

Introduction

Make your own paint program!

What you will make

You will click on the green flag to start, and you'll use the mouse to move the pencil and hold down the left mouse button to draw. Clicking on a colour will change pencil colours, and clicking on the eraser will change to the eraser!



What you will learn

- How to use the Pen extension in Scratch
- How to use broadcasts to communicate between sprites
- How to detect mouse events

What you will need

Hardware

- A computer capable of running Scratch 3

Software

- Scratch 3 (either [online](#) or [offline](#))

Step 1: Make a pencil

Start by making a pencil that you can use to draw on the Stage.

✔ Activity Checklist

- Open the 'Paint box' Scratch starter project.
Online: open the starter project at rpf.io/paint-box-on
Offline: open rpf.io/p/en/paint-box-go in the offline editor.
If you need to download and install the Scratch offline editor, you can find it at rpf.io/scratchoff

In the starter project, you should see pencil and eraser sprites:



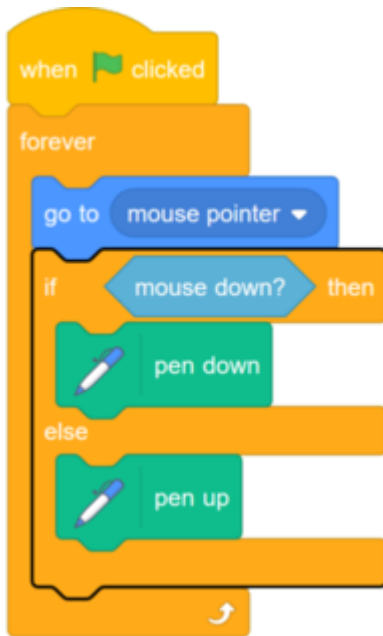
- Add the Pen extension to your project.
- Add some code to the **pencil** sprite to make the sprite follow the mouse pointer **forever** so that you can draw:



- Click the flag and then move the mouse pointer around the Stage to test whether your code works.

Next, make your pencil only draw **if** the mouse button is being clicked.

- Add this code to your pencil sprite:



Test your code again. This time, move the pencil around the Stage and hold down the mouse button. Can you draw with your pencil?

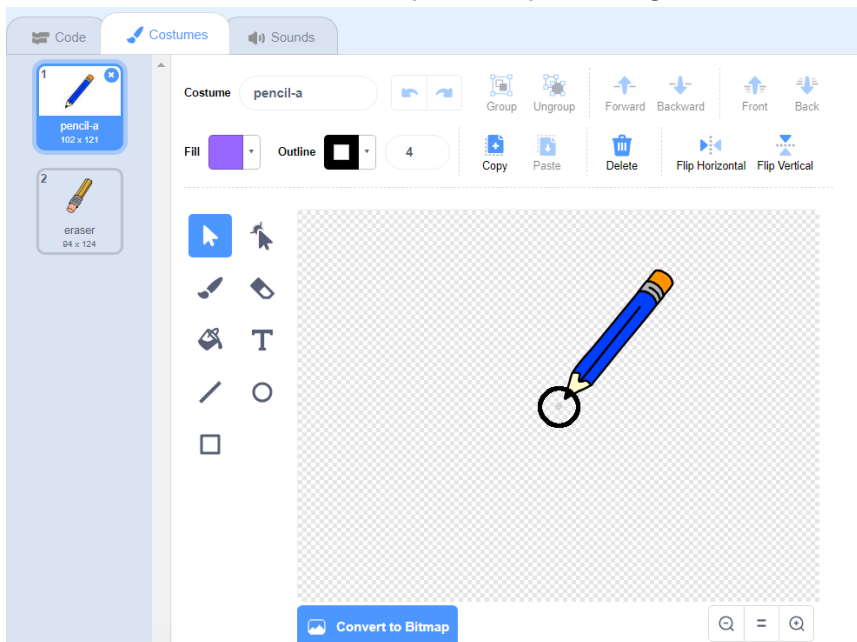


Does your pencil not draw from its tip?

If the line your pencil draw looks like it is coming from the pencil's middle, you need to change your pencil sprite's so the tip is the sprite's centre.

Click on the pencil sprite, and then click on the **Costumes** tab.

Move the costume's so the tip of the pencil is **just above** the centre.



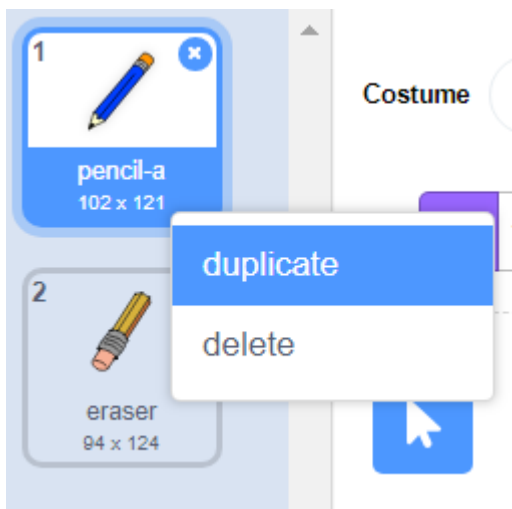
Now move the pencil around on the Stage and draw. The pencil should now draw a line from its tip.

Step 2: Coloured pencils

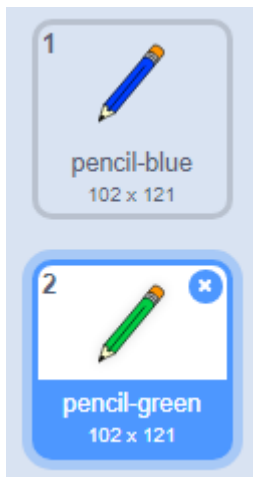
Now you're going to add different coloured pencils to your project and allow the user to choose between them.

✔ Activity Checklist

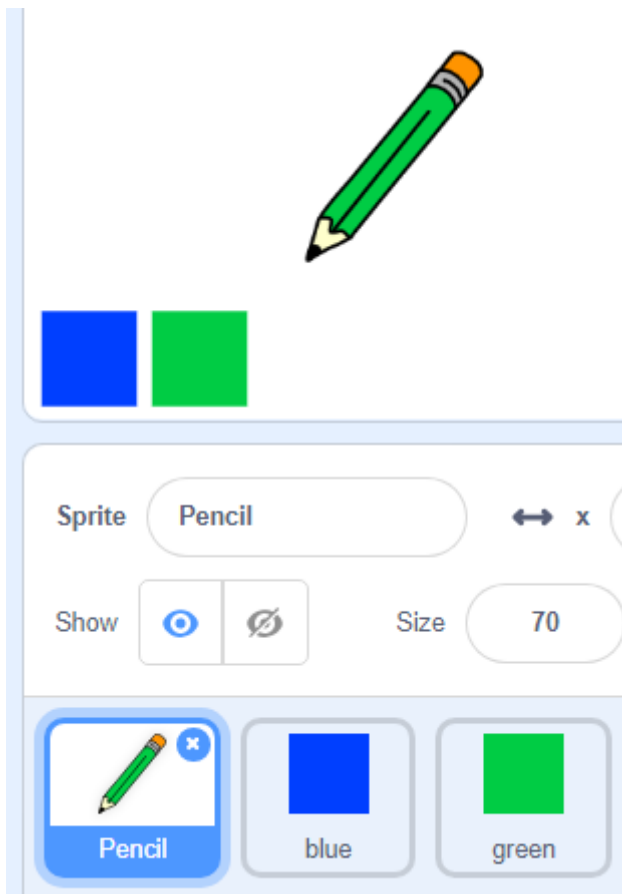
- Click on the pencil sprite, click on **Costumes**, and duplicate the 'pencil-blue' costume.



- Name the new costume 'pencil-green', and colour the pencil green.



- Draw two new sprites: one blue square and one green square. These are for choosing between the blue and green pencil.

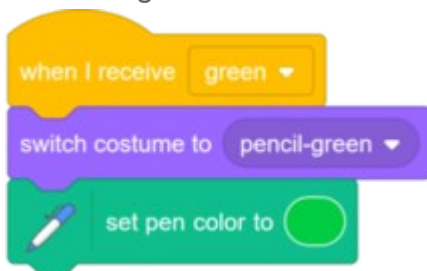


- Rename the new sprites so that they are called 'blue' and 'green'
- Add some code to the '**green**' sprite so that when this sprite is clicked, it **broadcasts** the message "green".



The pencil sprite should listen for the "green" message and change its costume and pencil colour in response.

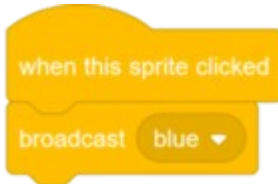
- Switch to your **pencil** sprite. Add some code so that when this sprite receives the **green** broadcast, it switches to the green pencil costume and changes the pen colour to green.



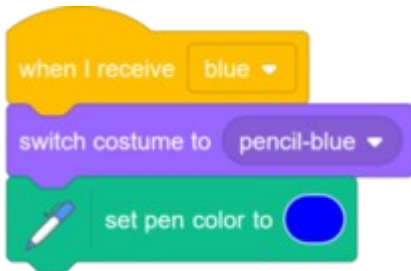
To set the pencil to colour to green, click the coloured square in the **set pen color** block, and then click on the green square sprite.

Then do a similar thing so that you can switch the pencil colour to blue.

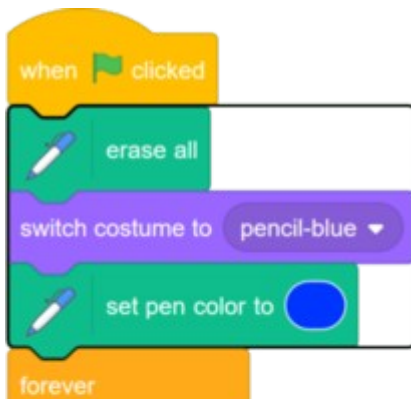
- Click on the blue square sprite and add this code:



Then click on the pencil sprite and add this code:



- Finally, add this code to tell the pencil sprite which colour to start with, and to make sure that the screen is clear when your program starts.



If you prefer, you can start with a different colour pencil.

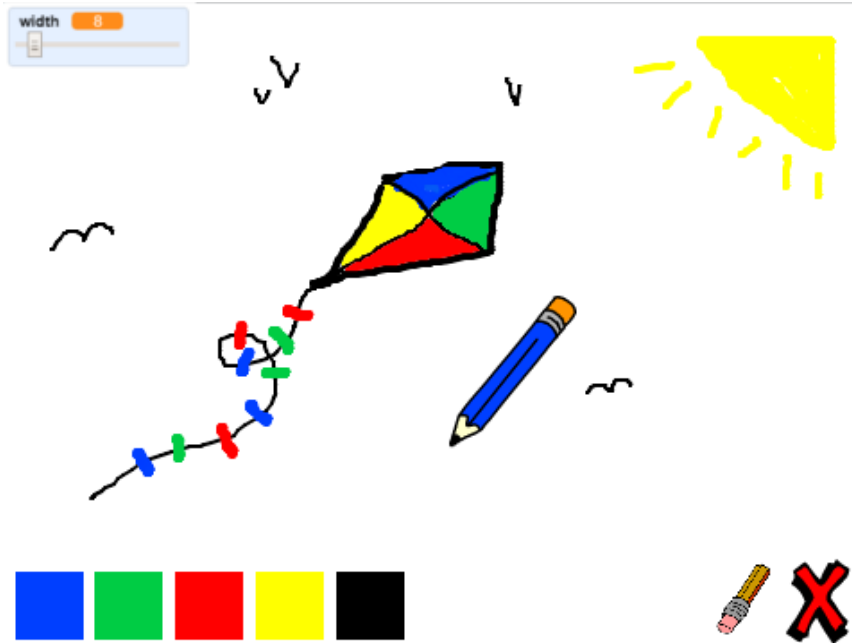
- Test your code. Can you switch between the blue and green pencil colours by clicking on the blue or green square sprites?



Challenge: more pencils

Can you add red, yellow, and black pencils to your paint program? Take a look at the earlier steps if you want a reminder of how to do this.

Can you use your pencils to draw a picture?

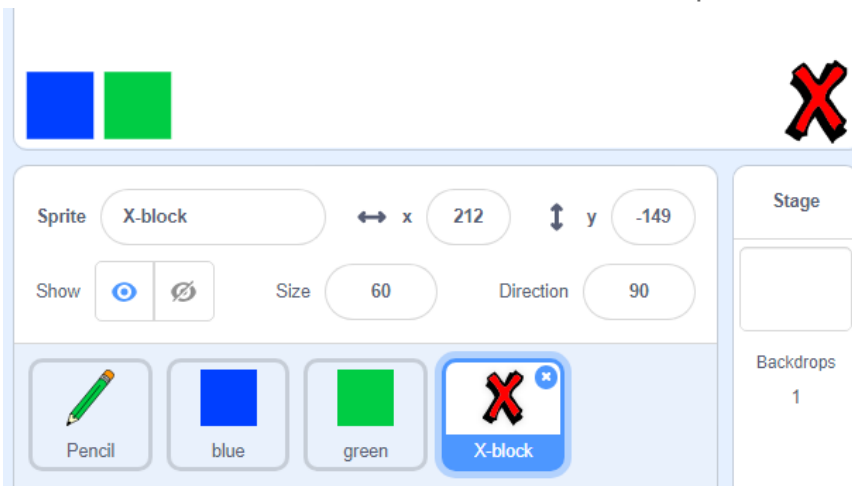


Step 3: Undo mistakes

Sometimes mistakes happen, so add a 'clear' button and an eraser button.

Activity Checklist

- Add the 'X-block' sprite from the library's letters section. Colour the sprite's costume in red and make it a little smaller. This sprite is the 'clear' button.

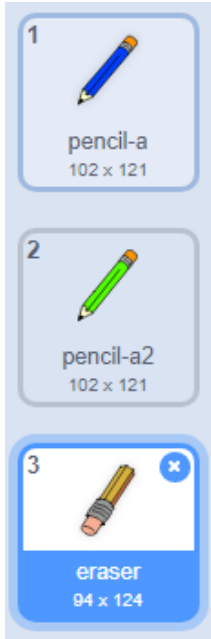


- Add code to the 'X-block' sprite to clear the Stage when the sprite clicked.



You don't need to use a **broadcast** to clear the Stage, because the **erase all** block does that job.

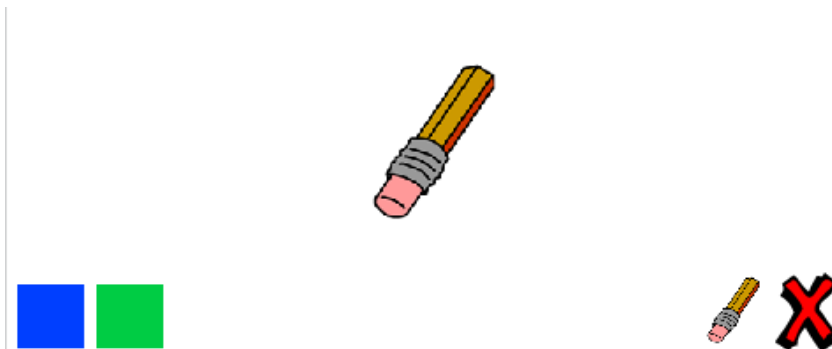
Do you see that the pencil sprite includes an eraser costume?



Your project also includes a separate eraser sprite.



Right-click on this eraser sprite and then click on **show**. Here is how your Stage should look now:



Add code to the eraser sprite to send an **'eraser'** broadcast when the eraser sprite is clicked.



When the pencil sprite receives the 'eraser' message, it should switch its costume to the eraser and switch the pen colour to white, which is the same colour as the Stage!

- Add some code to create the eraser.
Here is what the code should look like:

```
when I receive eraser
switch costume to eraser
set pen color to white
```

- Test your project to see if you can clear the Stage and erase pencil lines.



There's one more problem with the pencil: you can draw anywhere on the Stage, including near the 'clear' and eraser buttons!



- To fix this, change the code so that the pen is only down if the mouse is clicked **and** the **y** position of the mouse pointer is greater than **-120**:

```
when costume to pencil blue
set pen color to blue
forever
  go to mouse pointer
  if mouse down? and mouse y > -120 then
    pen down
  else
    pen up
```

- Test your project. You now should not be able to draw near the buttons.

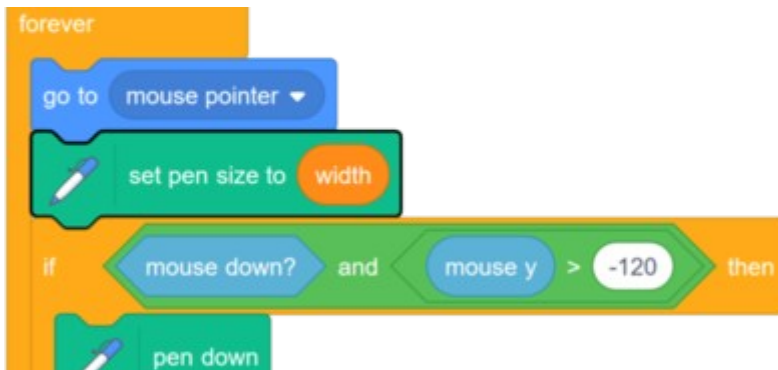


Step 4: Change the pen width

Next you will add code to allow the person using your program to draw things with different pen widths.

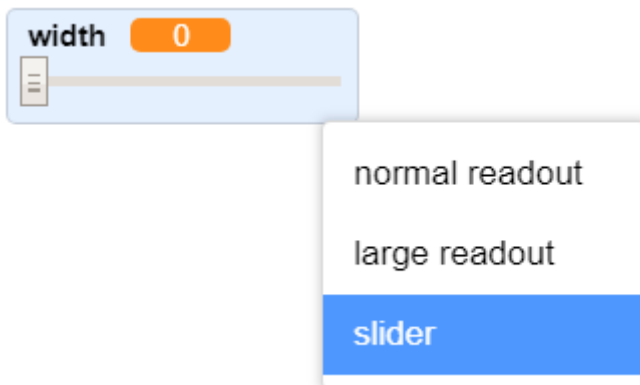
✔ Activity Checklist

- First, add a new variable called `width`.
- Add this line **inside** the `forever` loop of the pencil sprite's code:



The pen width now repeatedly gets set to the value of the `width` variable.

- Right-click on the `width` variable displayed on the Stage, and then click on **slider**.

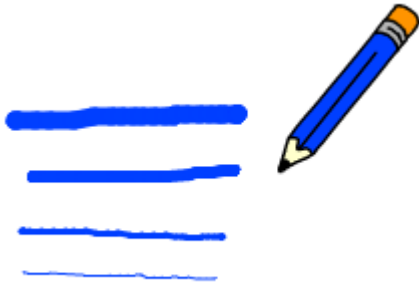


You can now drag the slider that is visible below the variable to change the variable's value.





Test your project and see if you can add code to adjust the pen width.



Challenge: keyboard commands

Can you add code so that, instead of clicking on the coloured squares or buttons on the Stage, you can make things happen by pressing keyboard keys? For example:

- `b` = Switch to blue pencil
- `g` = switch to green pencil
- `e` = switch to eraser
- `c` = clear screen

If you want to, you can also add code so that pressing the arrow keys changes the pen width.