

Turtlestitch Investigations: recursion garden

Growing a fractal tree

1. A very simple tree is just 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.

```

    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.

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2. Make a block for a branch.

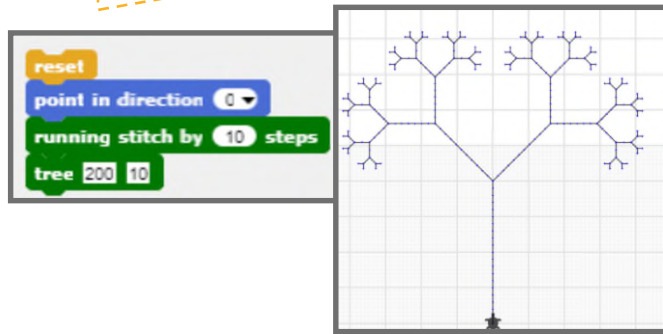
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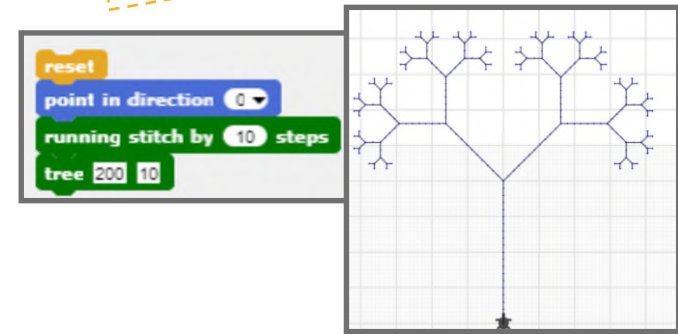
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4. Make a block for a tree.

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.



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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.



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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...

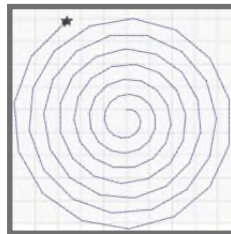
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Turtlestitch Investigations: Spin Cycle

How can you make a spiral?

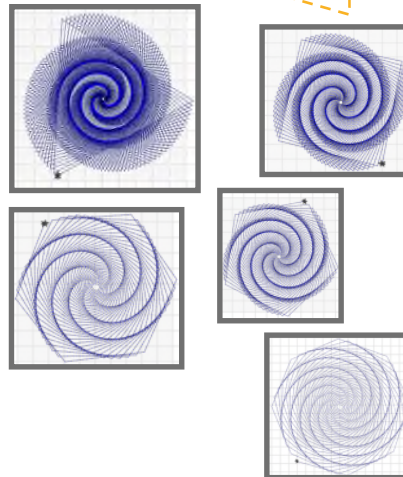
1. These blocks could draw a circle. What number would you need to add to the repeat loop?

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.

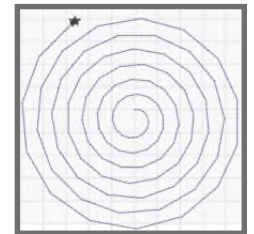


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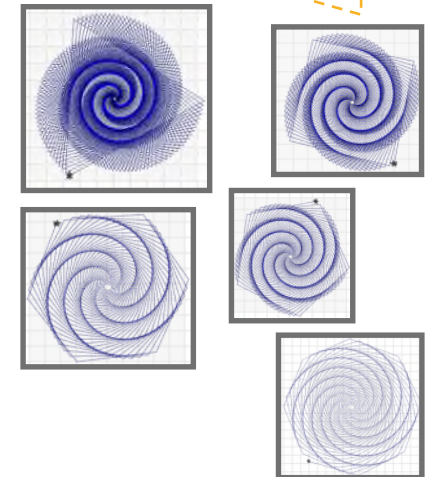
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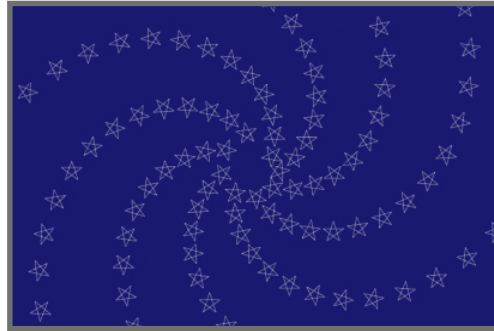
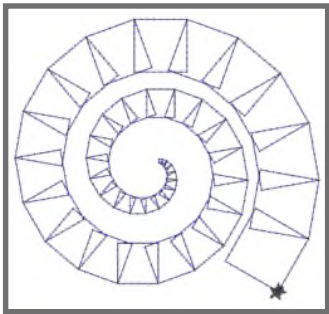


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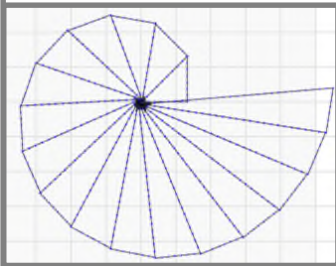
5. Try making spirals with shapes instead of a single line.



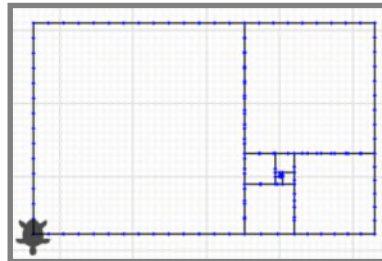
Watch the video tutorial on creating spirals like this.

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
```



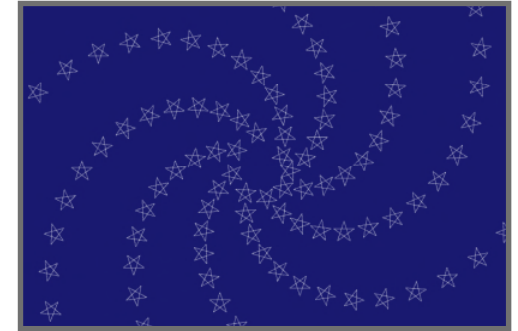
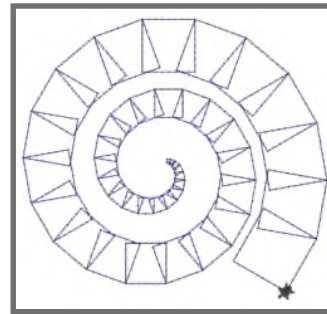
```
triangle SideLength
move Scale * 100% of SideLength steps
turn 90 degrees
move Scale * FirstSideLength steps
turn 90 * 100% of SideLength degrees
move Scale * 100% of SideLength + 1 steps
```



Taking it further...

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

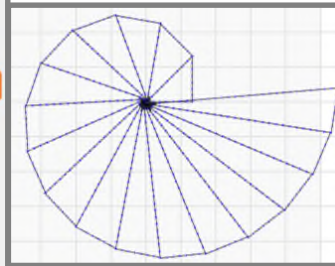
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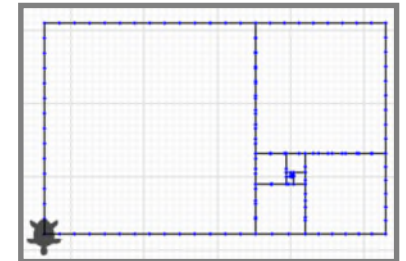
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Turtlestitch Investigations **Answers**

How can you make a spiral?

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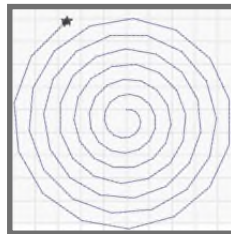
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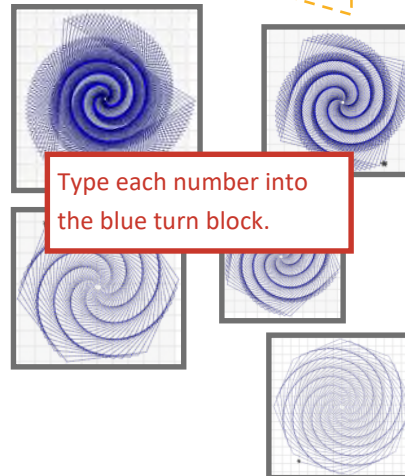
repeat 100

move NumberOfSteps steps

turn 25 degrees

change NumberOfSteps by 1

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



Type each number into the blue turn block.

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

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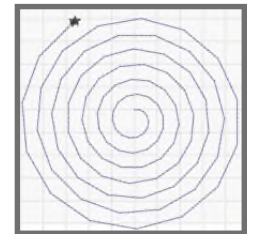
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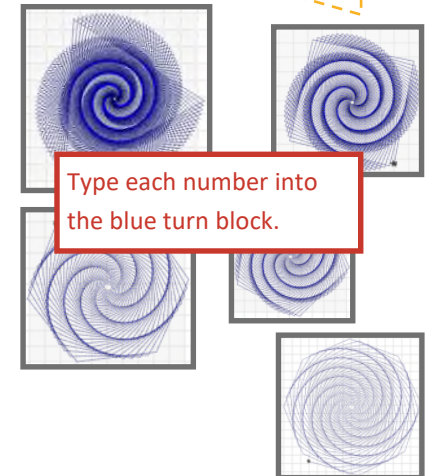
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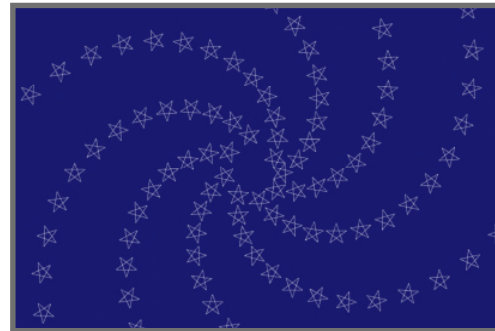
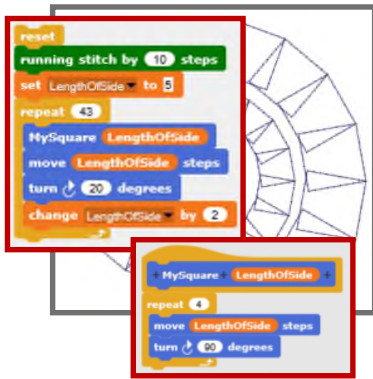
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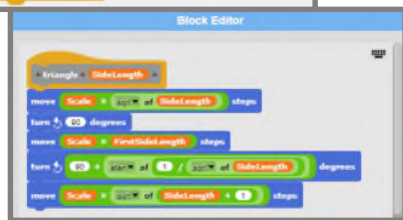
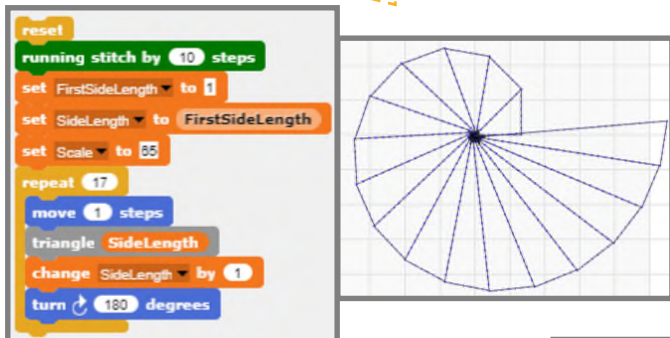
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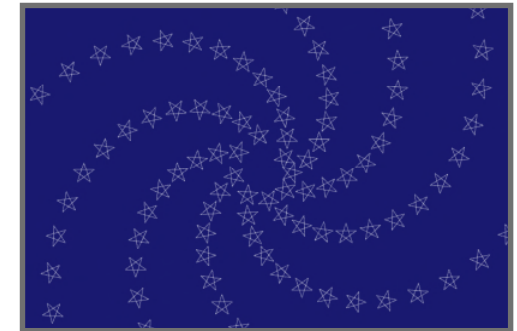
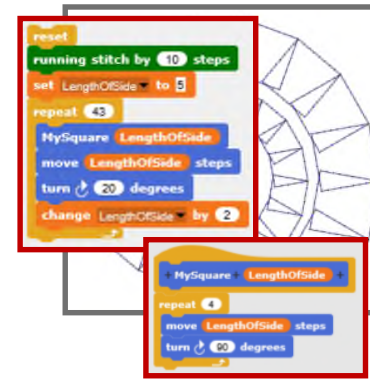
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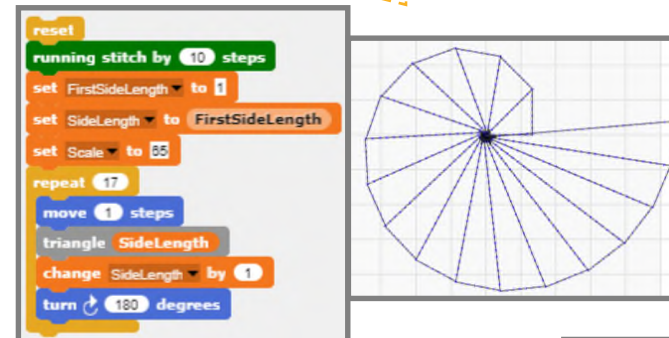
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