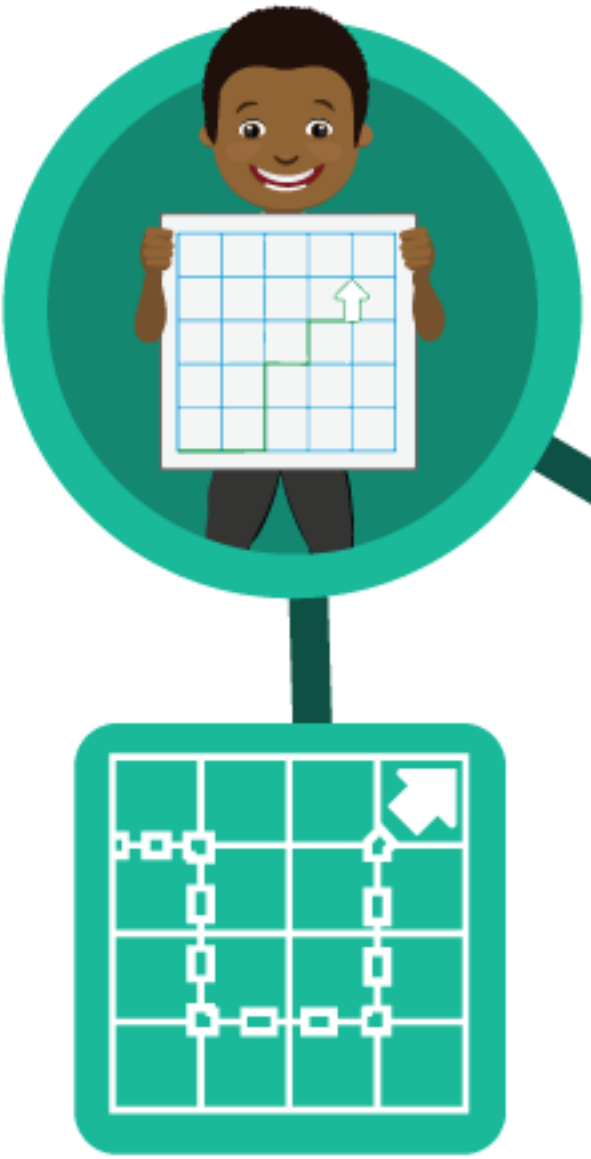
purple mash

Computing

Scheme of Work

Unit 4.5 - Using Logo



Year Group: 4
Number of Lessons: 4

From 2simple

Contents

Introduction

Logo is a text based coding language used to control an on-screen turtle to create mathematical patterns. Children were introduced to turtle patterns using 2Go in year 1.
In this unit they will:

- Learn common commands and constructs of the Logo programming language.
- Develop their ability to compose algorithms for drawing mathematical structures and turn these into Logo code.

In the lesson plans, Logo code is written in capital letters to distinguish it from the rest of the text. However, Logo is not case sensitive and lower case can be used as well. There are strong links between Logo and Mathematics and it might be beneficial to incorporate maths angle and shape work into lessons whilst doing Logo work. If children have not used floor turtles or the 2Go program lower down the school, then familiarity with these might be beneficial for some students. Unit 1.5 of the Scheme of Work uses 2Go to develop related concepts on screen.

If your pupils do not have individual logins for Purple Mash, we can help you with this. Contact your school Purple Mash administrator or email us at support@2simple.com.

To force links within this document to open in a new tab, right-click on the link and then select 'Open link in new tab'.

Year 4 - Medium-term Plan

Lesson	Aims	Success Criteria
1	To learn the structure of the language of Logo. To input simple instructions in Logo.	• Children know what the common instructions are in Logo and how to type them. • Children can follow simple Logo instructions to create shapes on paper. • Children can follow simple instructions to create shapes in Logo.
2	Using 2Logo to create letter shapes.	• Children can create Logo instructions to draw patterns of increasing complexity. • Children understand the pu and pd commands. • Children can write Logo instructions for a word of four letters.
3	To use the Repeat function in Logo to create shapes.	• Children can follow Logo code to predict the outcome. • Children can create shapes using the Repeat function. • Children can find the most efficient way to draw shapes.
4	To use and build procedures in Logo	• Children can use the Procedure feature. • Children can create 'flowers' or 'crystals' using Logo.

Lesson 1

Aims

- To learn the structure of the language of Logo.
- To input simple instructions in Logo

Success criteria

- Children know what the common instructions are in Logo and how to type them.
- Children can follow simple Logo instructions to create shapes on paper.
- Children can follow simple instructions to create shapes in Logo.

Resources

- Lesson 1 – Worksheet 1 and Logo Commands sheet
- Pencils
- You may also want the children to use a protractor.

Activities

1. Share the learning objectives and success criteria with the children.
2. Introduce the children to Logo. Explain that Logo is a text-based coding language used to control an on-screen turtle to create mathematical patterns. Relate this to work that they have done with floor-turtles and on 2Go.
3. Open 2Logo on the whiteboard in single line mode with the speed set to 'slow'. The buttons to do this are on the top right of the screen:

4. Switch the grid to visible using the grid button in the menu bar  .
5. Discuss the possible meaning of the following commands; FD, RT, LT, BK; there are clues on the screen for observant pupils. You could display the Logo Commands sheet at this point if you wish.
6. Draw children's attention to the fact that when going FD or BK the number refers to the distance whereas going LT or RT the number refers to the number of degrees to rotate. The turtle only rotates and doesn't move any distance when using the command RT and LT.
7. Show children how several commands can be combined and then run by pressing the enter key. Emphasise the importance of the spacing; show what happens when the spacing is not correct. Case is **not** important; children can use lower or upper case.
8. **Note:** in single line mode, you can run a line of code and then click on it in the window at the bottom and it will copy to the command line where it can be run again or edited to save lots of typing.
9. Hand out Lesson 1 - Worksheet 1. Children should predict what shapes will be drawn following the commands and draw these shapes on the sheet. They should then create two sets of instructions of their own.

10. Ask for some children to read out their own instructions and see if the class can work together to draw these shapes.
11. Return to 2Logo on the whiteboard and show children how to clear the screen using the  button.
12. Children should now input the Logo instructions in 2Logo to check their own answers.
13. EXTENSION – Can the children use the 'Pen Up' and 'Pen Down' instructions to draw all of the shapes on one screen?
14. **Note:** It is possible to drag the turtle to a new starting location on the screen, this makes the use of pu and pd less necessary, however they are important commands to grasp as part of the Logo language.

Lesson 2

Aims

- Using 2Logo to create letter shapes.

Success criteria

- Children can create Logo instructions to draw patterns of increasing complexity.
- Children understand the pu and pd commands.
- Children can write Logo instructions for a word of four letters.

Resources

- Squared paper
- Lesson 2 – Worksheet 1.

Activities

1. Share the learning objectives and success criteria with the children. Then, recap the learning from the last lesson.
2. Show the children the letter E.
3. Explain that one square on the squared paper is the equivalent of one square in 2Logo.
4. Draw the letter E on the squared paper.
5. Explain how to use the 'Pen Up' and 'Pen Down' instructions.
6. **Note:** It is possible to drag the turtle to a new starting location on the screen in 2Logo, this makes the use of pu and pd less necessary, however they are important commands to grasp as part of the Logo language. In the commands for the letter E in the following steps, the use of pu and pd allows the shape to be drawn using less commands.
7. Review the use of the button.
8. As a class, draw the letter E in Logo **but deliberately make some mistakes** (see the error example). The instructions below are for guidance (you will need to change the numbers used to match the letter drawn on the squared paper).

FD 8 RT 90 FD 4 RT 90 PU FD 4 RT 90 PD FD 4 LT 90 FD 4 LT 90 FD 4

Error Example Logo FD 8 RT 90 FD 4 RT90 PU FD 3 RT9 PD FD 4 LT 90 FD 4 LT 90 FD 4

9. When you try to run the code, 2Logo will inform you of an error (no space between RT and 90), click on the line of code to copy it back to the command line then correct the first error and run again **but 'forget' to clear the screen first**.

10. Feign frustration and complain that it's hard to read such a long line of code at once and remember everything. Hopefully, the children will agree with you! Select the line of code and press Ctrl + C keys to copy the line. Then show the children how you can switch to multi-line mode: 

11. Paste the commands back into the coding window (press Ctrl + V keys) and show that you can press the enter key to put the code onto more than 1 line to make it more readable e.g.

```
FD 8 RT 90
FD 4 RT 90
PU
FD 3 RT9
PD
FD 4 LT 90
FD 4 LT 90
FD 4
```

12. Then clear the screen and run the code by pressing the  button. It will still have an error (no space between RT and 9). Add the space, clear the screen and run again.

13. The code is still not making the letter E but there is no error message. However, now that it is split onto separate lines, it might be easier to identify the problem. Can any of the children find it?

14. The RT 9 should be RT 90. Go through and correct this then clear and run again and you should get an E but still not quite correct; can children find the rogue FD 3 where it should be FD 4?

15. Hand out Lesson 2 – Worksheet 1 for children to complete. Children should convert curved letters into letters with straight sides as they do not yet know how to make curves so 'O' could become ⬡ or □. depending upon ability/ambition. They may need whiteboards or paper to draft their instructions.

16. Children should save the files of the individual letters to their work folders.

17. EXTENSION – Can the children write their initials in Logo?

Lesson 3

Aims

- To use the Repeat function in Logo to create shapes.

Success criteria

- Children can follow Logo code to predict the outcome.
- Children can create shapes using the Repeat function.
- Children can find the most efficient way to draw shapes.

Resources

- Lesson 3 – Worksheet 1
- Squared paper.

Activities

1. Recap the work from Lesson 1 about how to draw a square. Show the children the instructions about how to draw a square

   FD 5 RT 90 FD 5 RT 90 FD 5 RT 90 FD 5 RT 90

2. Can the children see which code is repeated and how many times? FD 5 RT 90 is repeated 4 times.

3. Introduce the Repeat function. This is written as REPEAT (or RPT) and then the number of times it is to be repeated. The instruction to be repeated is then placed in square brackets. So, to draw a square, the instructions can be shortened to

   REPEAT 4 [FD 5 RT 90]

4. Ensure that children know how to find the square brackets on their device and that they are clear that these are different brackets from the usual curved brackets.

5. Hand out Lesson 3 – Worksheet 1. Children need to predict what shapes the code will make then type the code in 2Logo to see if they were correct.

6. EXTENSION 1 – Can the children use the Repeat function to find the most efficient way to write letters?

7. EXTENSION 2 – Make use of the shape backgrounds within 2Logo. Click the  button and select one of the backgrounds below. Create Logo code to draw the shapes using repeat along with the other commands that they have learnt.

Lesson 4

Aims

- To use and build procedures in Logo

Success criteria

- Children can use the Procedure feature.
- Children can create 'flowers' or 'crystals' using Logo.

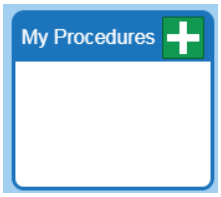
Resources

- Lesson 4 – Worksheet 1. You may want to copy this for children or use it for your own reference.

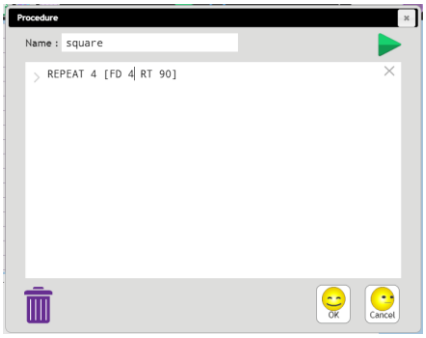
Activities

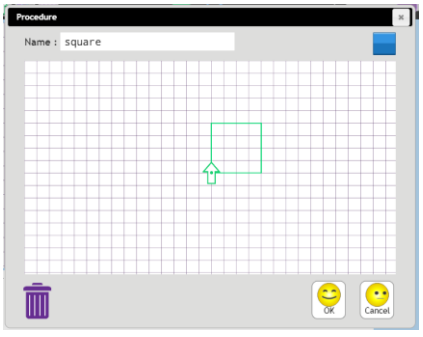
1. Remind the children of the lesson where they wrote the code to draw shapes. If any children did the extension and made their initials, how did they do it?
2. Probably by writing the code to do one letter then erasing it and writing the code to do a different letter.

   It would be quite time consuming to do this for a whole word (or sentence). If your name was Barbara, then it would be useful to be able to repeat the code for the 'a' and the 'r' several times without re-writing it.
3. In Logo this can be done by using procedures. We are going to start with a procedure to draw a square. Recap the Logo needed to construct a square from the last lesson.
4. Explain that to add a new procedure, you click on the plus symbol of the My Procedures box.

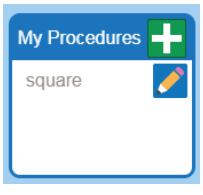


5. Name the procedure by a sensible name e.g. 'square' and type in the Logo to draw a small square. You can test your procedure by clicking the play button on this window. If you wish to edit it further, click the 'stop' button.





6. Then click OK once you are happy with the procedure. You will see the procedure name in the list in My Procedures now.



7. To draw a square in Logo, we just type 'square' in the code window and run the code. Draw a square on the screen.
8. Remind children of the 'Pen Up' and 'Pen Down' commands. Can they suggest how you could draw 2 squares next to each other? Sample instructions could be:

```
SQUARE
PU
RT 90 FD 5
LT 90
PD
SQUARE
```

9. Can they work out from this how to make a **procedure** to draw a row of 6 squares? Note; the turtle will need to be moved to a suitable starting place for this to fit on the screen.

```
REPEAT 6
[ SQUARE
PU
RT 90 FD 5
LT 90
PD]
```

10. Ask the children to go to their own devices define the following procedures:
    - square
    - triangle
    - hexagon
    - rowOfHexagons
    - EXTENSION: pageOfHexagons
11. Bring the class back together to explore combining procedures in a different way. For this activity, the children will use all that they have learnt to create some 'flowers' or 'crystals'.
12. Create a procedure called squareFlower on the whiteboard as follows:

```
REPEAT 9
[ SQUARE
RT 20]
```

Can children guess what might happen?

13. Run the procedure and note that the pattern is not complete.
14. Can children suggest how to complete it? Some children will guess but if you have some advanced mathematicians in your class you can point out the degrees that are rotating to make the pattern; 20 degrees, 9 times; 20 x 9 = 180.

How many degrees are in a complete circle? (360) So how many repeats are needed to reach a total of 360 degrees? (18). Run the completed procedure.

15. Ask children to create their own rotating shape patterns using squares, triangles or hexagons; see the worksheet for examples. You could extend this to circles as well; see example.

16. There are many other types of patterns than can be made through rotation of basic lines. The worksheet gives examples and you may wish to explore a selection with your class or extend this lesson into further sessions and explore in more depth in association with angle work in maths.

17. Children will also enjoy changing pen colour and pen size using the commands SETPC and SETPS followed by a colour name or number. The default pen size is 4 so smaller numbers will produce a thinner lines and larger numbers a wider line.

'SETPC BLUE' - Pen colour will be blue

The colours that are included by name in 2Logo are; black, white, red, blue, green, yellow, orange, purple, pink, grey, brown, lime, cyan, magenta. Advanced users can also create their own colours using HTML color codes e.g. setpc "#990000" - dark red (you need the # and the ")

Unit 4.5 – Lesson 1 – Worksheet 1 – Using Logo to draw shapes

Name _____ Date _____

Look at the instructions below. What shape do you think the instructions will make?

INSTRUCTION	SHAPE
FD 1 RT 90 FD 1 LT 90 FD 1 RT 90 FD 1 LT 90 FD 1 RT 90 FD 1 LT 90	
FD 5 RT 90 FD 5 RT 90 FD 5 RT 90 FD 5 RT 90	
RT 90 FD 3 LT 90 FD 3 LT 90 FD 3 RT 90 FD 3 RT 90 FD 3	
FD 8 RT 120 FD 8 RT 120 FD 8 RT 120	

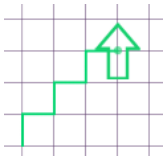
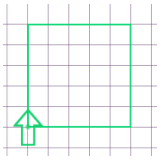
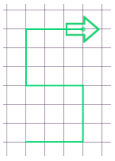
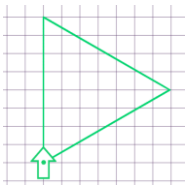
Can you think of some more shapes and write some instructions for your friends to follow?

INSTRUCTION	SHAPE

Unit 4.5 – Lesson 1 – Worksheet 1 – Using Logo to draw shapes - ANSWERS

Name _____ Date _____

Look at the instructions below. What shape do you think the instructions will make?

INSTRUCTION	SHAPE
FD 1 RT 90 FD 1 LT 90 FD 1 RT 90 FD 1 LT 90 FD 1 RT 90 FD 1 LT 90	
FD 5 RT 90 FD 5 RT 90 FD 5 RT 90 FD 5 RT 90	
RT 90 FD 3 LT 90 FD 3 LT 90 FD 3 RT 90 FD 3 RT 90 FD 3	
FD 8 RT 120 FD 8 RT 120 FD 8 RT 120	

Can you think of some more shapes and write some instructions for your friends to follow?

INSTRUCTION	SHAPE

List of Logo Instructions

Instruction	Description	Example
BK	Move backwards a distance of units	BK 50 – Move the turtle back 50 units
FD	Move forward a distance of units	FD 50 – Move the turtle forward 50 units
LT	Turn left a given number of degrees	LT 90 – Turn the turtle 90° to the left
RT	Turn right a given number of degrees	RT 45 – Turn the turtle 45° to the right
REPEAT	Repeat a set of instructions a number of times	REPEAT 4[FD 10 RT 90] – This will draw a square
SETPC	Set pen colour to a value	SETPC 1 – Pen colour is **BLUE**
SETPS	Set pen thickness	SETPC 1 – pen is thin; SETPS 10 – the line is a lot thicker
PU	Lifts the pen off the screen	
PD	Places the pen to begin drawing	

Unit 4.5 – Lesson 2 – Worksheet 1

Name _____ Date _____

Write a set of instructions in Logo for each of these letters:

Starter

C	
F	
S	

Moving On

M	
W	
O	

Unit 4.5 – Lesson 2 – Worksheet 1 – Possible Answers

Name _____ Date _____

Write a set of instructions in Logo for each of these letters: NB Children's answers will vary

Starter

C	RT 90 FD 5 BK 5 LT 90 FD 8 RT 90 FD 5
F	FD 8 RT 90 FD 5 BK 5 RT 90 FD 3 LT 90 FD 4
S	RT 90 FD 4 LT 90 FD 4 LT 90 FD 4 RT 90 FD 4 RT 90 FD 4

Moving On

M	FD 8 RT 135 FD 3 LT 90 FD 3 RT 135 FD 8
W	LT 30 FD 6 BK 6 RT 60 FD 6 RT 120 FD 6 LT 120 FD 6
O	FD 2 RT 45 FD 2 RT 45 FD 2 RT 45 FD 2 RT 45 FD 2 RT 45 FD 2 RT 45 FD 2 RT 45 FD 2 RT 45

Unit 4.5 – Lesson 3 – Worksheet 1

Name _____ Date _____

Look at the instructions below. What shape do you think the instructions will make?

INSTRUCTION	PREDICTION	SHAPE MADE
REPEAT 4 [FD 6 LT 90]		
REPEAT 3 [FD 8 RT 120]		
REPEAT 6 [FD 6 RT 60]		
REPEAT 10 [FD 2 RT 36]		
REPEAT 36 [FD 1 RT 10]		

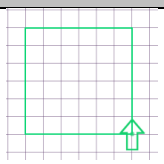
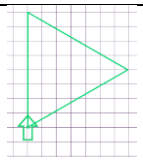
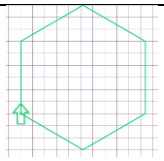
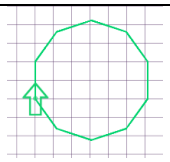
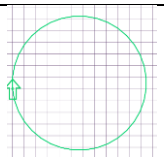
EXTENSION – Use the Repeat function to find the most effective way to draw these letters:

LETTER	INSTRUCTION
B	
P	

Unit 4.5 – Lesson 3 – Worksheet 1 – Answers

Name _____ Date _____

Look at the instructions below. What shape do you think the instructions will make?

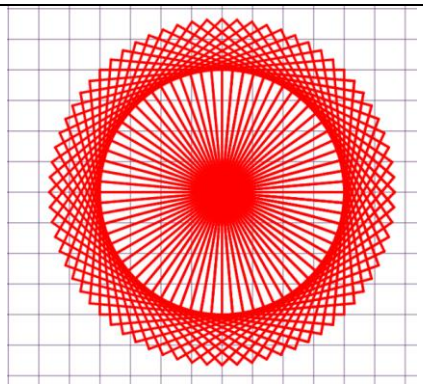
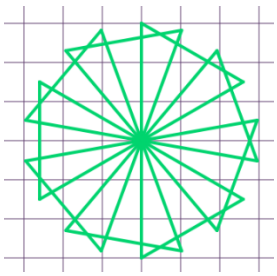
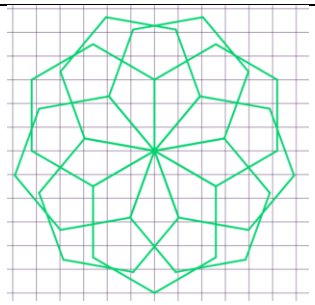
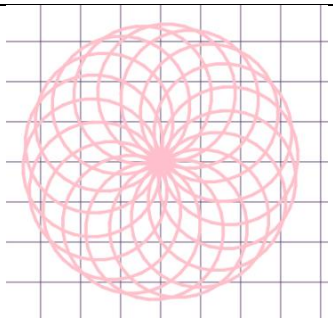
INSTRUCTION	PREDICTION	SHAPE MADE
REPEAT 4 [FD 6 LT 90]		
REPEAT 3 [FD 8 RT 120]		
REPEAT 6 [FD 6 RT 60]		
REPEAT 10 [FD 5 RT 36]		
REPEAT 36 [FD 1 RT 10]		

EXTENSION – Use the Repeat function to find the most effective way to draw these letters:

LETTER	INSTRUCTION
B	REPEAT 4 [FD 4 RT 90] FD 4 REPEAT 4 [FD 4 RT 90]
P	FD 4 REPEAT 4 [FD 4 RT 90]

Examples of Logo flowers/crystals/patterns to explore

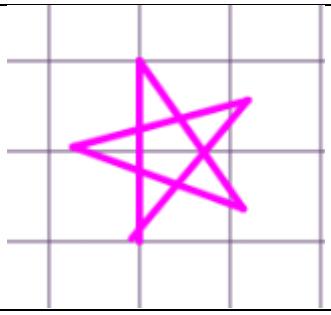
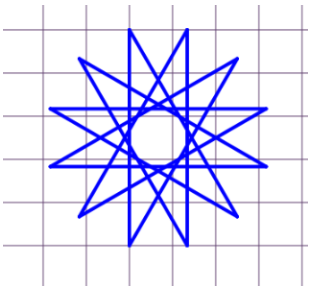
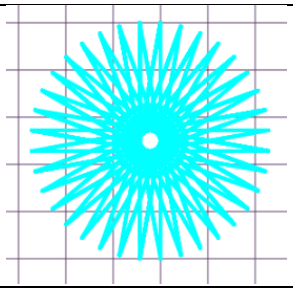
Simple shape rotation

Square pattern REPEAT 72 [square RT 5]	
Triangle pattern REPEAT 9[triangle RT 40] NB triangle is REPEAT 3[fd 3 RT 120]	
Hexagon pattern REPEAT 9 [hexagon RT 40]	
Circle pattern REPEAT 18 [circle RT 20] NB circle is REPEAT 36 [FD 0.3 RT 10]	

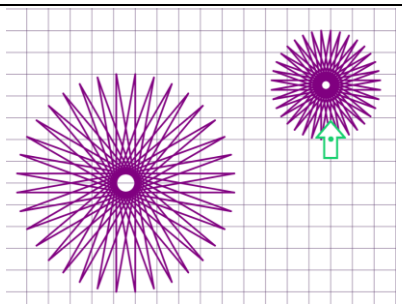
Unit 4.5 – Lesson 4 – Worksheet 1 – Examples of Logo Flowers

Stars and more

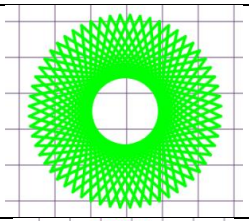
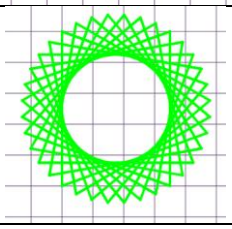
Exploring stars (and other patterns) – Made by repeating and rotating 2 lines at an angle where the lines intersect on each repetition to make the pattern, eventually they get back to the start point to complete the pattern. Changing the angle will change the look of the star.

Simple star RPT 5 [FD 2 RT 145]	
RPT 12 [FD 5 RT 150]	
REPEAT 36 [FD 5 RT 190]	

Adding extra movement between each repetition will expand the pattern

REPEAT 36 [FD 5 RT 190 FD 5]	

Altering the angle (between 91 and 180) will change the centre void area

REPEAT 60 [FD 5 RT 138]	
REPEAT 60 [FD 5 RT 110]	

Assessment Guidance

The unit overview for year 4 contains details of national curricula mapped to the Purple Mash Units. The following information is an exemplar of what a child at an expected level would be able to demonstrate when completing this unit with additional exemplars to demonstrate how this would vary for a child with emerging or exceeding achievements.

Assessment Guidance	
Emerging	Children can 'read' small Logo programs and predict the outcome using some logical reasoning although they might not always be correct (Unit 4.5 Lesson 1. Point 9). Children think about the Logo commands that they need in small steps, one or two commands at a time. When their code does not execute as they expect, they can sometimes find the error independently but as the code becomes longer, they need support to do so (Unit 4.5 Lesson 2. Points 8-17). They understand that the repeat command makes things happen more than once but might not be able to plan the repeat; they work out a solution using trial-and-error that includes some logic (Unit 4.5 Lesson 3. Point 5). They can create a procedure but might not realise the full value of creating a procedure to make quality code and save coding the same thing many times over (Unit 4.5 Lesson 4).
Expected	Children can 'read' Logo programs with several steps and predict the outcome accurately (Unit 4.5 Lesson 1. Points 9) & (Unit 4.5 Lesson 3. Point 5). Children can think about the Logo commands that they need steps of two or more commands at a time before executing the code to check the result e.g. fd 4 rt 90 fd 6 rt 90. When their code does not execute as they expect, they can sometimes find the error independently but as the code becomes longer, they need support to do so (Unit 4.5 Lesson 2. Points 8-17). They understand the repeat command and can plan simple repeat structures before executing rather than relying on trial-and-error (Unit 4.5 Lesson 3. Points 5-7). They experiment with repeating procedures to make more complex patterns (Unit 4.5 Lesson 4). They understand the value of a procedure in making code more efficient and call these procedures appropriately (Unit 4.5 Lesson 4). Most children can manipulate instructions within Logo to create common shapes using repeat functions (Unit 4.5. Lesson 3). They can edit instructions to produce shapes created in the most efficient way including using the Procedures function (Unit 4.5. Lesson 4 Points 4 – 10). In (Unit 4.5 Lesson 4), they can use some knowledge of mathematics to understand how the patterns are formed.
Exceeding	Children enjoy and challenge themselves to think about the Logo commands that they need in long steps of several commands at a time before executing the code to check the result e.g. fd 4 rt 90 fd 6 rt 90 fd 5 lt 90 fd 9 These commands include repeats alongside sequential steps. They fully understand the value of the pu and pd commands to achieve the effects that they desire (Unit 4.5 Lesson 1. Point 13).

Assessment Guidance	
	When their code does not execute as they expect, they use logical reasoning and debugging techniques such as running accumulating parts of the code to find the source of the error independently (Unit 4.5 Lesson 2. Points 8-17). They create procedures and call these procedures efficiently, they can refine their code to put procedure calls within other procedures (Unit 4.5 Lesson 4. Point 10). They experiment with repeating procedures to make more complex patterns demonstrating the mathematical understanding behind the patterns (Unit 4.5 Lesson 4 - worksheet). Children can 'read' increasingly complex Logo programs with several steps and predict the outcome accurately (Unit 4.5 Lesson 3. Point 5) including procedures within repeats (Unit 4.5 Lesson 4, Point 14 and worksheet).