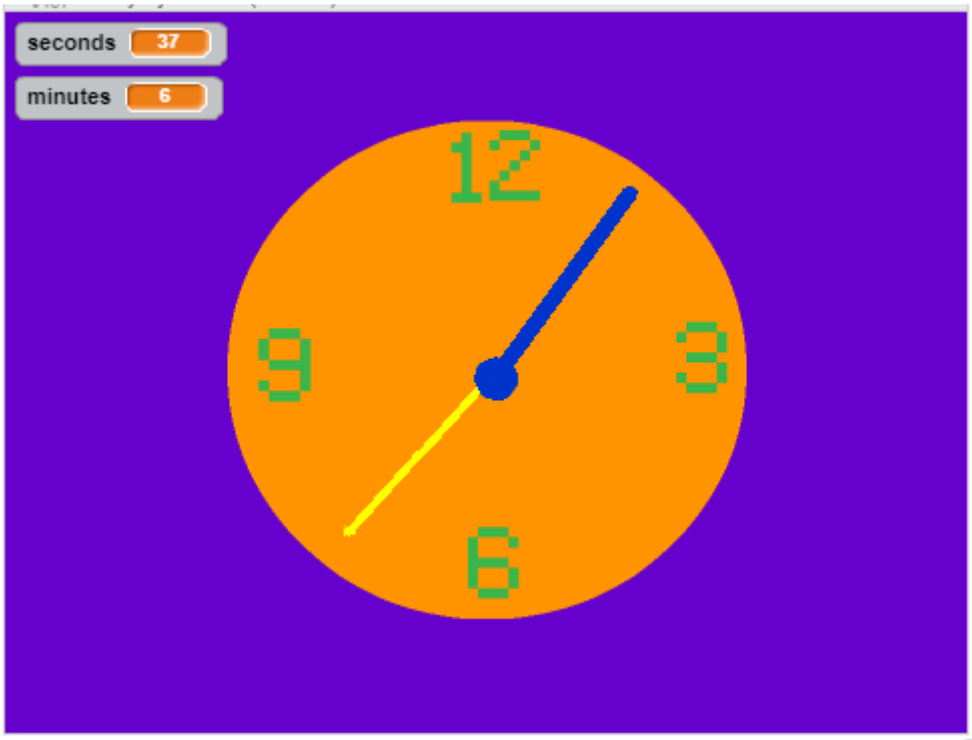
Clock!

This project is from (Hello World) magazine, see https://helloworld.raspberrypi.org/issues/3.

This project shows you how to program a clock with moving hands:



Step 1: Draw the clock face

This sort of clock (with moving hands) is called an analogue clock. The other sort you are probably familiar with (with changing numbers) is called a digital clock. You can program both sorts in Scratch, but these instructions are only for the analogue one.

- Start a new Scratch project, and delete that cat.
- Choose colours you like, and draw a circle for the clock face on the background.
- We are going to add the numbers as sprites, from the sprite library. (Later on we might want to put some code on them, too…)
- Look in the Sprite Library, and select the 'Letters' category. There are two different styles of numbers, called 'Glow' and 'Pixel'. I used Pixel, but it is up to you – you can even draw each number as a new sprite, if you like.

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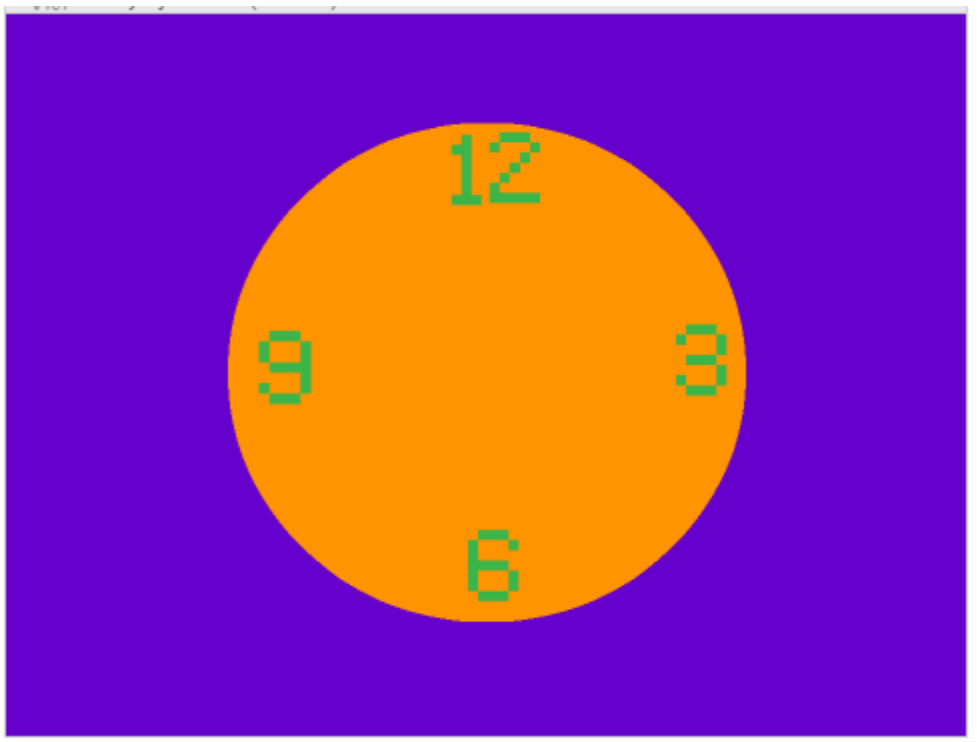
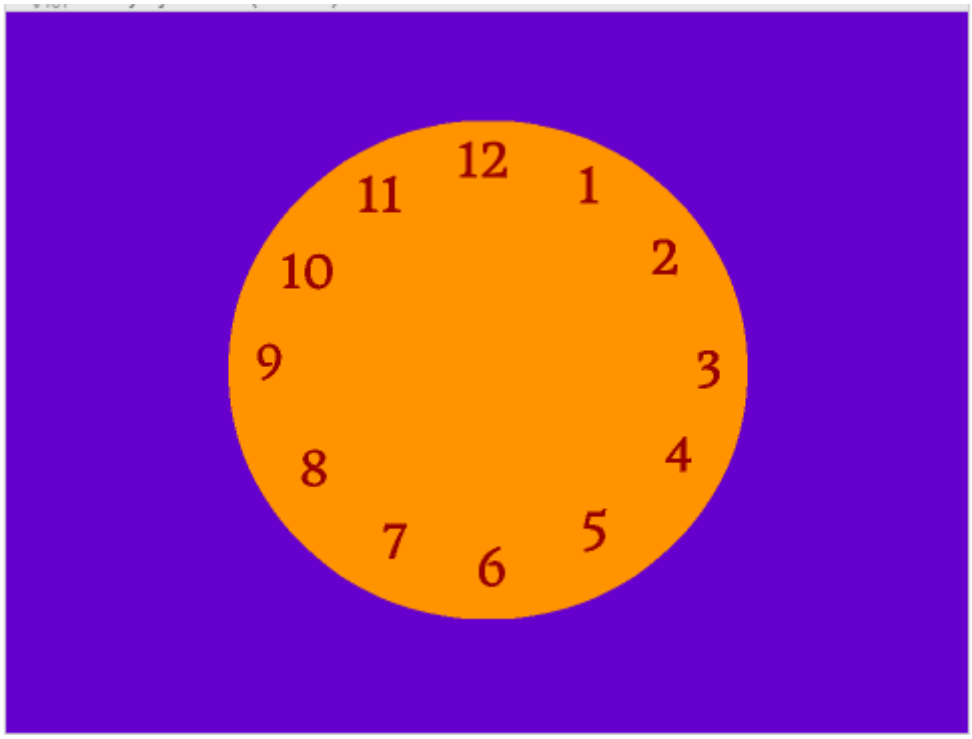
- Add the 12, 3, 6, and 9 numbers first – these go at the top, right, bottom and left of the clock face. Some clocks only show these four numbers, so you can stop there if you like, or add the other numbers in too. Either:



or



Save your project

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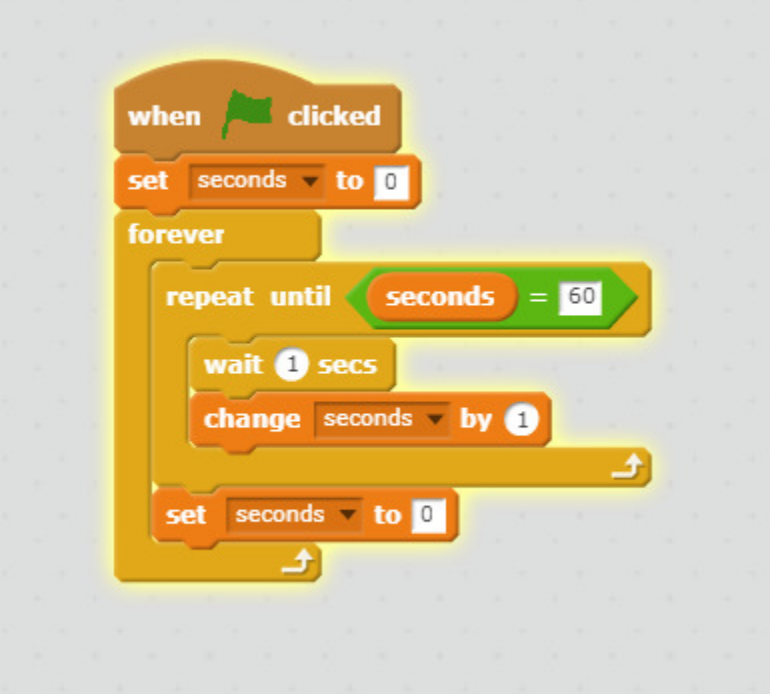
Step 2: Add the second hand

- To add the second hand, we first need to make a variable and call it 'seconds'.
- Then add the following code to the background:



- The code inside the 'repeat until' loop adds 1 to our variable every second, until it reaches 60 seconds (one minute). Then the loop finishes, our variable is set to 0 again, and the 'forever' loop starts the 'repeat until' loop again!
- You can see the seconds variable counting up to 59, then starting again from zero, just like a clock would.

Save your project

- Now we need to draw a second hand, so create a new sprite with the paintbrush icon, and draw a clock hand. Draw it horizontally and pointing to the right, like this:

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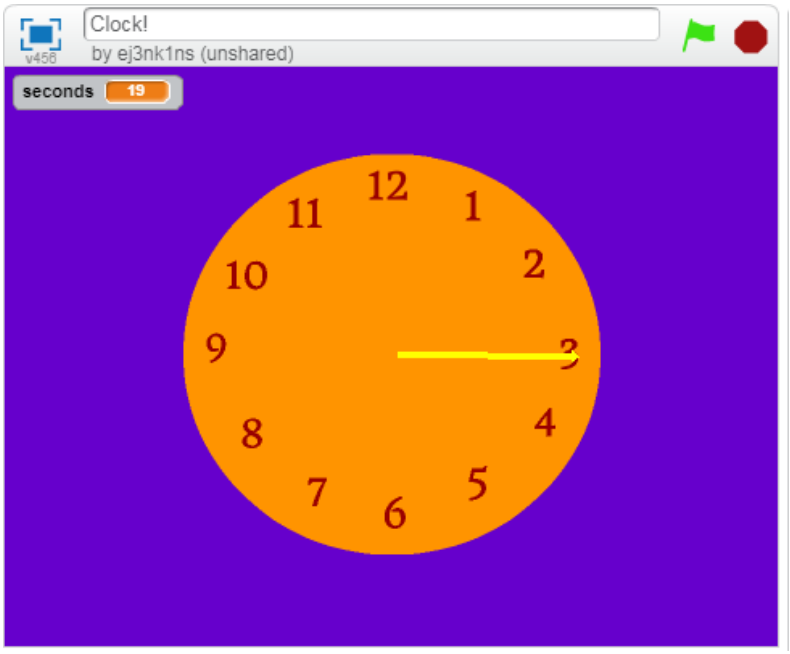
- You can choose any colour that shows up on your clock, and it can be as fancy or as plain as you like.
- Now set the costume centre to be at the base of the hand (the bit that will be in the middle of the clock). Position the hand on your clock background so it looks correct (and is still pointing to the right):



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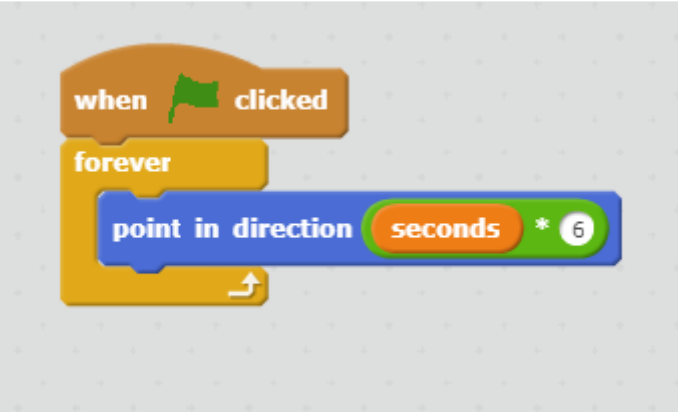
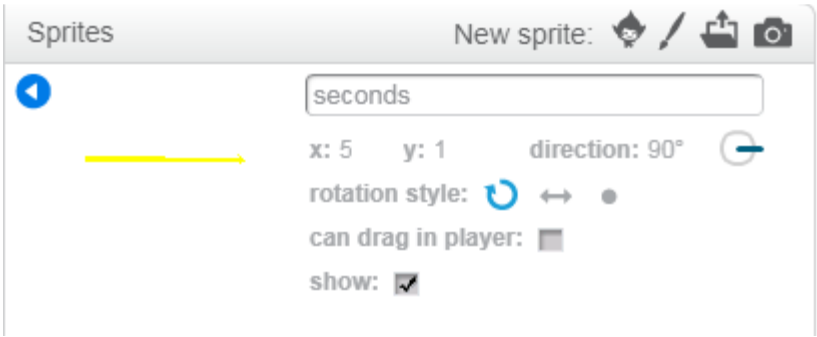
- Here is the code to add to the second hand:



- Test it out – does it work?
- Can you explain how it works? Why do we multiply the seconds variable by 6, to set the direction of the second hand? (see later for an explanation)

Step 2: Add a minute hand

- You might be happy to leave your clock as it stands, but if you think it needs a minute hand, then read on!
- If we are going to add minutes (and hours?), let us make sure we have named our second hand sprite 'seconds':



- Next create a new sprite and draw a minute hand, making it different from your second hand in some way (colour, shape, thickness…). Mine looks like this:

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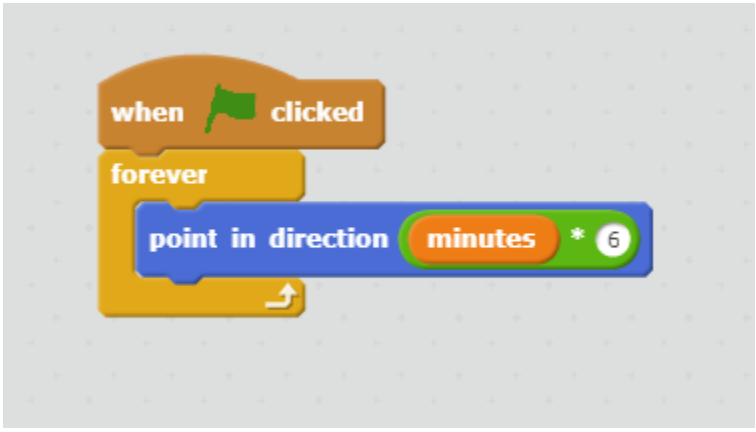
- Again, make sure you draw it pointing to the right, and centre the costume at the base of the hand.
- Name your minute hand sprite 'minutes'
- Next, make a variable called 'minutes'. (Scratch will not get confused that they have the same name, because they are different things.)

Save your project

- To save time, we can copy the code from the second hand to the minute hand. What one change do we need to make?
- The answer is below:



- We also need to extend the code on the backdrop to add to the minutes every time we get to 60 seconds. Have a think about how to do this, then compare your ideas with the code below (make sure you add to your existing block of code, don't start a new block!):

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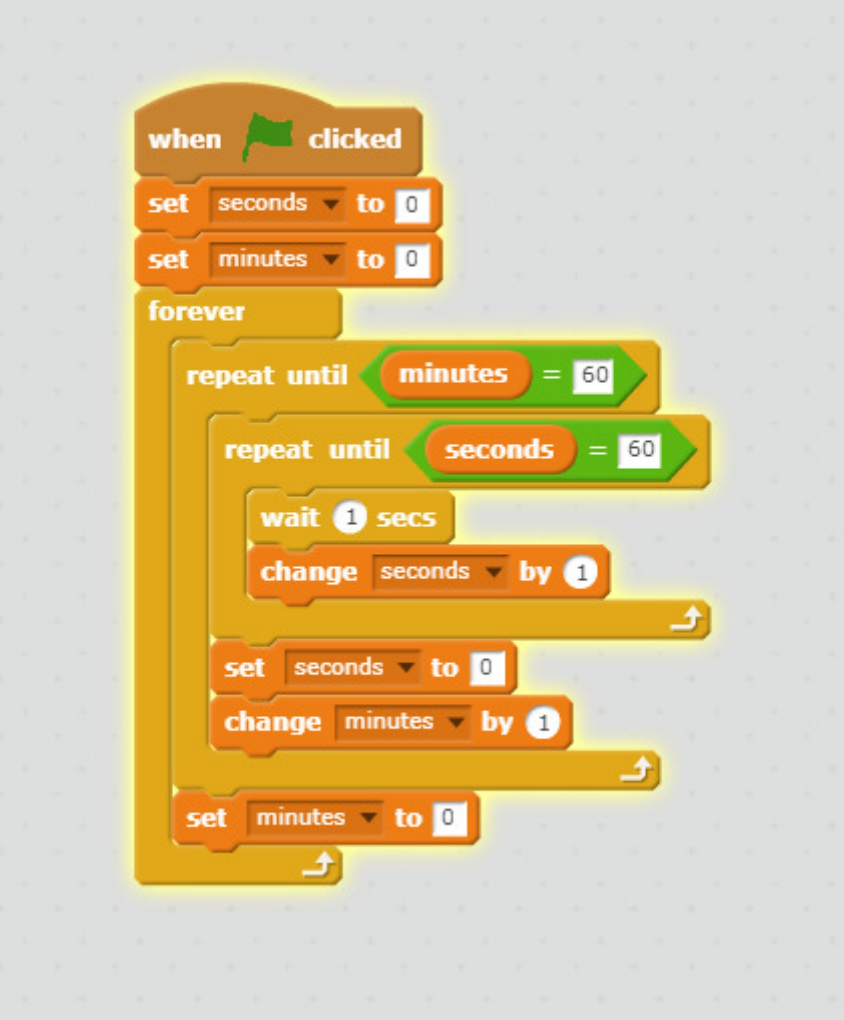

- Can you see that the 'repeat until' loop that works out the seconds, is inside (we say it is 'nested' inside) the new loop that works out the minutes? And every time we get to 60 seconds, we add 1 to our minutes variable, and set our seconds variable back to 0.
- There is a code block 'set minutes to 0' right near the end of this piece of code – where will the clock hands be when this gets run?

Save your project

More ideas

- We have used sprites for our numbers, but so far they have no code on them – what code could you add to each number sprite? Can you give each one a different costume, so that it changes colour (or does some other special

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effect) when one of the hands is touching it? Or how about playing a sound when the hand reaches the number 12, like a clock striking the hour?

- If you are still wondering about the question above, we multiply the seconds variable by 6 to set the position of the second hand, because there are 60 seconds in a minute, and 360 degrees in a circle. For example, when 5 seconds have passed, the second hand should be pointing at the number 1 (or one twelfth of the distance around the clock face). One twelfth of 360 degrees is 30 degrees, and we work out this position by multiplying 5 seconds by 6, 5 times 6 is 30 (degrees). This rule works for any position on our clock face.
- Can you add an hour hand? What code would you need to position the hour hand correctly?

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