How to make your own web server
- More about making your web server smarter
- How you can use Python to control your character in the Pi version of Minecraft
- How to make a simple webcam
- Which parts and extras you need to start making hardware projects
- How to build a simple thermometer
- How to make a web page for a hardware project

Foolish Assumptions

Raspberry Pi For Kids For Dummies makes some guesses about what you do and don't know already. You don't need to know anything about code or about how computers work on the inside. This book does assume the following:

- You can use a Mac or a PC or maybe even a Linux computer.
- You're comfortable with a mouse and keyboard, and you can find your way around your computer's desktop.
- You're not scared of plugging together computer parts to add extras.
- You're fine with using Google or some other search engine to find things on the Internet.
- You have a little (but not much) cash to spare. Fifty dollars will cover most of what you need, and $100 will cover everything easily.

Icons Used in This Book

Throughout the margins of this book are little round pictures known as icons. Here's what those icons signify:

The text next to this icon offers tips for completing tasks or for making your job easier. You'll want to take advantage of these nuggets of wisdom!

Pay special attention when you see this icon. It points out information you'll want to make sure to remember.

This text warns you of things that can go wrong . . . very wrong!

This icon marks text that tells you all the technical details you may or may not be interested in. If you don't care, you can skip this text without missing anything.

Beyond This Book

The fun doesn't stop with this book. Online, you will find the following goodies:

- **Cheat Sheet:** You can find this book's Cheat Sheet online at `www.dummies.com/cheatsheet/raspberrypiforkids`. See the Cheat Sheet for checklists.
- **Dummies.com online articles and chapters:** You can find companion articles and bonus chapters for this book online at `www.dummies.com/extras/raspberrypiforkids`.
- **Updates:** If this book has any updates after printing, they'll be posted to `www.dummies.com/updates/raspberrypiforkids`.

Where to Go from Here

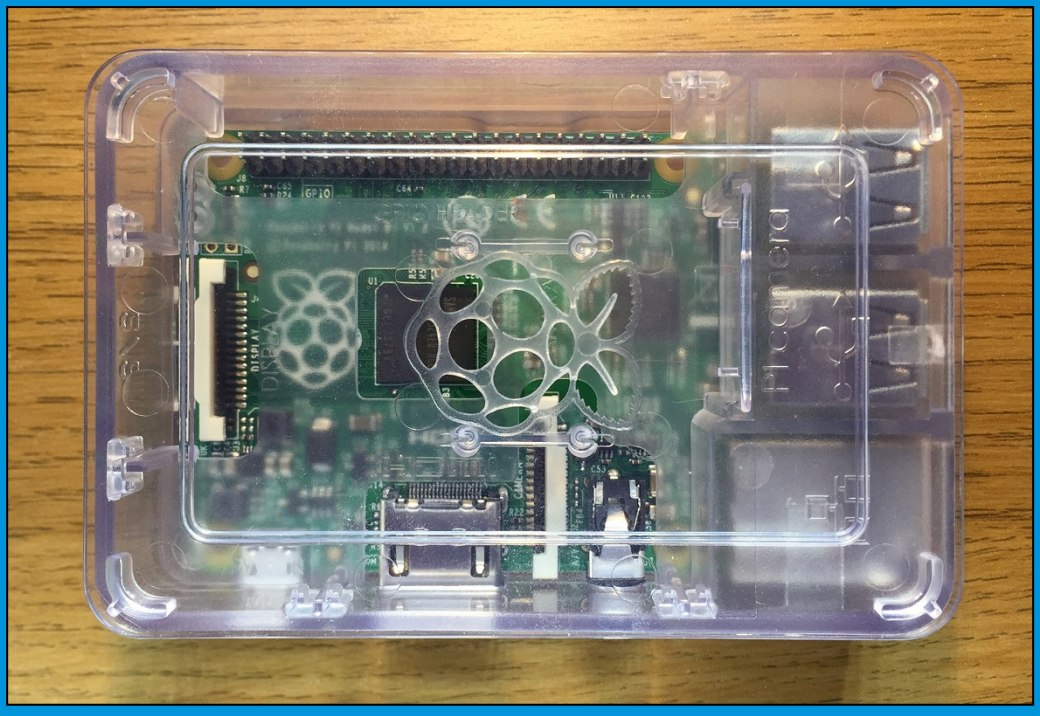
Like other *For Dummies* books, *Raspberry Pi For Kids For Dummies* is a reference. That means you can read it in the order that makes sense to you. You can flip through it to find new ideas, or you can use the table of contents and index to zero in on exactly the topic you're looking for.

You also have the option to read this book like a book, from beginning to end. If you're a complete beginner, I recommend you work through at least the first few chapters in order. If you're new to the Raspberry Pi, those early chapters have everything you need to get started.

Some later chapters assume that you've worked your way through earlier chapters or you already know the topics they cover. The last few chapters are projects that tie together a lot of earlier details. It's best not to jump into them unless you already know some of the basics!

Good luck — and don't forget to have fun and do cool things!

Week 1
Making a Pi



In this part, you'll . . .

- Find parts for your Pi 9
- Create a mind for your Pi 27
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- Use the desktop 76

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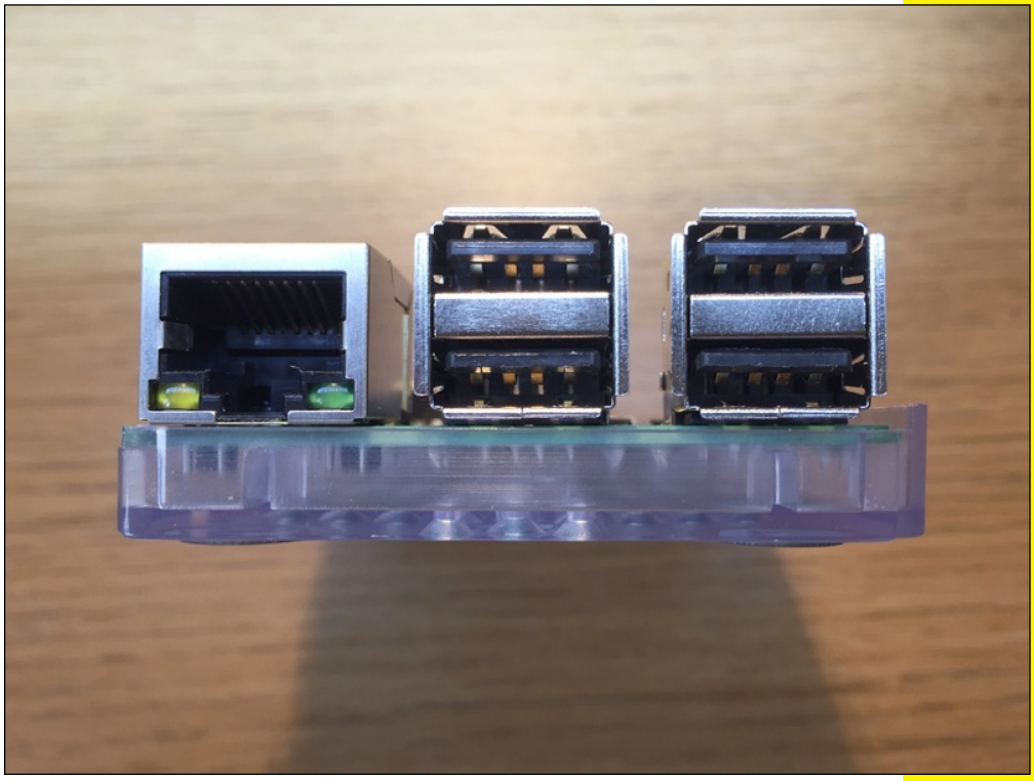
CHAPTER

1

Find Parts for Your Pi

The Raspberry Pi is a super-cool, super-small, super-cheap microcomputer. In fact, it's a super-cool, super-small, super-cheap microcomputer *board,* and it doesn't do much on its own. Before you can do super-clever things with it, you have to add some extras to build a Pi system.



Understand the Pi

The Raspberry Pi, shown in Figure 1-1, is a tiny computer developed in the UK by the Raspberry Pi Foundation (`www.raspberrypi.org`). It's much smaller than a Mac or PC — it's almost exactly the same size as a credit card! And it's also much cheaper. (Prices vary, but a Pi costs around $30 in the United States and between £20 to £30 in the UK.)

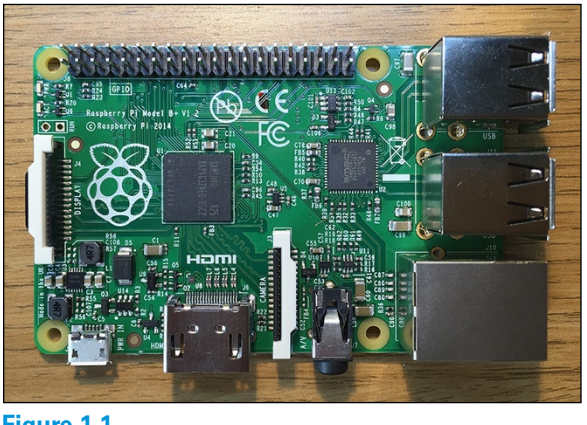


Figure 1-1

The Pi only comes in Raspberry. There is no Apple Pi, Blueberry Pi, or Pumpkin Pi. A lot of people like Raspberry, so that's fine with Pi fans.

Here are a few of the things you can do with a Pi:

- Learn how computers work
- Make and play games
- Learn how to program
- Make web pages
- Make digital music
- Build simple electronic projects

- Design awesome Minecraft worlds
- Have a ton of fun!

What you can't do with a Pi

Although the Pi is a fully working computer, it's not a Mac, a PC, a tablet, or a games console. It's not as powerful as more expensive computers. Here are some things you can't do with a Pi:

- Run Microsoft Windows, or any Windows software
- Download and play apps or games from the Apple App Store
- Develop software for Windows, iOS, or OS X
- Use popular web browsers like Chrome, Safari, IE, or Firefox
- Play popular mainstream commercial games

Does that seem disappointing? It shouldn't.

What you can do with a Pi that you can't do with a bigger computer

To make up for it, you can do a lot of things with a Pi you can't do with a bigger computer. For example, you can

- Wipe your Pi in minutes and start from scratch if you make a bad mistake
- Experiment with writing your own software
- Build projects that do useful things and save money
- Rewrite and customize all the software in your Pi
- Make your Pi do something at certain times of day, or on dates you choose, or when a sensor notices a change

The Pi story explained

The Pi follows an old British tradition. Back in the 1980s, the UK led the world in computers and computer companies with fancy names, like the Spectrum, the Dragon, the Tangerine, and the Acorn. These computers were much less powerful than the Pi, but many kids learned how to program on them. Some of those kids became professional software developers, and one of them went on to develop the Pi.

The Raspberry Pi Foundation wants to help the kids of the 2010s follow the same route and to have fun along the way.

- Connect thermometers, cameras, motion sensors, and other extras
- Leave Pi projects running 24/7 without using a lot of electricity

You can see now why the Pi is special. Unlike a PC or a Mac, it's so small and cheap you can buy a separate Pi for every project. You can leave it running all the time. And it comes with a good set of simple tools for writing software — all free.

Discover the Different Pi Models

Pi boards come in different types (see Table 1-1). You need to know about the differences so that you don't buy the wrong one.

The older models are called the A and B boards. The newer models are called the A+ and B+ boards. As of early 2015, there's an even newer, faster, shinier, and better board called the Pi 2.

Figure 1-2 shows a Model B+ and a Model B.

The boards are the same size, and they use the same software. But they have different numbers of connectors and other bits and pieces.

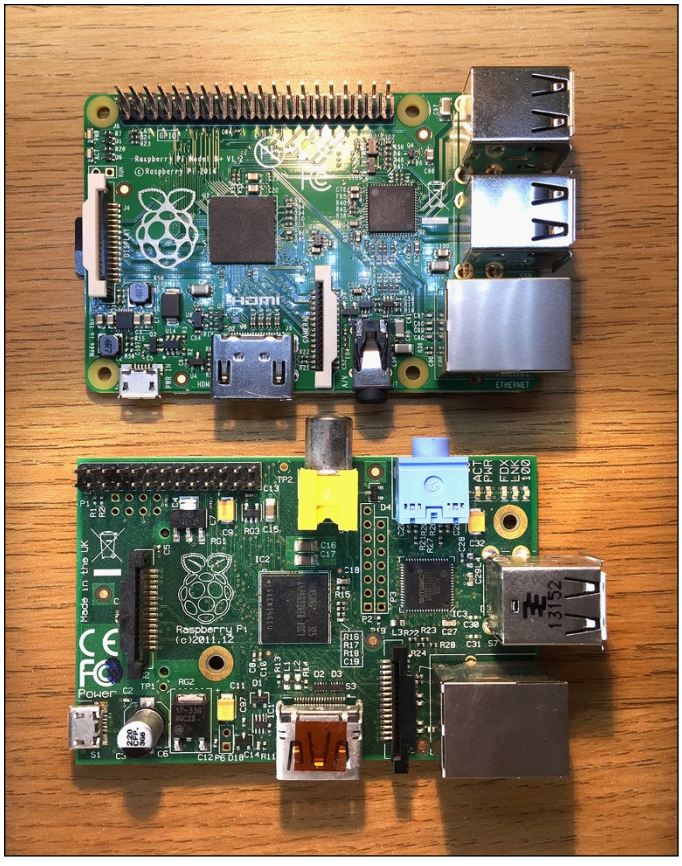


Figure 1-2

I'll make it easy to choose: You want a Pi 2. The older models are out of date now. You can still buy them, but the Pi 2 is much better for almost everything.

What's the deal with the A+? It's a cut-down budget Pi board with some important bits missing. It's definitely not the Pi you want when you're starting out.

It may, sometimes, kind of, perhaps be the right board for small finished projects. But don't get one until you've read the rest of this book!

Table 1-1	Comparing Raspberry Pi Models
Model	**What It's Good For**
A	Out of date now. Don't buy one!
B	Out of date.
A+	Smaller, cheaper, slower than a Pi 2. Only useful for special projects.
B+	Out of date. Get a Pi 2!
Pi 2 Model B	You want this one.

There is no Pi 2 Model A/A+ — at least, not yet. It's possible the Pi people will start selling one by the end of 2015. Or maybe 2016. Or never. You'll have to wait and see. If they do, it could be a cheaper option for finished projects. No one knows yet. And if it appears, your first Pi should still be a Pi 2 B, not an A.

Understand Pi Extras

When you buy a Raspberry Pi, you get a small circuit board. And that's it. On its own, the board does nothing. You can't do anything with it, except look at it, and maybe play catch, which is fun but not what it's made for.

Collect Pi parts

To turn a Pi board into a working computer, you have to add some extras. Collecting all the extras and connecting them to the Pi is your first project. And it's a big one!

Here's a list of what you need:

- USB hub with separate power (A and B models only)
- USB keyboard

- USB mouse
- Monitor or TV
- Memory card
- Power supply
- Long network cable
- Cables and connectors

Try to do it yourself and ask for help from a grown-up only if you get stuck. You'll learn a lot about getting started with computers. If you want to save time and maybe money, skip to the "Collect Parts the Lazy Way" section, later in this chapter.

Decide whether you need a hub

Are you getting a Pi 2? You don't need a hub. Did you get an old Model A+ or B+ board? You don't need a hub either.

Otherwise, there's something you need to know: the original A/B models had a problem: If you plugged a keyboard and mouse into the USB connectors, the Pi often stopped working.

Figure 1-3 shows how you have to fix this issue by connecting everything to the Pi, including a keyboard, and mouse, through a USB hub.

The hub has to have its own separate power supply. The hub solves the problem, but leaves you with a big mess of wires and connectors and stuff.

The A+/B+/2 models work fine without a hub, as shown in Figure 1-4. This makes them easier to set up. They don't need so many wires and cables.

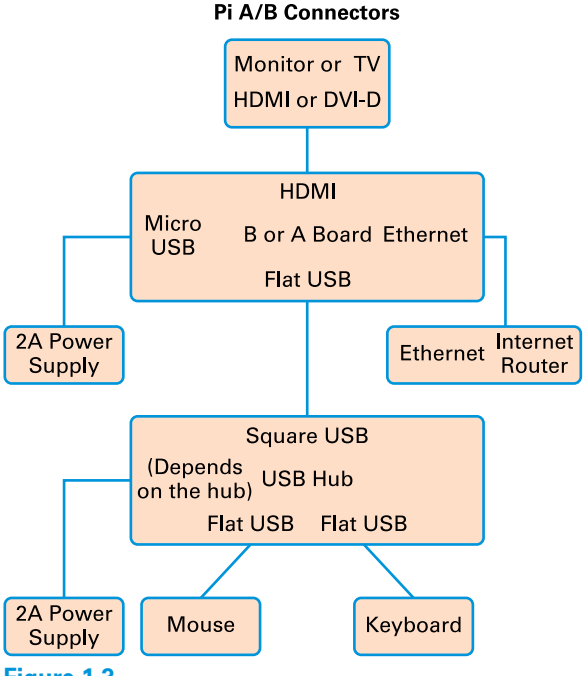


Figure 1-3

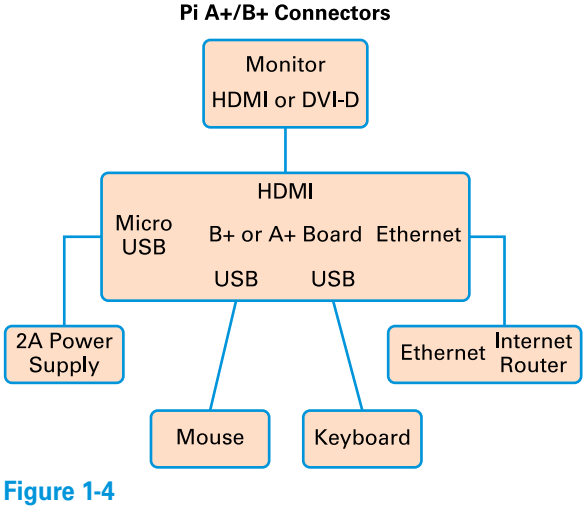


Figure 1-4

A *hub* is a box with plenty of USB connectors. You plug one end into a single socket on the Pi, and then you plug all your other USB extras into the hub. If the hub has its own power supply, it makes sure that everything gets the power it needs.

If you plug things that use a lot of electricity to whirr or flash, like robot motors and killer lasers, you need a hub even on a Model A/+ and B+. Small things like keyboards and mice don't need one.

Choose a mouse and keyboard

You can use any mouse or keyboard with a USB plug. Models with a cable should just work. You can *probably* use wireless models, as long as they come with a USB receiver dongle. (Anything made by Logitech should work.) Bluetooth mice and keyboards probably won't work.

You don't need to spend a lot of money on these extras. Basic models are fine.

You won't be using your Pi for serious gaming, so you don't need a Predator Ultra Galaxy Killer Destructo-Mouse with 15 buttons and a sharp and pointy design you can cut your fingers on. But if you have one spare, you can use it if you like. (The extra buttons won't do anything.)

Choose a monitor or TV

The Pi can work with a monitor or a TV.

The best way to connect the Pi to a monitor is to use the HDMI socket. Most new TVs and many monitors have an HDMI socket that takes an HDMI cable. Hook up the cable to the Pi at one end and the monitor or TV at other, and you're done.

Figure 1-5 shows where the HDMI connector is.

The monitor/TV doesn't have to be very new, or very good. The Pi can barely produce HD video. Almost any monitor less than ten years old should work fine.

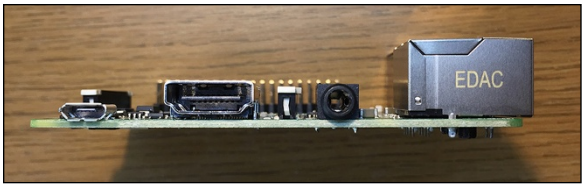


Figure 1-5

A few monitors have a different socket called a DVI-D connector. If you can't find a monitor with HDMI, you need an *adaptor cable* with an HDMI plug at one end and a DVI plug at the other. Look on Amazon and eBay for a cheap one.

If your monitor has only a VGA connector, you need a special adaptor and a cable. Amazon and eBay should help again, but you may as well see whether you can find a used new or used monitor with the right connections. It may be cheaper than an adaptor.

The Big Yellow Socket on the Model A/B Pis can work with an old-fashioned analog TV — the kind that lives in a huge wooden box with a heavy thick glass screen. Most people don't use them anymore. You shouldn't either because the picture will be very fuzzy, and you won't be able to read words on the screen.

You don't really need a monitor at all because you can control a Pi remotely from another computer. This is called *running headless* — not because you can do it without your head, but because you don't need a monitor, mouse, or keyboard. (These are just like the Pi's head, kind of, if you use your imagination.) Setting up a headless Pi is kind of complicated, especially if you're just starting out. It works differently on a Mac and a PC. If you're curious, search the web for Headless Raspberry Pi. You probably won't be able to get it working until you've spent more time with your Pi.

Recognize cables and connectors

Wait — USB? VGA? DVI? HDMI? What do all these letters mean? If you don't already know, search the web to find out!

Type the letters into a browser search bar and see what you get. Search for images to see pictures.

You don't need to know how the cables work. You don't even need to remember that HDMI stands for High-Definition Multimedia Interface. (Like, really, who cares?)

But you do need to be able to tell cables apart so that you know which cable goes where on the Pi. You can also use the photos in this chapter as a guide. For example, Figure 1-6 shows the network/Ethernet and USB connectors on the side of a B+ board.

Figure 1-6

Letter lists like these are called TLAs — Three-Letter Acronyms. To make an acronym, you take the first letter of every word in a complicated technical name and put it in order. This makes a shorter word that is easier to remember (but not always easier to say). There are a lot of TLAs in computing. Some of them have four letters, which doesn't make sense, but that's just how it is. You don't need to remember them all, but it helps to remember the ones that get used a lot.

Choose a memory card

The Pi doesn't have a disk drive. It stores everything on a small memory card. The Model A or B needs an SDHC card with a speed rating of 8 or 10. For a Model A+/ B+/2, get a microSD card.

Figure 1-7 shows the bottom of a Model B+. The memory card is the black rectangle at the right.

The card should hold at least 4GB. You can get a bigger card if you like, but it will cost more, and most of the space will be wasted.

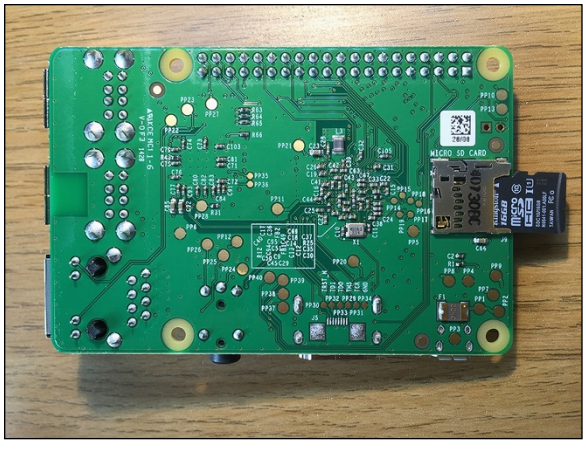


Figure 1-7

Some MicroSD cards come with an SDHC adaptor. If you get one of these you can use the same card in older A/B and newer A+/B+ Pi boards.

Find memory cards

The cheap option is to get a blank card — Amazon is a good choice — and write the software to the card by hand. You can only do this if your Mac or PC has a card reader/writer. If it doesn't, you'll have to buy one for about $5 to $10 (less than £10 in the UK).

The lazy option is to buy a card with the Pi software already installed. The software is called NOOBS. You can buy prewritten cards from Amazon and shops that specialize in Pi extras. The cards cost a few dollars or pounds more, but they save you some time.

Find a power supply

Although the Pi is cheap to run, it needs a special power supply and a special cable. The power connector on the Pi is a tiny microUSB socket, and it needs a matching plug. The socket grips the power cable hard so that you can't pull it out by accident.