

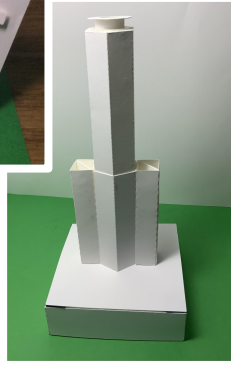
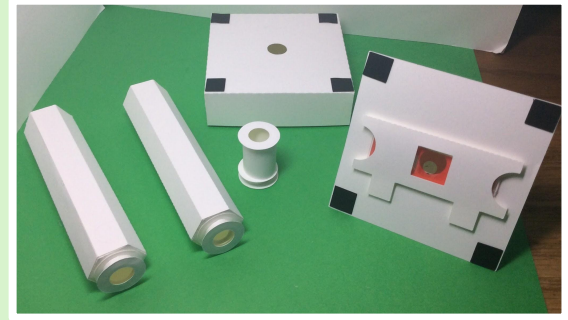
TurtleStitch : A Tool for Mathematical Modeling - From Embroidery to Paper Design



Elaine Wolfe
With Special Guests
Cynthia Solomon & Beth Lloyd

ICERM
August 13, 2025

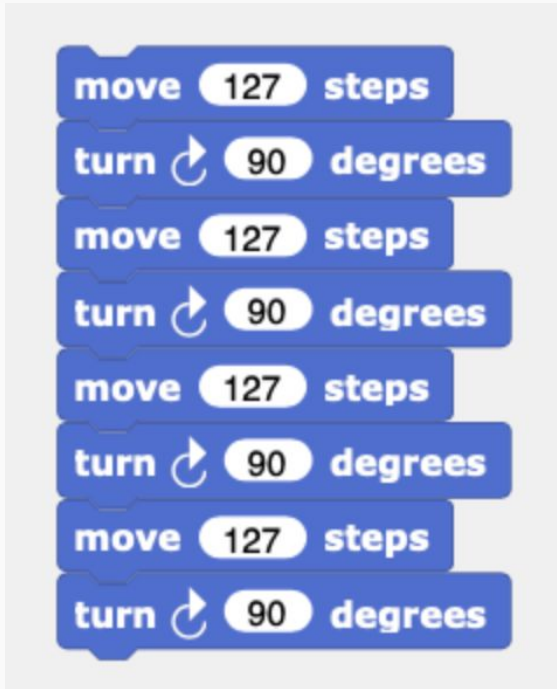




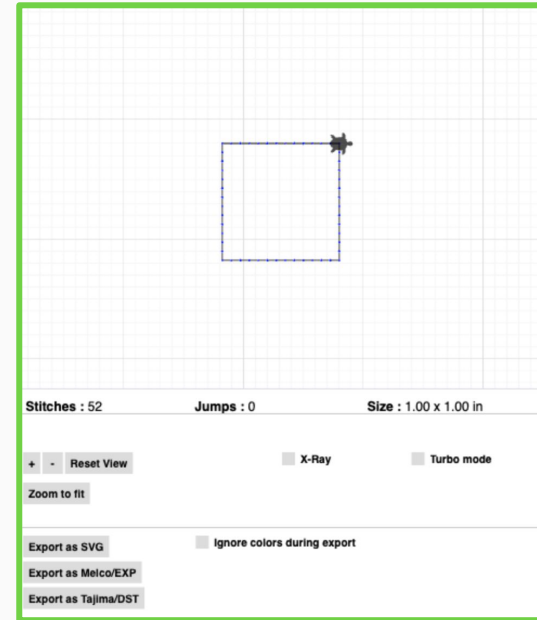


- Former math teacher and creator of 400+ designs that combine code, geometry, art, and making
- Collaborates with Make to Learn Professors Glen Bull at UVA and Michael Littman at Princeton on engineering, math, and fabrication
- Works with Cynthia Solomon, a LOGO pioneer in educational technology.
- Author of two blogs offering free project guides
- Transforms TurtleStitch code into physical objects—from animation with electronic devices to embroidered pillows

What is TurtleStitch?



These blocks make a square.
127 steps = 1 inch = 2.54 cm



The turtle draws a one inch square.

Getting Started with TurtleStitch

Open <https://www.turtlestitch.org> in your web browser

TurtleStitch | About | Categories | FAQ | Search

RUN

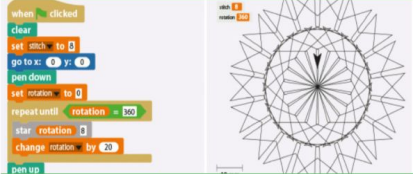
Coded Embroidery

A community driven platform turning your coded designs into embroidered works of art

TurtleStitch turns 10 – celebrate with us!
Join our festival & conference, July 18–20, 2025 in Tilburg/NL.
[Sign up to join in!](#)

How to Code


Tutorials



From first steps to advanced

How to Make


Project Descriptions



Ideas and descriptions of

Video Run-Through

ASMR Style



From code to physical object

Preparing to Code In TurtleStitch

The screenshot displays the TurtleStitch software interface. At the top, a green header bar contains the TurtleStitch logo, navigation links for 'About', 'Categories', and 'FAQ', a search bar, and a Raspberry Pi logo. Below the header, the interface is divided into three main sections:

- Palette:** Located on the left, it lists various command categories: Motion, Sensing, Pen, Embroidery, Other, Control, Operators, Variables, and Colors. A list of blue command blocks is visible, including 'move 10 steps', 'turn 15 degrees', 'point in direction 90', 'go to x: 0 y: 0', and 'arc radius: 50 degrees'.
- Scripting Area:** The central workspace where code blocks are assembled. It shows a sequence of 'move 100 steps' followed by 'move -100 steps'.
- Stage:** A grid-based workspace on the right where the code is executed. It features a small black turtle icon and a horizontal line extending to the right. Below the stage, status information is displayed: 'Stitches : 20', 'Jumps : 0', and 'Size : 0.79 x 0.00 in'. There are also controls for 'Reset View', 'Zoom to fit', 'X-Ray', 'Turbo mode', and export options like 'Export as SVG', 'Export as Melco/EXP', and 'Export as Tajima/DST'.

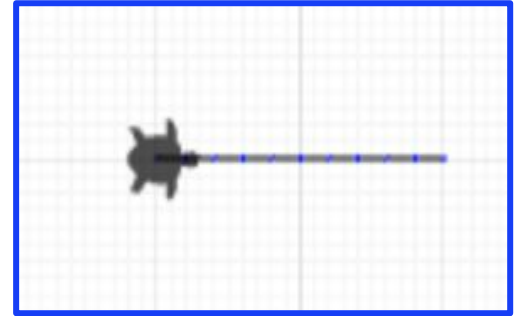
Coding Our First Snowflake

Mission objective: Create a snowflake using TurtleStitch

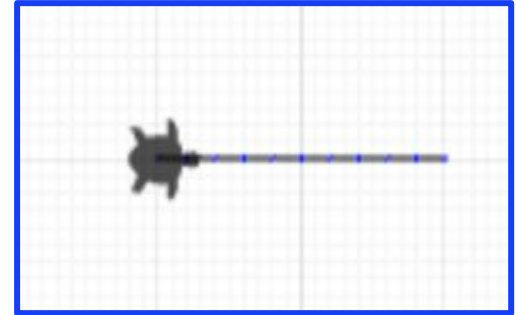
- **Make a Spoke:**
 - **Drag** out move and turn blocks to scripting area from the palette
 - **Click** on a block to execute the commands
 - Turtle moves on the stage



```
move 100 steps
move -100 steps
```



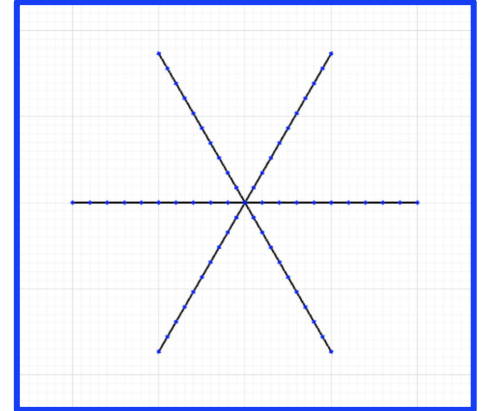
```
move 100 steps
turn 180 degrees
move 100 steps
turn 180 degrees
```



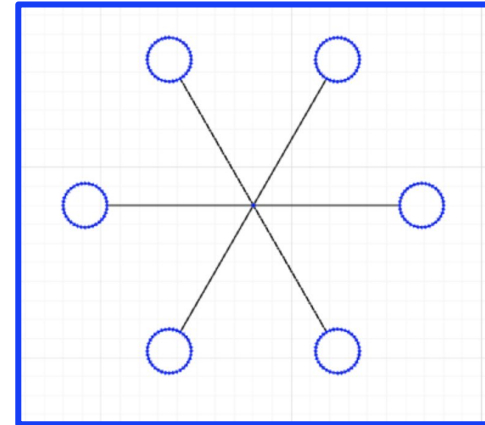
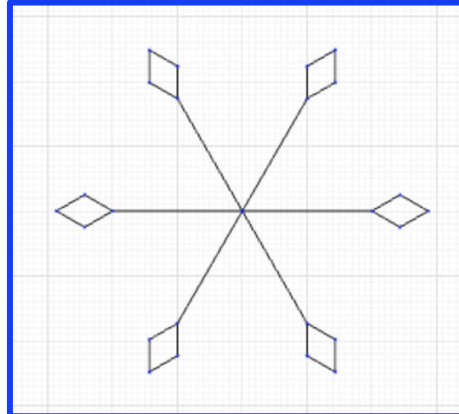
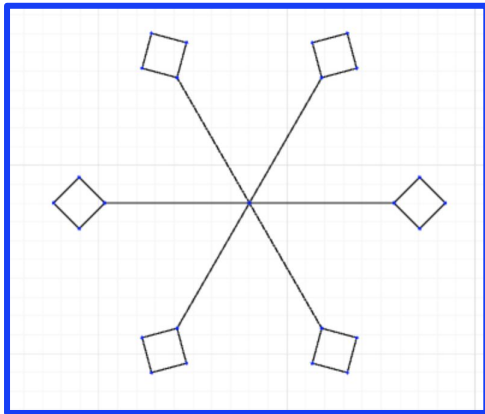
Snowflake Symmetry

Radial symmetry for
six-spoke snowflake:
 $360^\circ \div 6 = 60^\circ$

```
repeat 6  
  move 100 steps  
  move -100 steps  
  turn 60 degrees
```

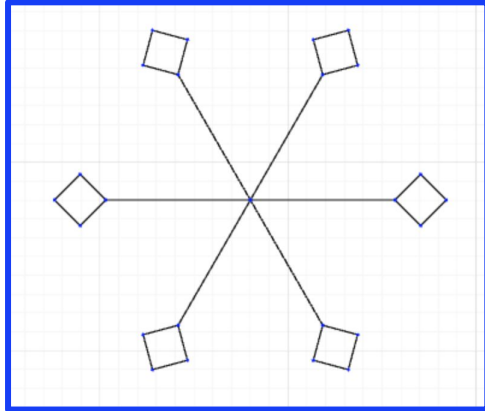


Add Endpoints to Spokes

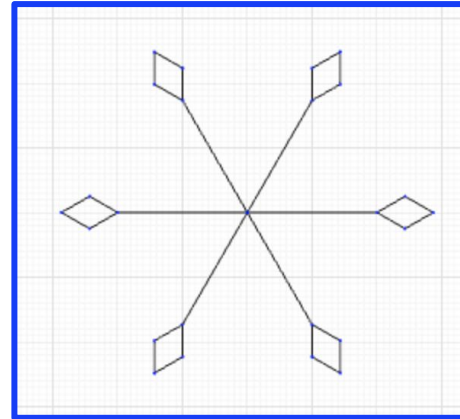


Adding Endpoints to the Spokes

```
repeat 6
  move 100 steps
  turn 45 degrees
  move 25 steps
  turn 90 degrees
  move 25 steps
  turn 90 degrees
  move 25 steps
  turn 90 degrees
  move 25 steps
  turn 90 degrees
  move -100 steps
  turn 60 degrees
```



```
repeat 6
  move 100 steps
  turn 30 degrees
  move 25 steps
  turn 60 degrees
  move 25 steps
  turn 120 degrees
  move 25 steps
  turn 60 degrees
  move 25 steps
  turn 120 degrees
  move -100 steps
  turn 60 degrees
```



Square Endpoints:

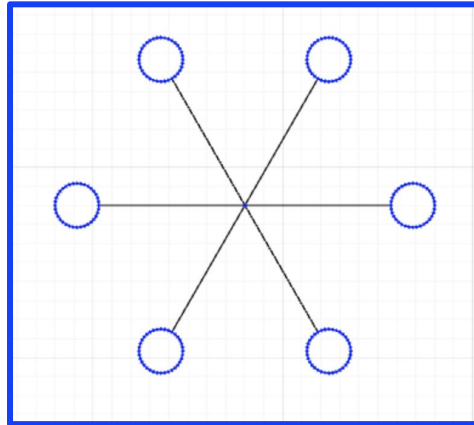
- **First turn:** 45° to position the square.
- **Next four turns:** 90° each to complete the square.
- **Return to center** and turn 60° for next spoke.

Diamond Endpoints:

- **First turn:** 30° to position the diamond.
- **Turns:** 60° , 120° , 60° , 120° to complete the diamond.
- **Return to center** and turn 60° for next spoke.

Adding Circle Endpoints to the Spoke

```
reset
repeat 6
  move 100 steps
  turn 90 degrees
  arc radius: 15 degrees: 360
  turn 90 degrees
  move -100 steps
  turn 60 degrees
```

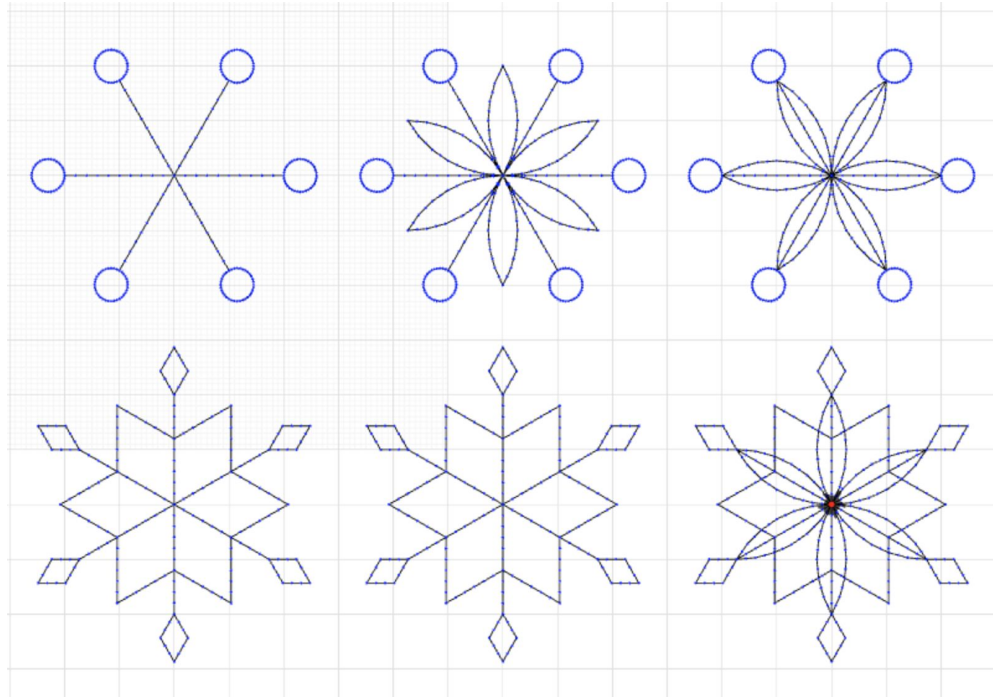


Circle Endpoints:

- **First turn:** 90° to align for the arc
- **Draw** circle with radius 15, 360° arc measure
- **Turn:** 90° to align to the spoke

<https://www.turtlestitch.org/run#cloud:Username=Elaine&ProjectName=Snowflake%20Spokes>

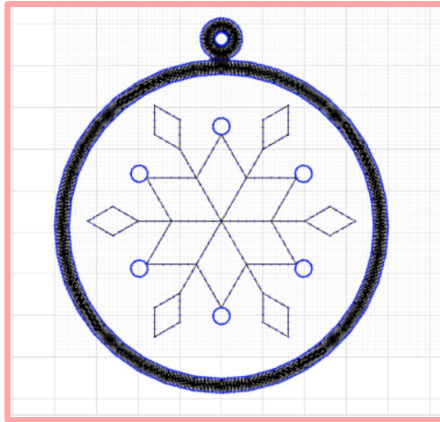
Adding Complexity To Snowflakes



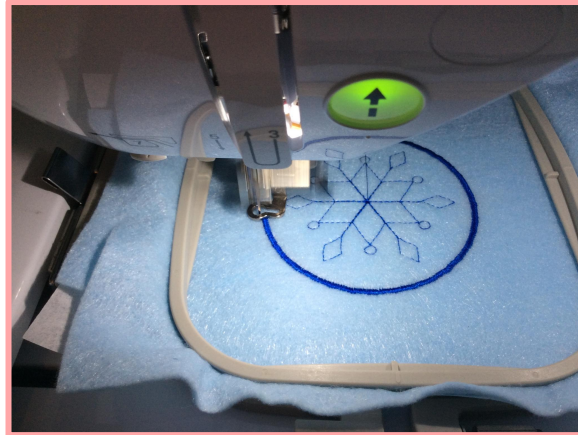
<https://turtlestitch.org/run#cloud:Username=Elaine&ProjectName=Snowflakes>

An Embroidered Snowflake

Export



Stitch



Fabricate

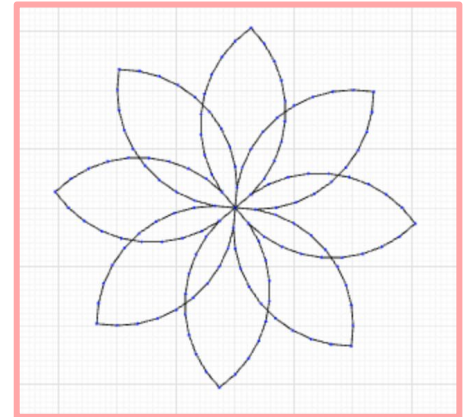
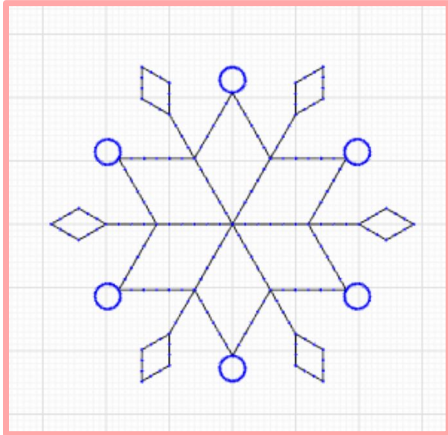


<https://www.turtlestitch.org/run#cloud:Username=Elaine&ProjectName=Snowflake%20Ornament%20%233>

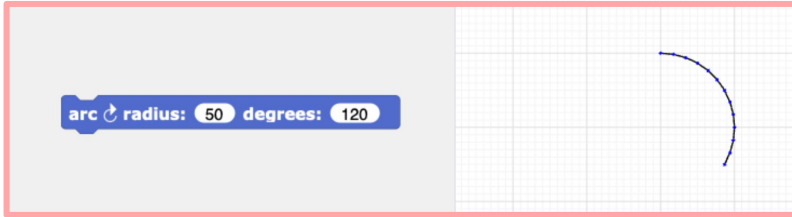
As the Snowflakes Melt...Math Blooms into Flowers

Snowflakes and flowers both have:

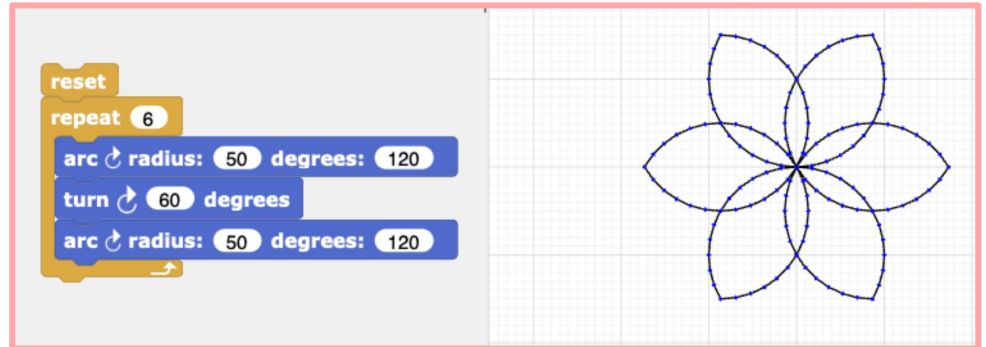
- Radial symmetry around a center
- Repeated patterns creating mathematical beauty



Designing Petals with Arc Block

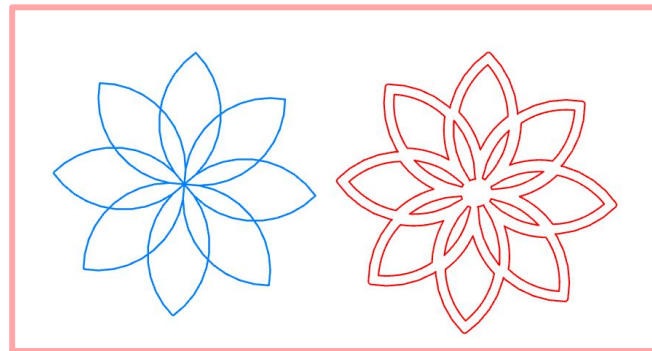


- **Arc block**
- **Turn:** $(180^\circ - \text{arc degrees})$ for second side; Ex: $(180^\circ - 120^\circ) = 60^\circ$
- **Repeat arc block**
- **Rotate:** $360^\circ \div \text{number of petals}$

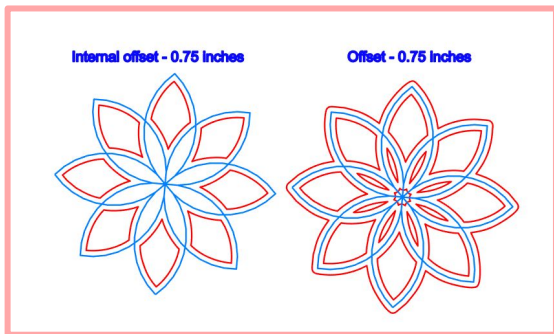


Constructing a Vase of Flowers

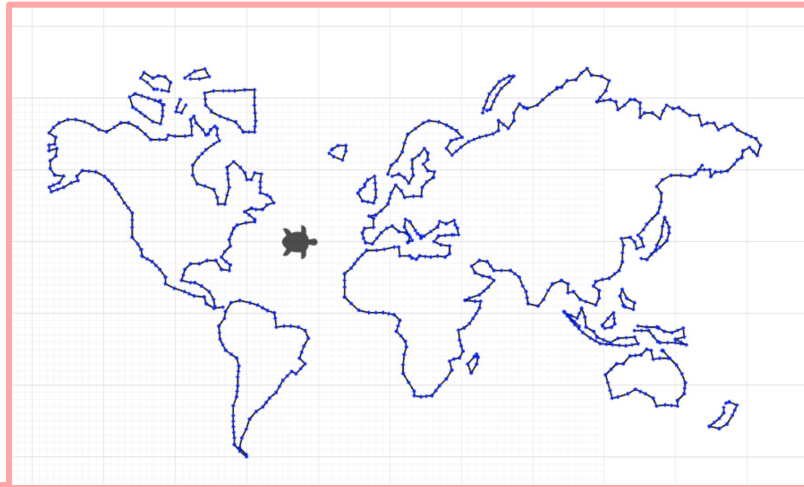
- **Export:** DXF or SVG file
- **Open:** Silhouette Studio
- **Apply:** Offsets
- **Manipulate image:** Scale, modify, or remove elements
- **Cut Out:** Vase and Flowers
- **Fabricate**



- **Blue = original:** TurtleStitch DXF export
- **Red = modified:** Silhouette Studio version
- **Lacy result:** Applied to cube vase



<https://www.turtlestitch.org/run#cloud:Username=Elaine&ProjectName=Petal%20Flower>



Thank you for discovering the world of TurtleStitch with me!

My TurtleStitch projects can be found at: <https://www.turtlestitch.org/user/Elaine>

Please visit my blogs:

 papercraftetc.blogspot.com

 turtlestitch.blogspot.com

There, you will find fun projects featuring math-based designs.