

In this activity you'll investigate an interesting pattern from a Logo program.

[The original Logo program looks like this:

```
to inspi :side :angle :increment
  fd :side lt :angle
  inspi :side :angle + :increment :increment
end
```



This problem is from Al Cuoco, Paul Goldenberg, and June Mark: "Habits of Mind: An Organizing Principle for Mathematics Curriculum," *J. Mathematical Behavior* 15(4):375-402, December, 1996.]

CONSTRUCT

Segment tool

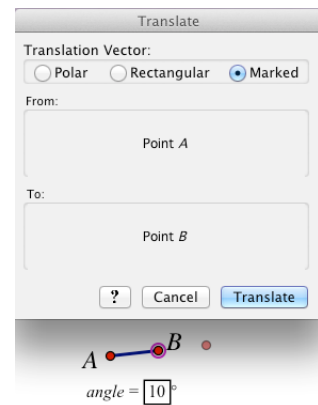
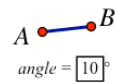
Number | New Parameter
Edit | Properties

Transform | Translate
Click A, then B

Transform | Rotate
Click B, then angle

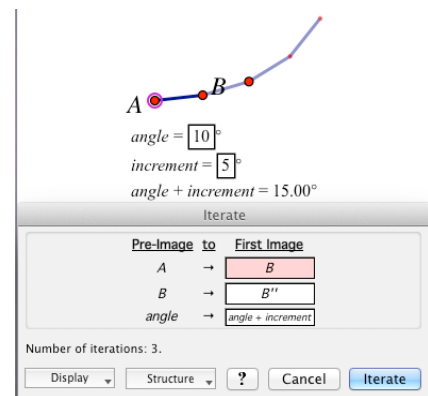
Number | Calculate
Click angle, type +,
click increment

- Construct a short segment AB and label it $side$.
- Create an angle parameter, label it $angle$, and set it to 10° . Change its Parameter Properties by setting Keyboard Adjustments to 1° .
- To advance the turtle forward by $side$, translate point B by the vector from A to B .
- To rotate the turtle's direction by $angle$, rotate point B' by $angle$ about point B . Then hide point B' .



Next, you will repeat the same translation and rotation, but this time incrementing the angle.

- Create another angle parameter, label it $increment$, and set it to 5° . Change its Parameter Properties by setting Keyboard Adjustments to 1° .
- Use the Calculator to compute the value $angle + increment$.
- Select the objects that will change when the operation is repeated: point A , point B , and parameter $angle$.
- Choose Transform | Iterate, and map $A \rightarrow B$, $B \rightarrow B''$, and $angle \rightarrow angle + increment$. Click **Iterate**.
- Delete the table that appears. Then select one of the iterated images and press the + sign repeatedly to create many iterations of the original construction.



Display | Line Style |
Hairline

10. Shorten the original segment AB (by dragging point A or B) to make the result fit on the page. Also delete the iterated red points, and make the iterated segments thin or hairline width.

Edit | Properties

11. To make lots of iterations, select the iteration and change the Iteration Properties to do many iterations. (Do at least 1000.)

INVESTIGATE

12. Investigate various values of (*angle, increment*). Here are some interesting values to try:

(0, 1)	(5, 1)	(0.3, 3)
(4, 2)	(3, 3)	(1.5, 3)
(1, 3)	(2, 3)	(0.5, 3)

What do you observe, and what do you wonder?