Digital Technology

MIT Scratch
Code and Challenges

Version 1
2021

Barry Butler
bbutl58@eq.edu.au

Coolum
State High School
Care · Respect · Excellence

Content and Challenges

| Section	Content
A	Getting Started
B	Loops
C	Variables and More Loops
D	Conditional Statements
E	Broadcasting and Receiving Messages
F	Creating Your Own Backdrops

A. Getting Started

Download and Install Scratch

Scratch is on-line at https://scratch.mit.edu/

You can also download it from https://scratch.mit.edu/download

The latter is preferable because all your work is saved on your computer and no internet access is required.

The Scratch Window

Note the various parts of the window.
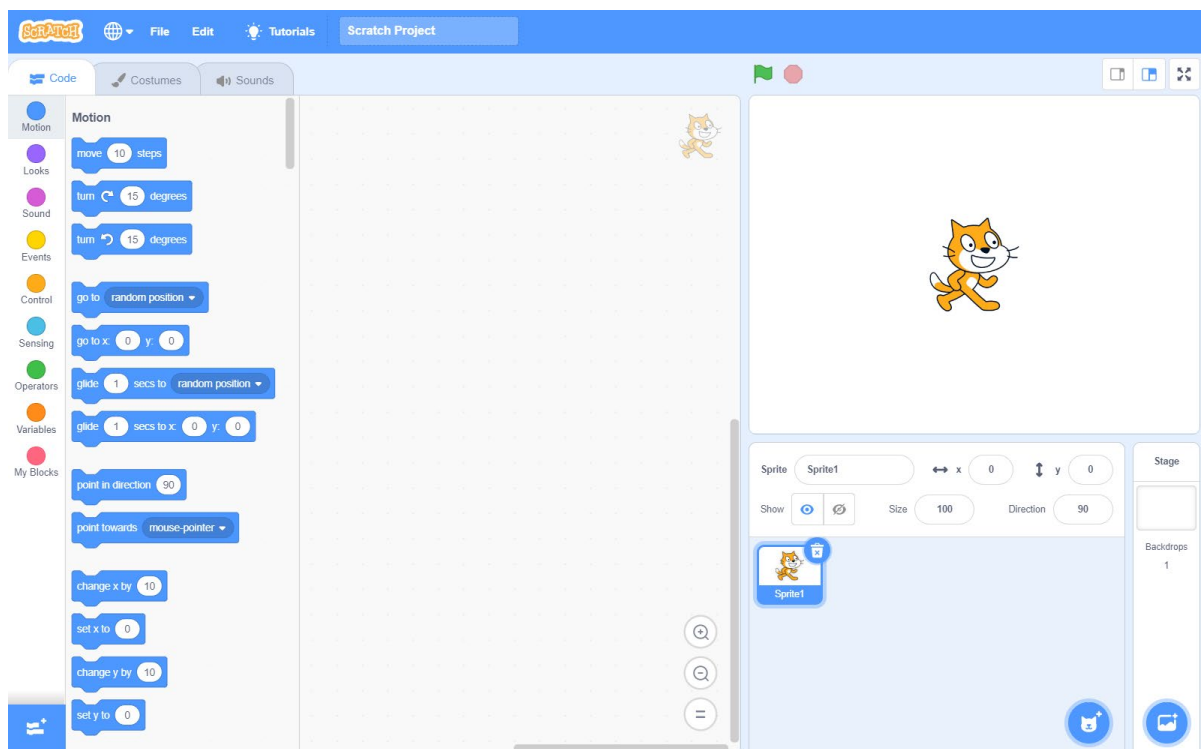
The Pen Extension

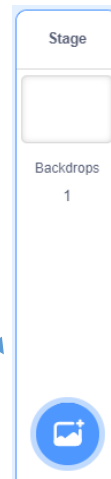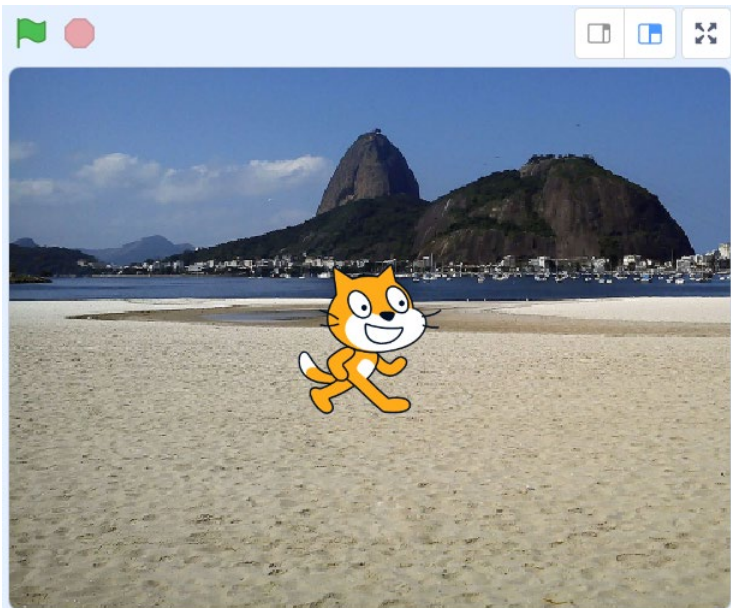One additional set of blocks we will use is the Pen.

Click the extension button and select the Pen extension.

Change the Backdrop

Every project needs a decent backdrop. Click the choose a backdrop button.

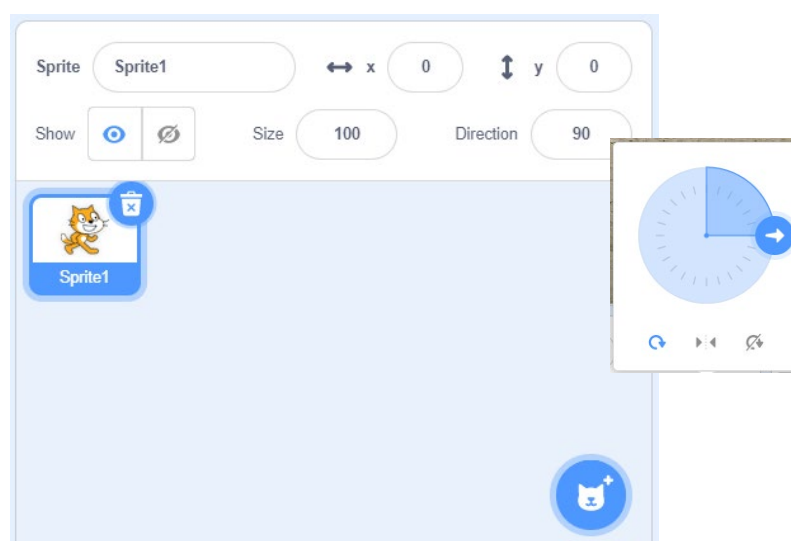Then select one of the beach backdrops from the list.

The stage will now look like:

Change Sprite Properties

Each project starts with one sprite – Scratch, the cat. We can change the initial position, appearance and orientation of Scratch.

- Change its' name
- Drag it to a new position (see how x and y change)
- Change its' size
- Change its' direction.
- Check out the options.

Coding
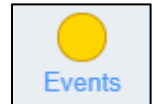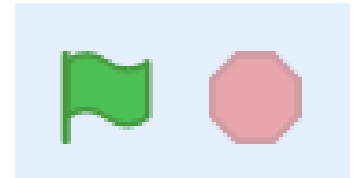
All projects are activated by clicking the green flag above the stage and are stopped by clicking the red stop sign.

Start with an Event Block

Your code must be linked to the flag being clicked, a key being pressed or a sprite being clicked on.

Click the events button on the left-hand side.

Drag *when flag clicked* onto the coding space in the middle of the screen.
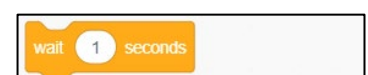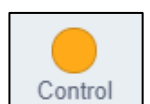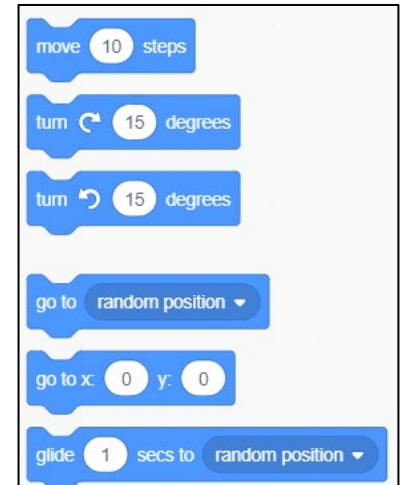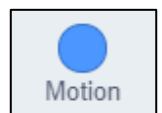
Move the Cat

Click the motion button on the left-hand side to view the motion blocks.

Drag any of these blocks underneath the *when flag clicked* block. Use a wait block to give more time between each action.
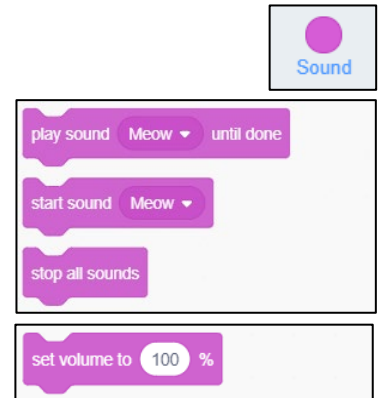
Click the green flag to start the action.

Investigate each of these blocks.

Add Sound

Click the sound button on the left-hand side to see the blocks to play a sound and set the volume.

Add these sound blocks to your code.
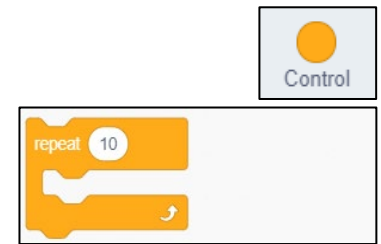
B. Loops

Repeat Loops

A repeat loop executes the code blocks within it many times. For example, to make Scratch move in a square:

The first two blocks resets Scratch to the coordinates and direction we want to start.

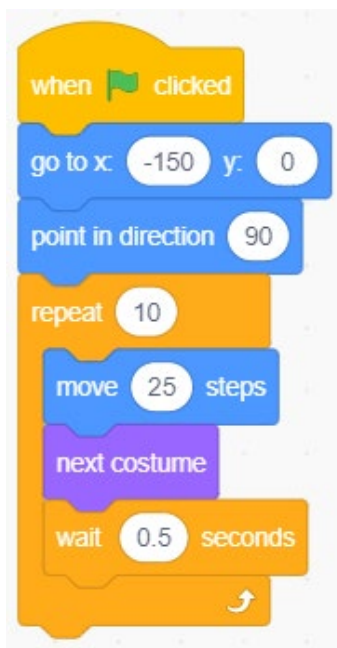This loop will be repeated four times.

Try other combinations of a repeat loop and movement.
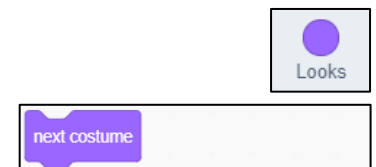
Change Costumes

Click on the costumes tab.

You will notice Scratch has two costumes or appearances, and can change between the two. Put this change into a loop:

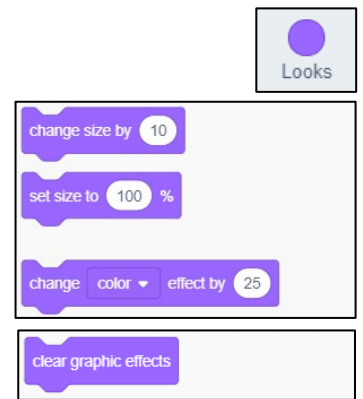Start Scratch further over to the left (x = -150)

Change Size and Colour

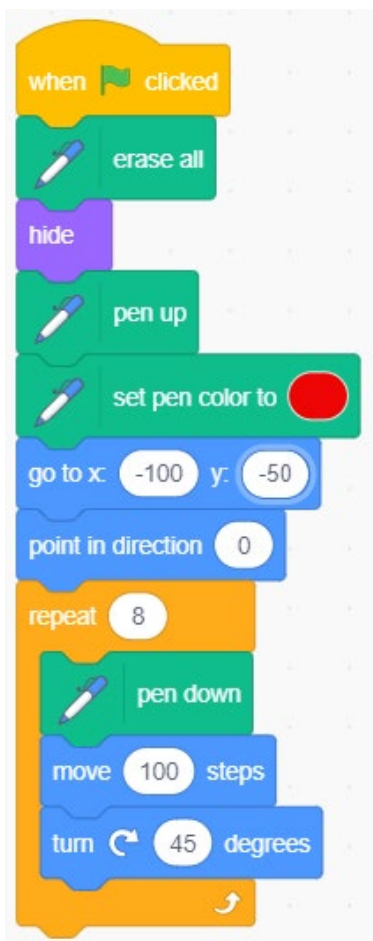We can also change the sprite size and colour:

Reset the size each time it is run.
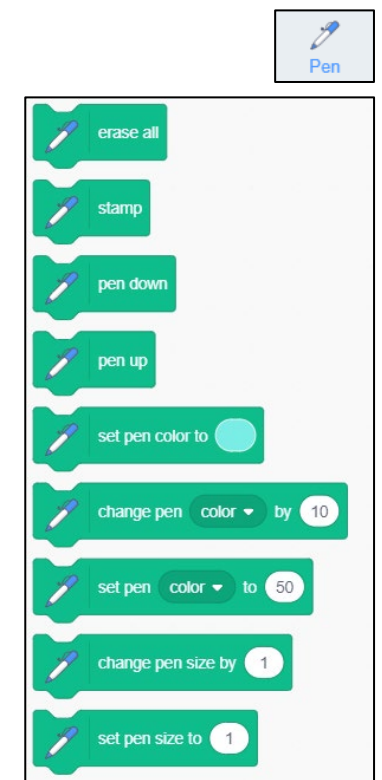
At the end, set Scratch to its' original colour.

Draw with the Pen (change the backdrop to Blue Sky 2)

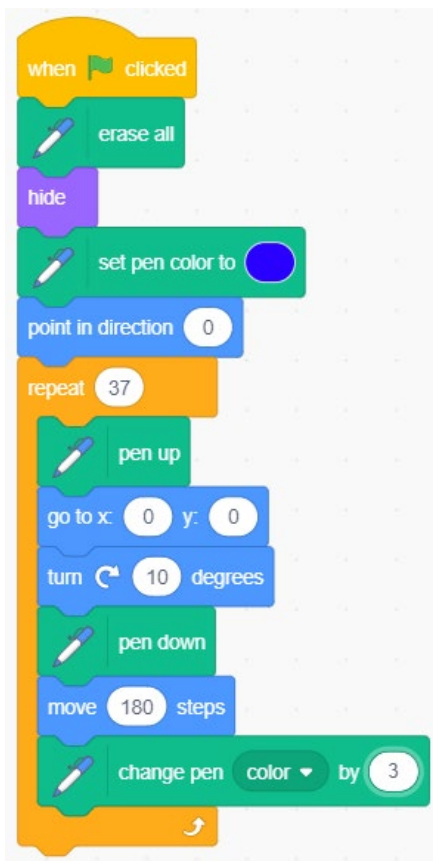We can use loops to create drawings. Click the Pen button for the pen blocks.

The first thing we will do in the code is erase the screen and make Scratch invisible, then put pen and motion blocks inside a loop.

Notice the use of pen up and pen down.

Draw a Star

```
when [flag] clicked
erase all
hide
set pen color to [blue]
point in direction (0)
repeat (37)
  pen up
  go to x: (0) y: (0)
  turn ↻ (10) degrees
  pen down
  move (180) steps
  change pen [color ▾] by (3)
```

Draw a Circle

```
pen down
repeat (36)
  move (20) steps
  turn ↻ (10) degrees
```

or for a finer circle

```
set pen size to (1)
pen down
repeat (72)
  move (10) steps
  turn ↻ (5) degrees
  change pen size by (0.5)
```

Loops inside Loops

Try putting a loop inside another loop for some interesting effects.

Explore drawing other shapes such as:

- **A simple house**
- **Geometry shapes**
- **A face**
- **A stick figure**

```
when [flag] clicked
erase all
hide
set pen color to [blue]
point in direction (0)
repeat (37)
  pen up
  go to x: (0) y: (0)
  turn ↻ (10) degrees
  pen down
  move (150) steps
  repeat (4)
    turn ↻ (90) degrees
    move (20) steps
```
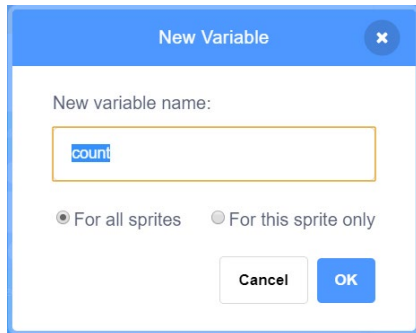
C. Variables and More Loops

Variables

- Variables enable us to store values (e.g. text and numbers).
- The value of a variable can change.
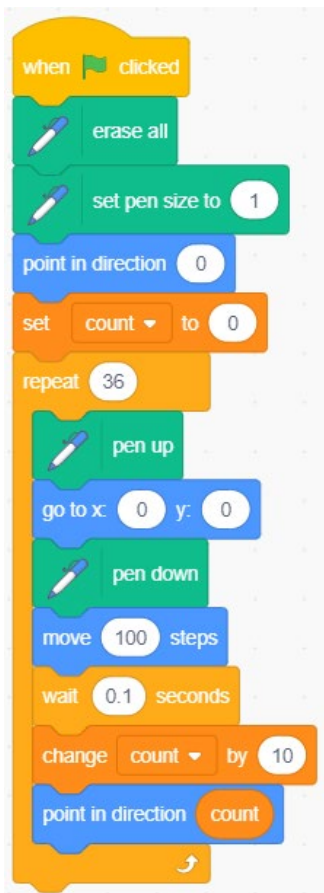- They must have a descriptive name so you can recognise them.

Click the **Make a Variable** button and enter the variable name.

The variable is shown on the stage. You can click the checkbox beside the variable name so it does not show on the stage.

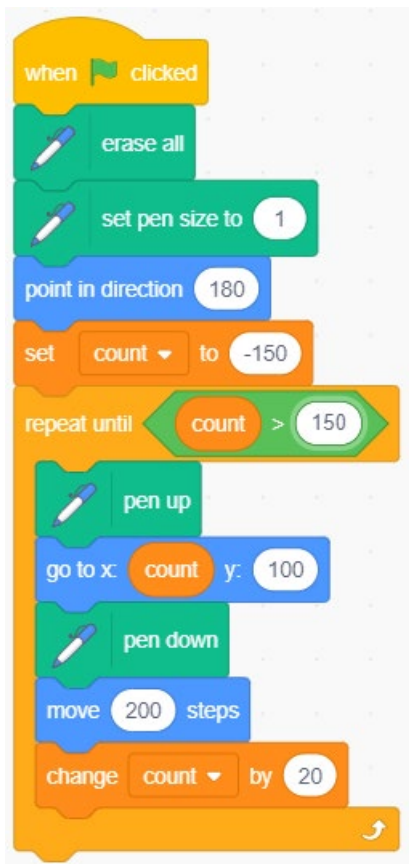**Use the variable to store the drawing angle**

Set the initial value of the variable

Increase the variable by 10

Point in the new direction

Repeat Until Loops

A repeat until loop continues a loop until a condition is met. Let's draw vertical lines on the screen from one side to the other – without having to calculate how many there will be.

Set the initial value of the variable.

Test whether the final value has been reached.

Go to the line start position.

Change the variable by the distance between the lines.

Repeat Until an Event Occurs

There are often situations where we want the loop to keep going until some event occurs – like a key pressed, mouse click, a collision or message received.

Notice that you might need to hold the key down for at least one second because of the glide delay.
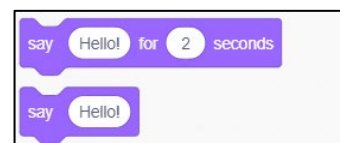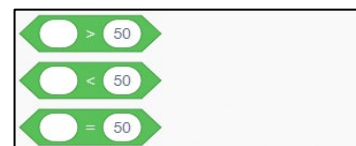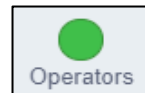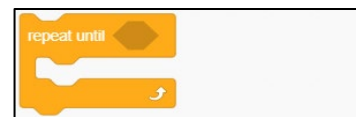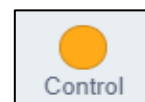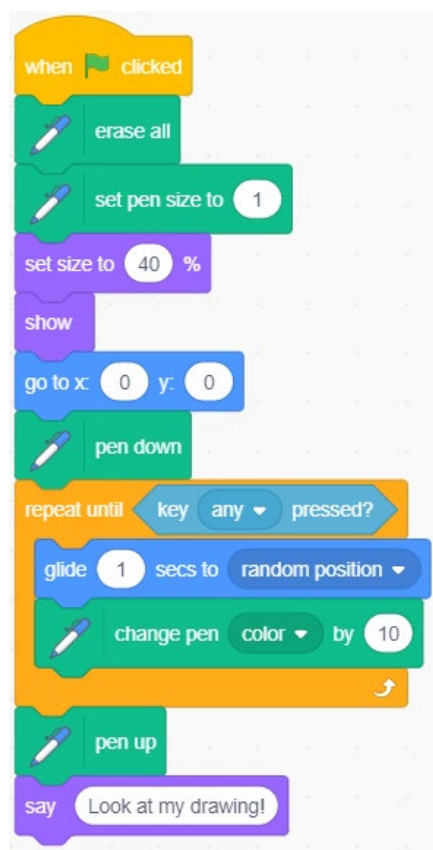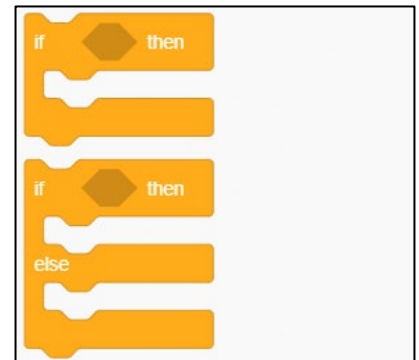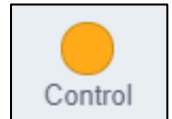
D. Conditional Statements

Conditional statements enable us to make decisions. They take the form:

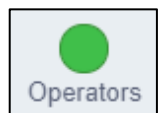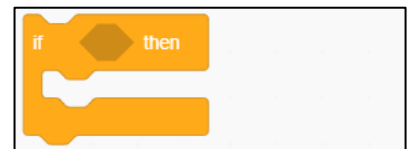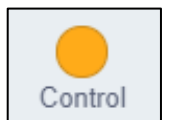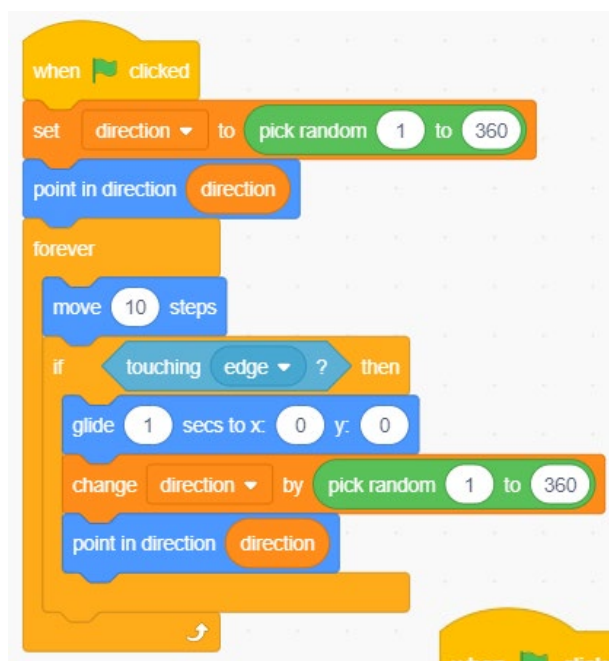>**if** <a statement is true> **then** (do something)

>**else** (do another thing)

- **If** blocks can be nested – that is have one **if** block inside another.
- **If** blocks can be inside loops

Random Cat

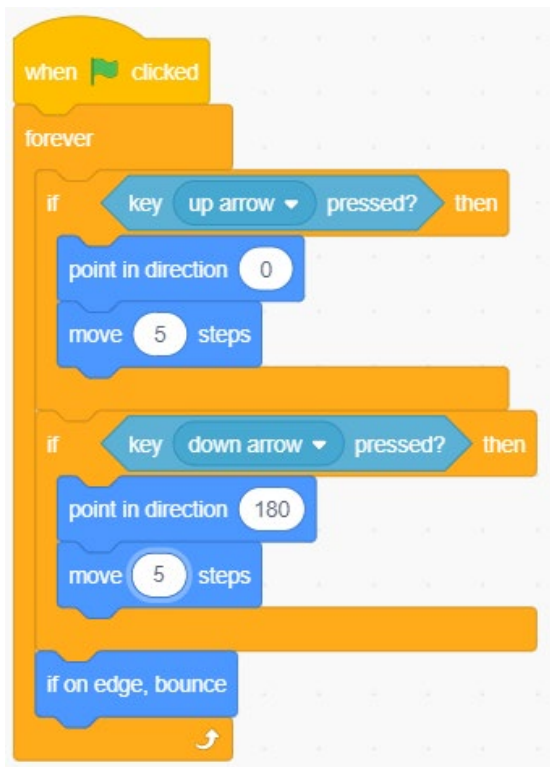Let's make Scratch bounce off the sides of the screen…

or only move if a key is pressed

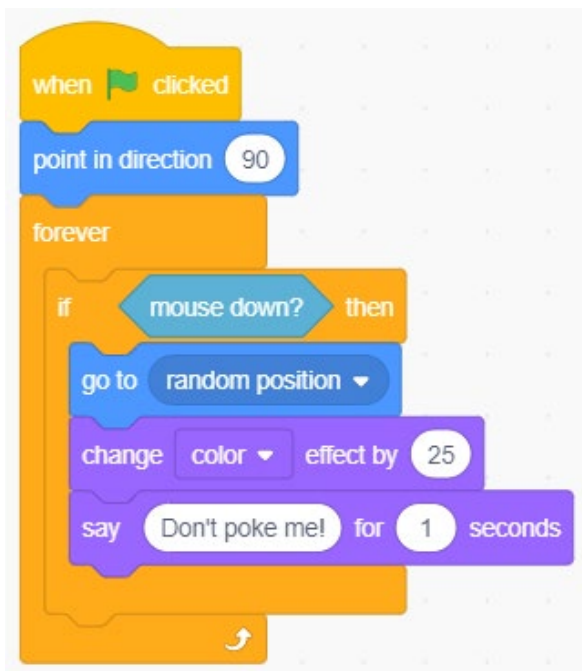**Better Control with the Arrow Keys**

Let's use the four arrow keys to control Scratch.

You can add if-then statements for the left and right arrow keys.

Mouse Clicks

We often want something to happen when we click on a sprite with the mouse.

Ask a Question

We can use if-then-else statements to check an answer to a question.
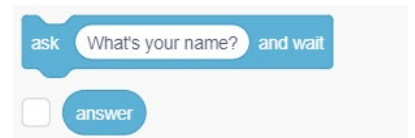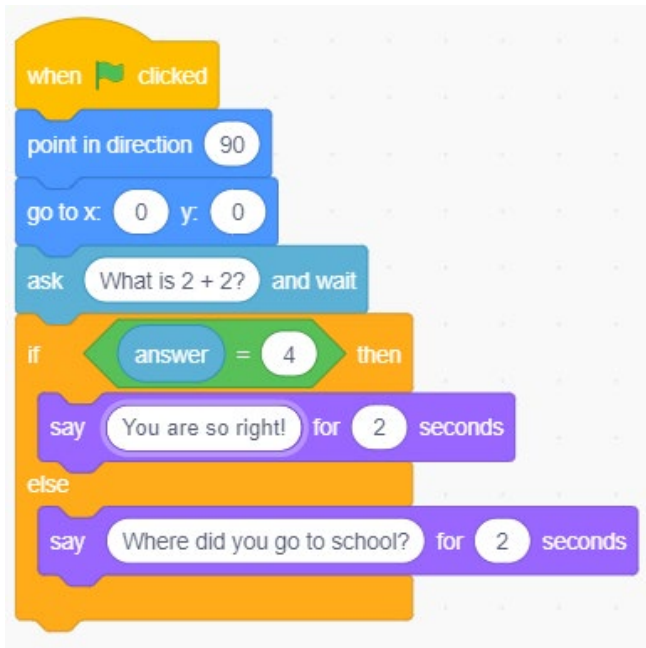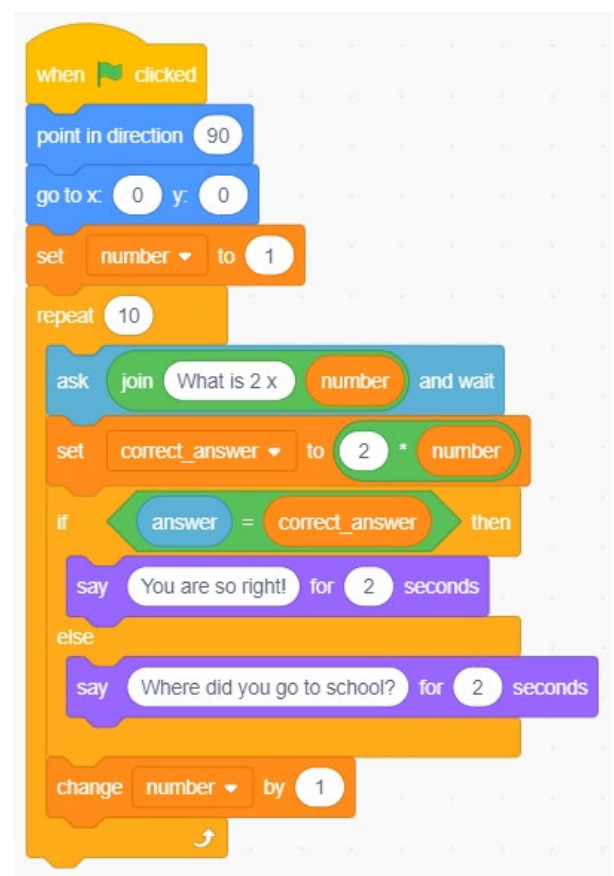

Times Tables Game

Let's combine a loop with an if-then-else statement to make a times table game.

Add **scoring** to the game:

Create a score variable.

If the answer is correct, change the score by one.

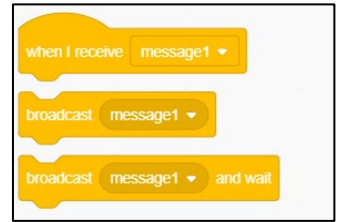At the end, have Scratch say the score.

E. Broadcasting and Receiving Messages

When one thing happens to a sprite, many other things often need to happen as well.

Scratch handles this by broadcasting a message from a sprite. Many other sprites and the backdrop can receive the message and respond to it.
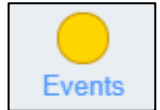
Synchronized Sprites

Select 3 different sprites and put them on the stage pointing in different directions.

For one of them, make this code:
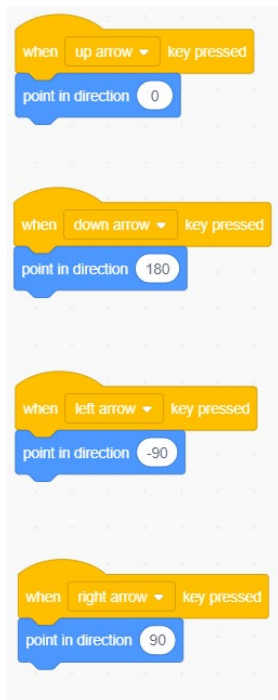
Click on the other sprites. Notice that this code does not appear for the others.

Press the arrow keys and notice that only one sprite moves.

Broadcast Messages

Let's add the statements to broadcast a different message for each arrow key.

Click on the message list and select **New Message**.

Receive Messages

```
when I receive  up pressed ▾
point in direction  0
```

For each of the other sprites, make the code to receive the messages.

Now, press the arrow keys and see what happens.
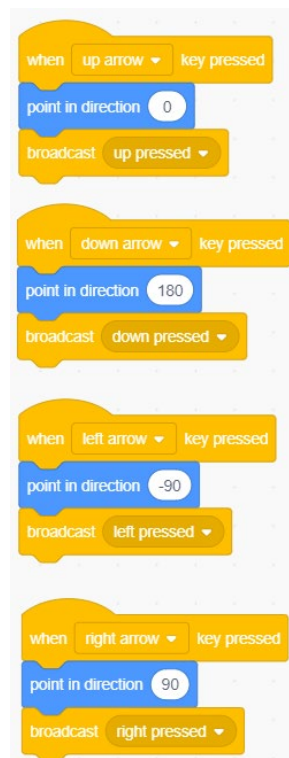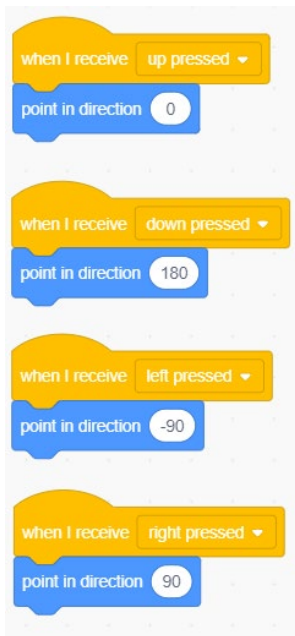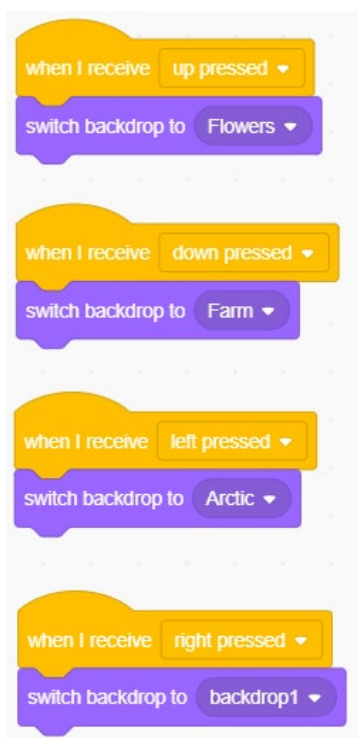
```
when I receive  down pressed ▾
point in direction  180
```

```
when I receive  left pressed ▾
point in direction  -90
```

```
when I receive  right pressed ▾
point in direction  90
```

Stage

Backdrops
4

Change the Backdrops Too

1. Add four backdrops.

2. Click the Stage button to make the code to change the backdrops.

```
when I receive  up pressed ▾
switch backdrop to  Flowers ▾
```

```
when I receive  down pressed ▾
switch backdrop to  Farm ▾
```

```
when I receive  left pressed ▾
switch backdrop to  Arctic ▾
```

```
when I receive  right pressed ▾
switch backdrop to  backdrop1 ▾
```
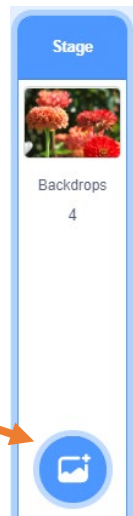
What happens now when you press the arrow keys?

F. Creating Your Own Backdrops

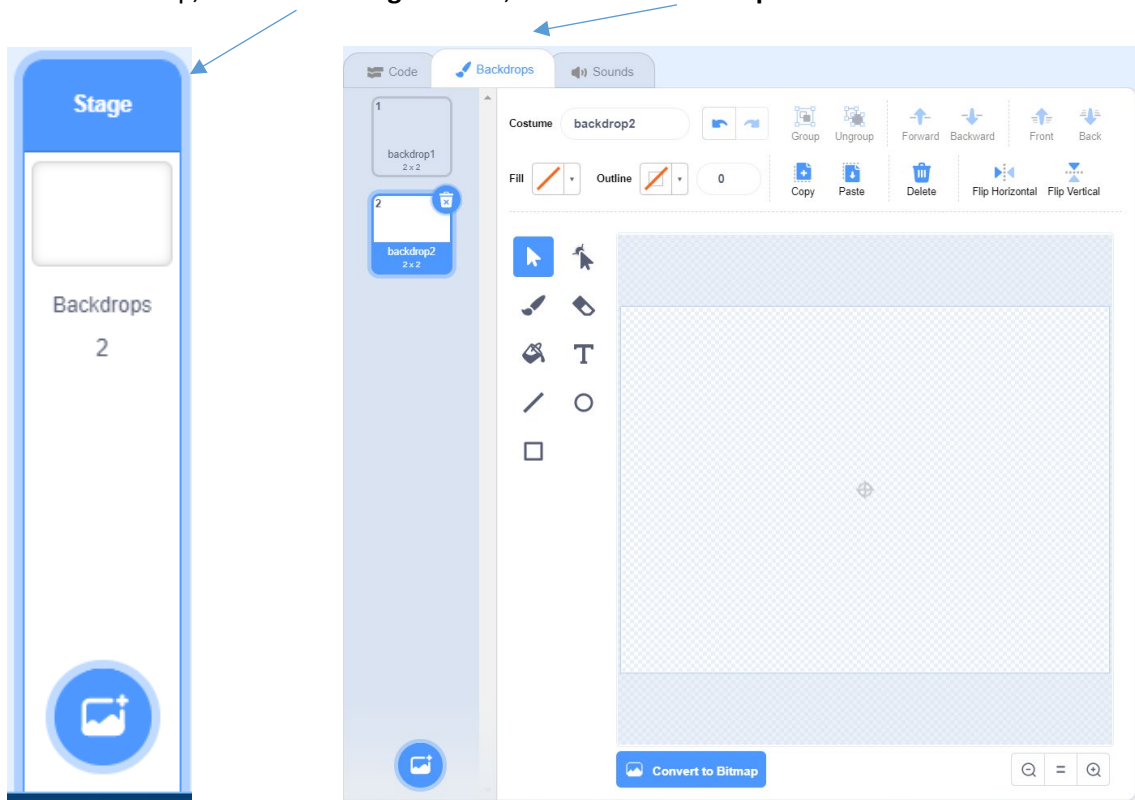To create your own backdrop, click on the **Stage** button, then select **Backdrops** from the tabs on the left-hand side.

First Steps

- ALWAYS use the backdrop editor in vector mode. If the blue button on the bottom says 'Convert to Vector', click on it.
- NEVER switch modes or you lose the ability to edit your work.

The order in which to create a backdrop should always be:

1. Place any images
2. Draw shapes
3. Write Text

Explore all the options and test them out before you use it to create a backdrop.

Placing Images

You can put images onto a backdrop but, weirdly, there is no button to do so. Therefore, take the following steps:

1. Move the mouse over the **Choose a Backdrop** button on the bottom left, then click **Upload Backdrop**.
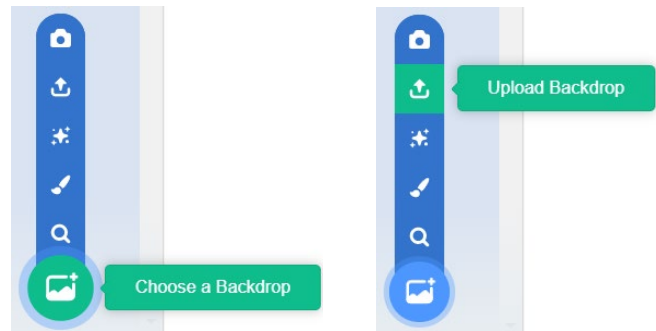
2. Select the image you want.

3. Click **Convert to Vector**

4. Click on the image and move it, enlarge it (from the corners), or copy and paste it onto a different slide.
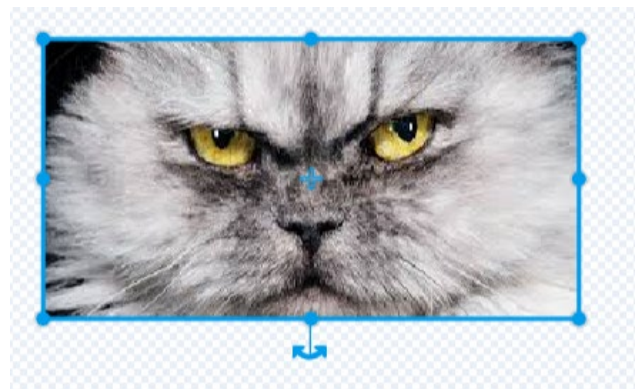
Writing Text

There is no option to change the size of text before you type, only to change the font.

To write text:

1. Click the Text tool button.

2. Click anywhere on the drawing canvas.

3. Type the text.

4. Click the Select button. A solid rectangle appears around the text.

    Drag the corners to **resize** it, drag inside the rectangle to **move** it and drag on the arrows to **rotate** it.