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Computer Science Concepts

- Decomposition
- Repetition repeat x loops
- If else selection
- Random choice using a variable

Maths Concepts

- Using Y axis to position a sprite
- Angles
- Random length and angle

Design a Tree

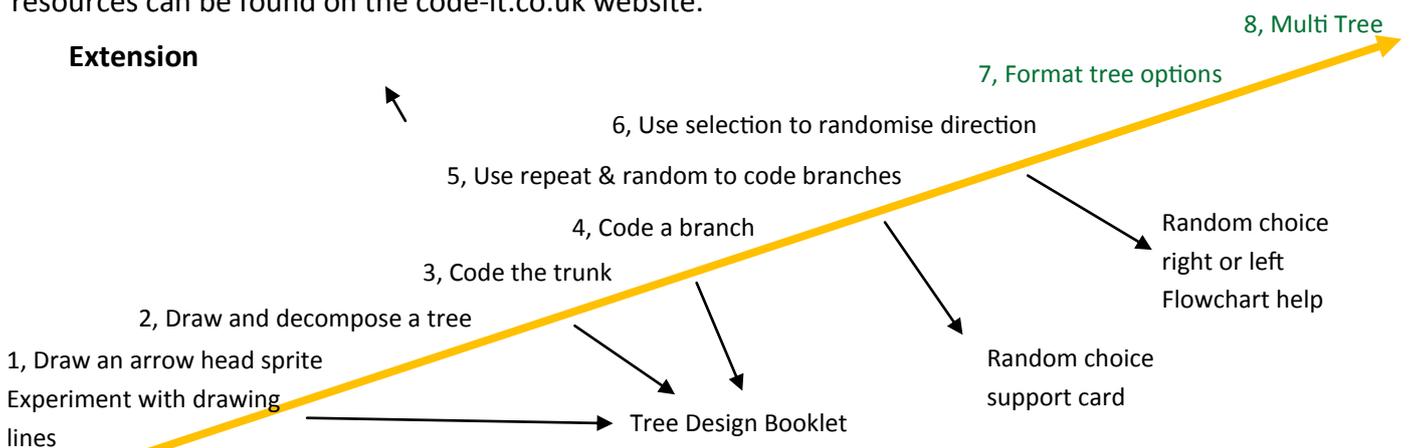
Program Aim Write a program that draws a different looking tree every time the program is run.

Hook

A games designer want to create a forest of trees as a backdrop to a scene in a game. To pay someone to draw these individually would be far too expensive. Write a program that draws a different looking tree every time the program is run.

Differentiation and Assessment for Learning At the beginning of each session the *learning intention sheet* is shared and the learning journey expanded through success criteria. Pupils feed their progress back to the teacher through annotating this sheet with smiley faces at the end of the lesson. Teachers can also annotate the sheet to indicate those who need more or less help in future lessons. These extra resources can be found on the code-it.co.uk website.

Extension



Learning Path

Support

1, Draw an arrow headed sprite

Show everyone how to do this.

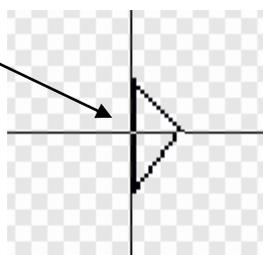
Delete the Scratch cat by right clicking on sprite 1 and selecting delete

Left click paint new sprite

Using the straight line tool draw an arrowhead pointing right

Click to set the costume centre

Line up the centre on the middle of the straight line



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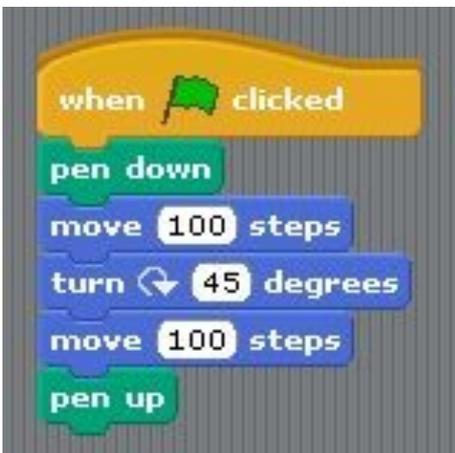


Design a Tree P2

1, Experiment with drawing lines (continued)

If pupils haven't had an opportunity to draw lines using the motion and pen commands then it is a good idea to give them a brief opportunity to do this. Demonstrate how the **pen down pen up** command can be coupled with the **move 100 steps** block and the **turn right 15 degrees** block to draw lines with turns.

After they have had time with this show them how you can return to the centre every time using the **go to X Y** block just using 0 0. You could add the 0 -180 to start at the bottom in the middle explaining about the Y axis line (which is on their planner in part 1) Add the **point in direction** block and demonstrate pointing up (0) as well. Give pupils time to draw some simple shapes as part of this.

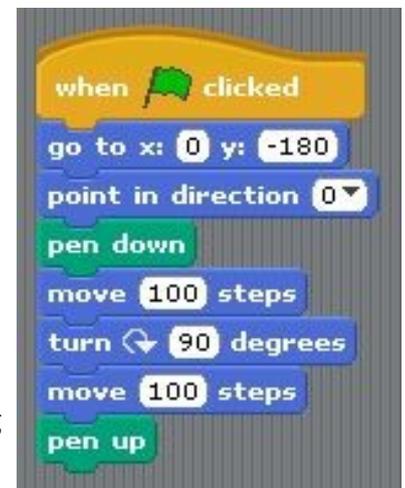


Resources

Tree Pupil Booklet Main
Tree Pupil Booklet Able

2, Draw and Decompose a Tree

Before pupils can program a randomising tree they need to draw a simple tree and



decompose its main elements. Looking carefully at all the tree properties such as where they attach to other parts of the tree and what size they are. Start by sharing the hook outlined on P1. Hand out the tree design booklets one between two. Ask them to draw a tree (Able group) making sure the trunk is on the Y axis. Get main group to label the parts of the tree and answer the questions. As pairs finish encourage them to work on the properties of the trunk, branch & branches on the next page (Able group) and write a trunk and branch algorithm (Main group). Once a suitable amount of detail has been added let pupils move onto coding the trunk. Encourage pupils to work in pairs but code separately. You may need to remind some pupils about the pen up and pen down button.

A tree is a good thing to draw for younger pupils as precision in angles is not required. The able group have a much wider choice of selected blocks and are asked to work out the properties of their trunk and branch before coding. The main group have a more limited selection of blocks and need to think of an algorithm for trunk and branch before coding. Generally I would use their Maths groups and any pupils who attend programming clubs as a way to group pupils.



Design a Tree P3

3, Code the trunk

There are many ways to do this. Our job as teacher is to encourage them to experiment and find a way that suits them but still fulfils the design criteria. I have included some possible code examples and questions to ask to help them think about the task if they are stuck. The trunk is the obvious place to start as it is in effect just one line.

Pupils will need a starting position (go to 0 -180) and need to point up (point in direction 0) They could then use move x steps or use the go to 0 and a higher place on y axis than -180. Some pupils will drag their sprite to the bottom and turn the blue line to face it. This is fine for casual use but ask them if this will work every time the program is run? Ask them how they can place the starting point and direction every time?

3a, If pupils get beyond point 6 in the planning you could challenge them to create a trunk that is wider at the base

```
when clicked
clear
pen up
go to x: 0 y: -180
point in direction 0
pen down
go to x: 0 y: -20
```

Using Y axis to draw trunk

```
when clicked
clear
pen up
go to x: 0 y: -180
point in direction 0
pen down
glide 1 secs to x: 0 y: -50
```

Using Y axis to draw trunk slowly

```
when clicked
clear
pen up
go to x: 0 y: -180
point in direction 0
pen down
move 100 steps
```

Using move to draw trunk

4, Code a branch

Encourage able pupils to use the properties of the tree sheet to help them draw one branch. This will need a start position, a number of turns and move distances between the turns. Every branch design in your able group could be different from every other one. As before pupils need lots of time to work this out for themselves.

Encourage your main ability pupils to refer back to their algorithms they created earlier. These will push them towards using Y axis for the trunk and move and angle turns for the branch.



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Design a Tree P4

5, Use repeat and random to code branches

Once pupils have coded one branch ask them how they can repeat their first branch in a different position? Can they find a way to repeat it without creating new code for ever new branch? After a while introduce the idea of randomising certain key numbers such as distance and turn in degrees.

You may wish to use examples like these

```

when clicked
clear
repeat 10
  pen up
  go to x: 0 y: 0
  point in direction 0
  pen down
  move pick random 40 to 60 steps
  turn pick random 20 to 50 degrees
  move pick random 40 to 60 steps

```

You can adapt the other example to draw multiple branches but I like to give pupils plenty of time to see if they can work this out for themselves before showing them this

```

when clicked
clear
pen up
go to x: 0 y: 0
point in direction 0
pen down
move pick random 40 to 60 steps
turn pick random 20 to 50 degrees
move pick random 40 to 60 steps

```

This example is best to show to the whole class as you can run it over and over to show random elements at work

```

turn pick random -30 to 30 degrees

```

6, Use selection or negative numbers to randomise the direction of turn right or left

Ask pupils if it is possible to make the branch turn right or left? Can they experiment to find ways to do this? There are two solutions to this. The first just involves using a negative number in the random command inside a turn x degrees

```

set rightorleft to pick random 1 to 2
if rightorleft = 1
  turn pick random 0 to 45 degrees
else
  turn pick random 0 to 45 degrees

```

The second involves using a selection block and a variable as shown



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Design a Tree P5

7, Format Tree Options

There are lots of extension options we can include such as colour of tree. Thickness of truck/branches. Can we add sub branches? Can we add leaves ?

8, Multi Tree Options

Can pupils