

Turtlestitch Investigations: recursion garden

Growing a fractal tree

1. A very simple tree is just a single branch.

Scratch code for a single branch:

- reset
- point in direction 0
- running stitch by 10 steps
- branch 100
  - move length steps
  - turn 180 degrees
  - move length steps
  - turn 180 degrees

2. Make a block for a branch.

3. In a more interesting tree the branch splits into two.

Scratch code for a tree with two branches:

- reset
- point in direction 0
- running stitch by 10 steps
- tree 100
  - move length steps
  - turn 45 degrees
  - branch length / 2
  - turn 90 degrees
  - branch length / 2
  - turn 135 degrees
  - move length steps
  - turn 180 degrees

4. Make a block for a tree.

Turtlestitch Investigations: recursion garden

Growing a fractal tree

1. A very simple tree is just a single branch.

Scratch code for a single branch:

- reset
- point in direction 0
- running stitch by 10 steps
- branch 100
  - move length steps
  - turn 180 degrees
  - move length steps
  - turn 180 degrees

2. Make a block for a branch.

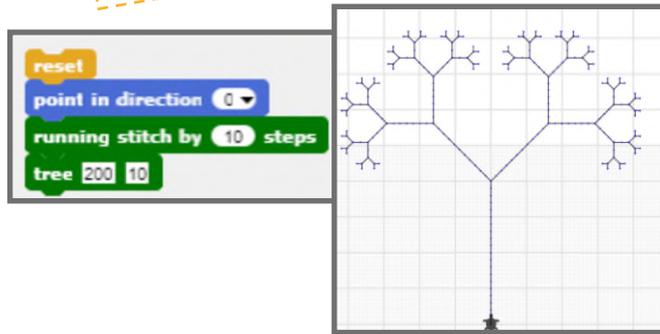
3. In a more interesting tree the branch splits into two.

Scratch code for a tree with two branches:

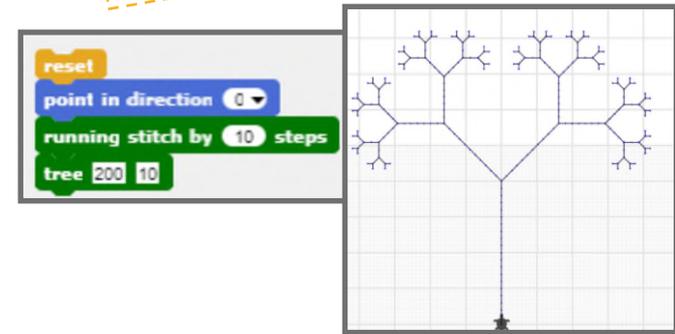
- reset
- point in direction 0
- running stitch by 10 steps
- tree 100
  - move length steps
  - turn 45 degrees
  - branch length / 2
  - turn 90 degrees
  - branch length / 2
  - turn 135 degrees
  - move length steps
  - turn 180 degrees

4. Make a block for a tree.

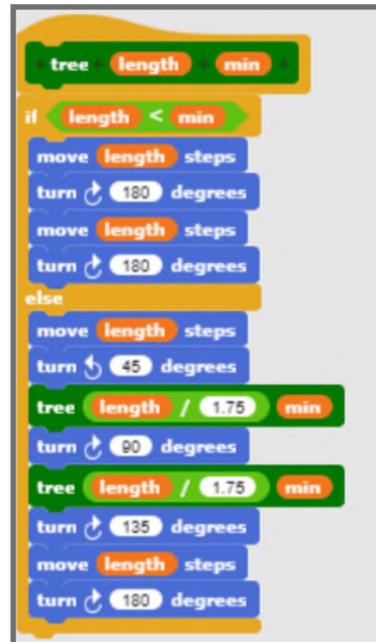
5. To make each branch split several times, you will have to repeat a lot of code. To do this simply, a block can use itself. This marvellous trick is called recursion.



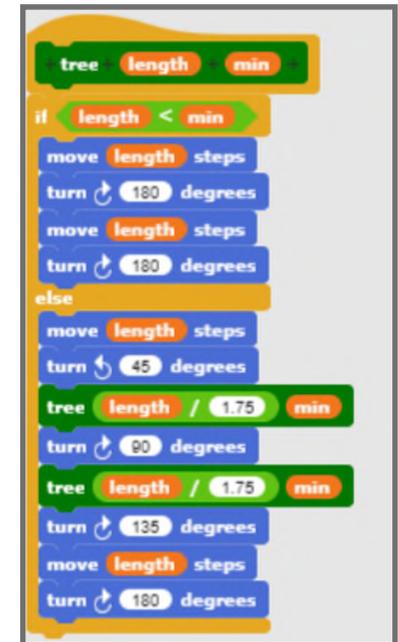
5. To make each branch split several times, you will have to repeat a lot of code. To do this simply, a block can use itself. This marvellous trick is called recursion.



6. Here the tree block uses itself. Think of a tree as having two smaller trees at the end of each branch, until they get too small. When they are too small, stitch the final branch.



6. Here the tree block uses itself. Think of a tree as having two smaller trees at the end of each branch, until they get too small. When they are too small, stitch the final branch.



**Taking it further...**

- Why use these turning angles?
- Can you change the angle between branches?
- What happens if you change the scale of the smaller trees?
- Can you add some randomness?
- Can you change the number of branches?

**Taking it further...**

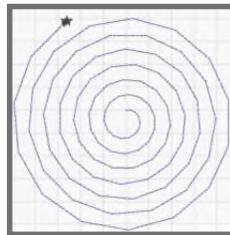
- Why use these turning angles?
- Can you change the angle between branches?
- What happens if you change the scale of the smaller trees?
- Can you add some randomness?
- Can you change the number of branches?

Turtlestitch Investigations: Spin Cycle

How can you make a spiral?

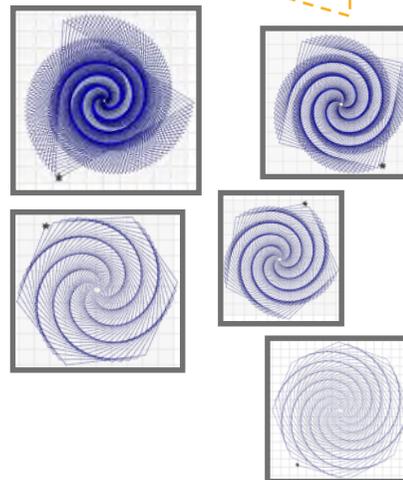
1. These blocks could draw a circle. What number would you need to add to the repeat loop?

2. Drawing a spiral is like drawing a circle that keeps getting bigger as you go around. How could you do this?



3. This code is nearly ready to make a spiral. Which block is missing?

4. Can you create these spirals? The numbers used are 119, 89, 71, 59 and 44.

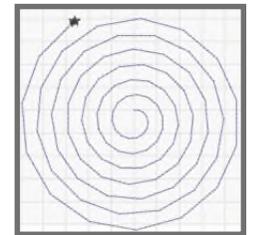


Turtlestitch Investigations: Spin Cycle

How can you make a spiral?

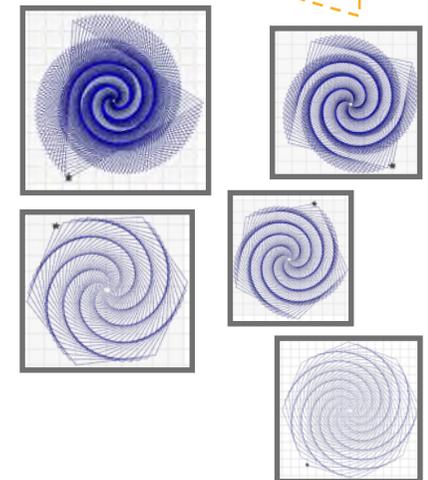
1. These blocks could draw a circle. What number would you need to add to the repeat loop?

2. Drawing a spiral is like drawing a circle that keeps getting bigger as you go around. How could you do this?

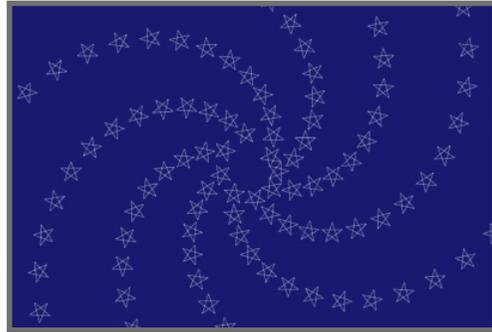
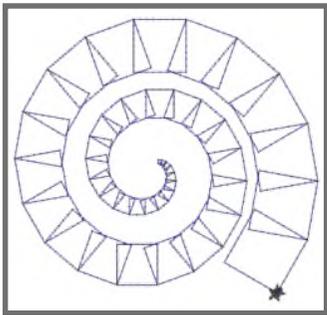


3. This code is nearly ready to make a spiral. Which block is missing?

4. Can you create these spirals? The numbers used are 119, 89, 71, 59 and 44.



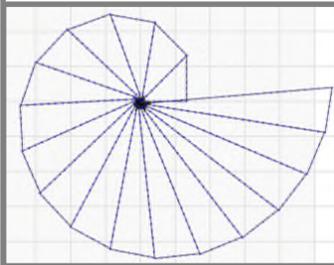
5. Try making spirals with shapes instead of a single line.



Watch the video tutorial on creating spirals like this.

There are many different kinds of spiral to take inspiration from. This is the Spiral of Theodorus.

```
reset
running stitch by 10 steps
set FirstSideLength to 1
set SideLength to FirstSideLength
set Scale to 65
repeat 17
  move 1 steps
  triangle SideLength
  change SideLength by 1
  turn 180 degrees
```



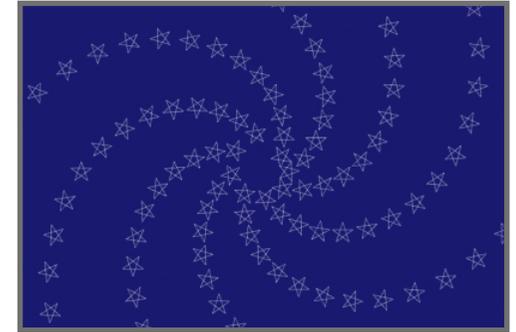
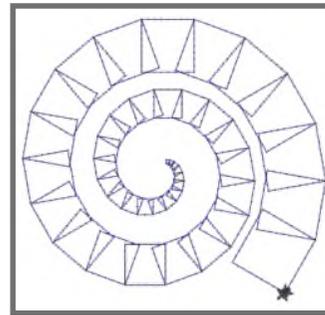
```
triangle SideLength
move Scale * 100% of SideLength steps
turn 90 degrees
move Scale * FirstSideLength steps
turn 90 * 100% of SideLength degrees
move Scale * 100% of SideLength + 1 steps
```



Taking it further...

Try making other famous spirals such as the Golden Spiral or these squares based on the Fibonacci sequence.

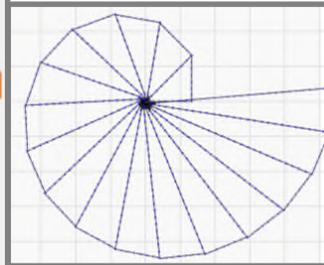
5. Try making spirals with shapes instead of a single line.



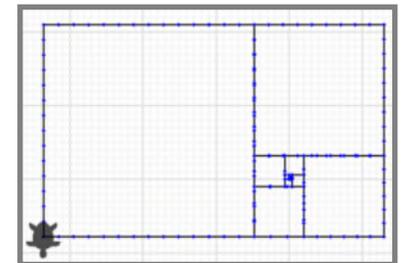
Watch the video tutorial on creating spirals like this.

There are many different kinds of spiral to take inspiration from. This is the Spiral of Theodorus.

```
reset
running stitch by 10 steps
set FirstSideLength to 1
set SideLength to FirstSideLength
set Scale to 65
repeat 17
  move 1 steps
  triangle SideLength
  change SideLength by 1
  turn 180 degrees
```



```
triangle SideLength
move Scale * 100% of SideLength steps
turn 90 degrees
move Scale * FirstSideLength steps
turn 90 * 100% of SideLength degrees
move Scale * 100% of SideLength + 1 steps
```



Taking it further...

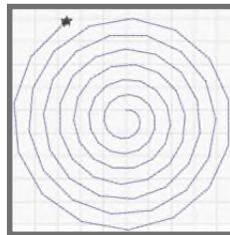
Try making other famous spirals such as the Golden Spiral or these squares based on the Fibonacci sequence.

Turtlestitch Investigations **Answers**

How can you make a spiral?

1. These blocks could draw a circle. What number would you need to add to the repeat loop?

2. Drawing a spiral is like drawing a circle that keeps getting bigger as you go around. How could you do this?



3. This code is nearly ready to make a spiral. Which block is missing?

Add the variable change block. I have set it to change by 1; you can experiment with this.

4. Can you create these spirals? The numbers used are 119, 89, 71, 59 and 44.

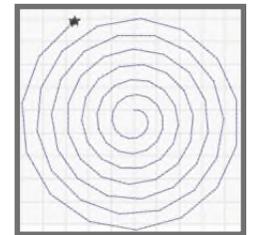
Type each number into the blue turn block.

Turtlestitch Investigations **Answers**

How can you make a spiral?

1. These blocks could draw a circle. What number would you need to add to the repeat loop?

2. Drawing a spiral is like drawing a circle that keeps getting bigger as you go around. How could you do this?



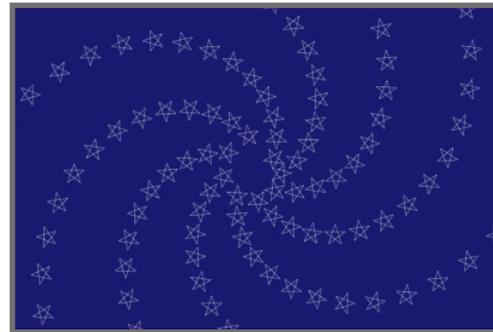
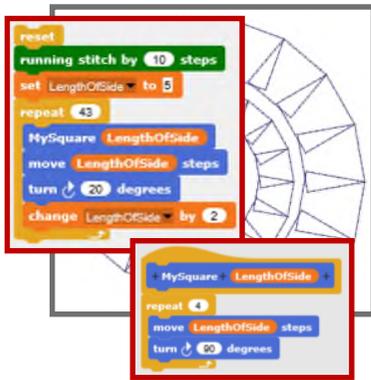
3. This code is nearly ready to make a spiral. Which block is missing?

Add the variable change block. I have set it to change by 1; you can experiment with this.

4. Can you create these spirals? The numbers used are 119, 89, 71, 59 and 44.

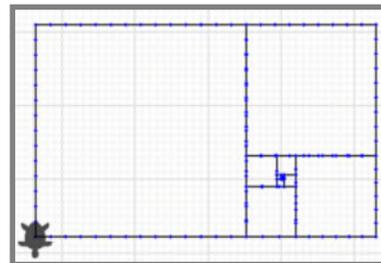
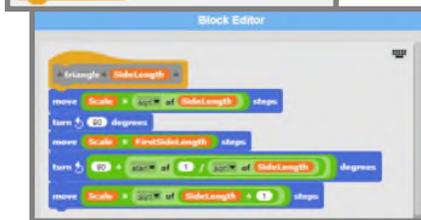
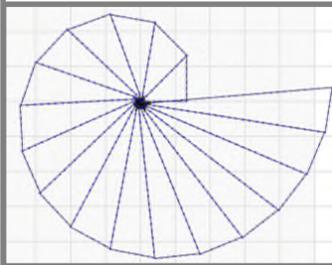
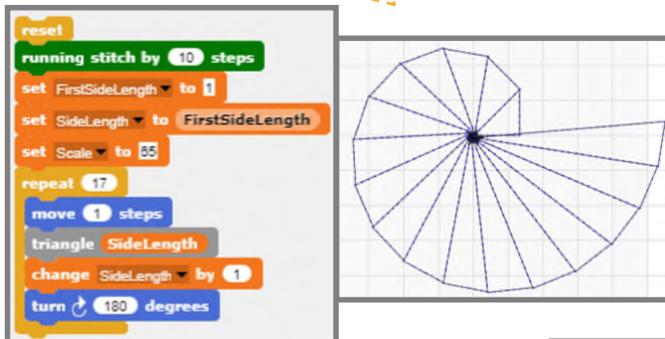
Type each number into the blue turn block.

5. Try making spirals with shapes instead of a single line.



Watch the video tutorial on creating spirals like this.

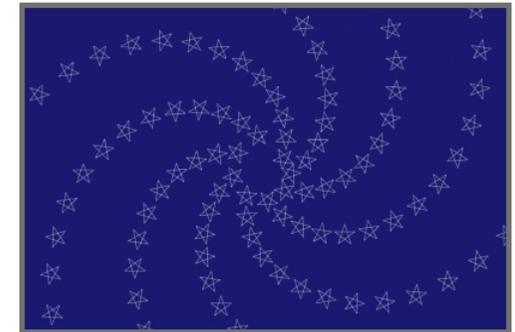
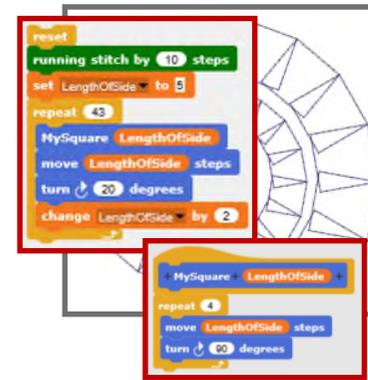
There are many different kinds of spiral to take inspiration from. This is the Spiral of Theodorus.



Taking it further...

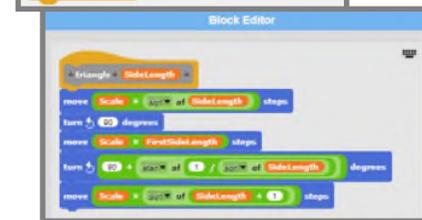
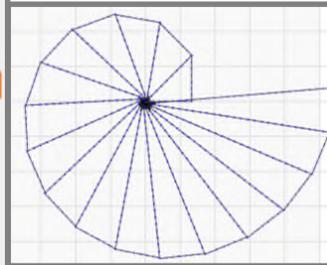
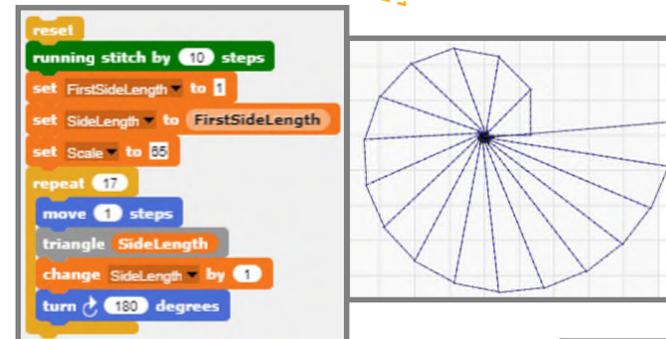
Try making other famous spirals such as the Golden Spiral or these squares based on the Fibonacci sequence.

5. Try making spirals with shapes instead of a single line.



Watch the video tutorial on creating spirals like this.

There are many different kinds of spiral to take inspiration from. This is the Spiral of Theodorus.



Taking it further...

Try making other famous spirals such as the Golden Spiral or these squares based on the Fibonacci sequence.