INITIATE Lesson Plan: *Driving on the Edge*

Lesson plan at a glance...

Name:	Driving on the Edge
Course:	Geometry
Grade Level:	10th
Prerequisites:	*Algebra I*
Time:	**Preparation: 10 mins** **Instruction: 90 mins**
Standard(s):	G.SRT.2. G.GMD.5. G.CO.4

In this lesson plan…

Lesson Overview

In this lesson Students will investigate external angles of polygons, properties of similar figures and scale factor by programming the smart car to drive the perimeters of various regular polygons.

Driving Questions

Overarching Driving Questions for Bowsher Wide Project:

- How can we make smart cars safer and more convenient?
- How can we protect them from cyberattacks?

Lesson Specific Question:

- How can the smart car be programmed to navigate through a path that takes it back to its starting point?

Materials and Equipment

List Materials Here

Preparation Tasks

	-Copy necessary worksheets and assessment -Be sure cars are charged and ready to go	*Time: 10 min.*

The Lesson

Warm-up Activity	*Time: 10 min.*
Activity 1: Students program the smart car to navigate around the perimeters of several regular polygons.	*Time: 20 min.*
Activity 2: Students program the smart car to navigate around the perimeters of scaled versions of the regular polygons in Activity 1.	*Time: 15 min.*
Activity 3: Students write code to direct the smart car to navigate around the perimeter of any regular polygon given the number and length of its sides.	*Time: 30 min.*
Wrap-up Activity: Students present findings and discuss methods. Students take a short exit slip formative assessment.	*Time: 15 min.*

Warm-up Activity (10 min)

Activity Overview: In this activity, students will get accustomed to Bloxter programming.

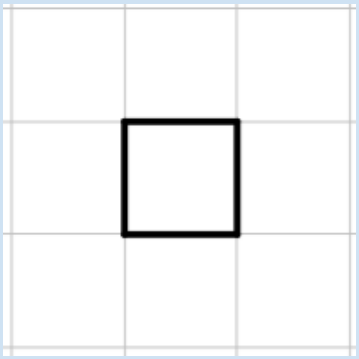
Activity: Fetching the data needed to code in Bloxter

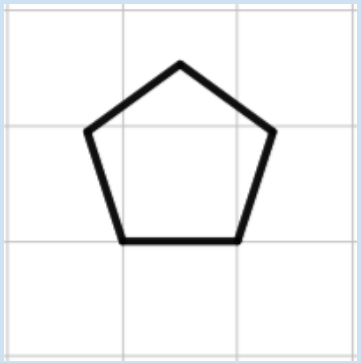
Students will measure lengths and angles to write a code in Bloxter to navigate GoPiGo car.

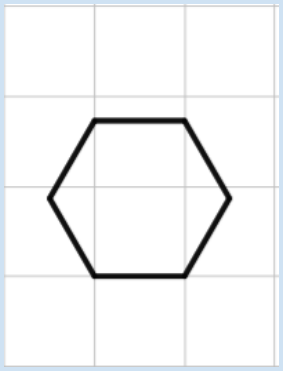
Activity 1: Bloxter Coding (20 minutes)

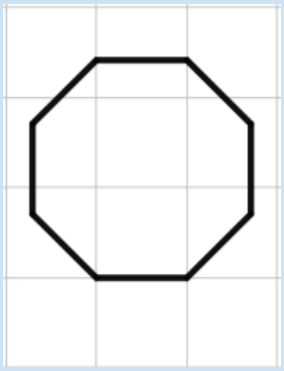
Activity Overview: In this activity, students will …

Activity:
Students are instructed to program the smart car to navigate their smart car around the perimeters of each of the following regular polygons, returning the car to its original position each time. After completing each task, students should record the instructions they gave the car and give a visual representation of what the car did.



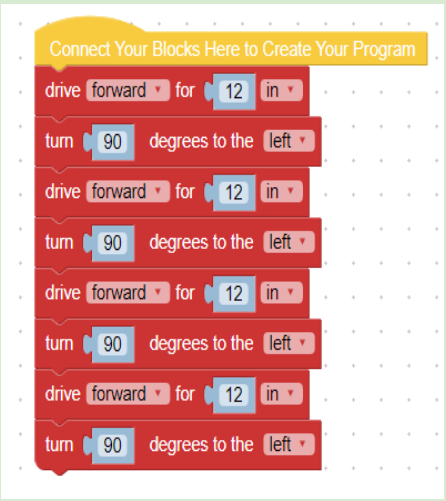




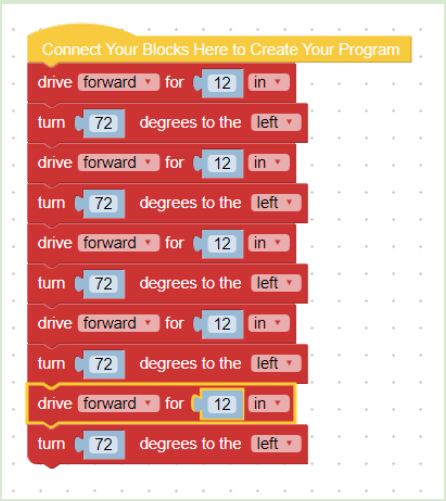


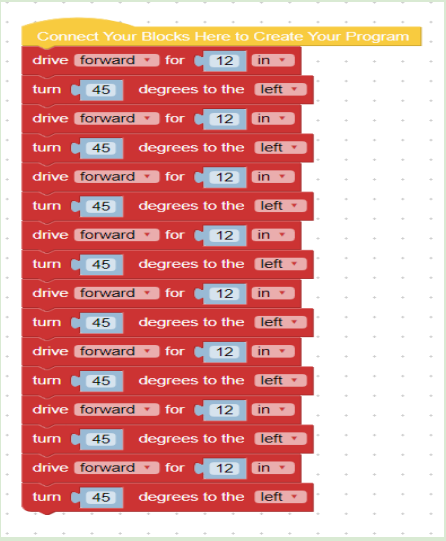
Teaching Tips: Student code may look like the following:

Square Pentagon Hexagon



Octagon



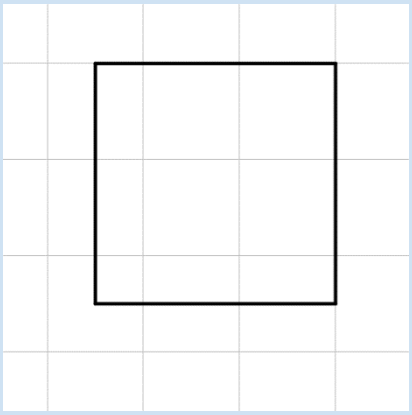


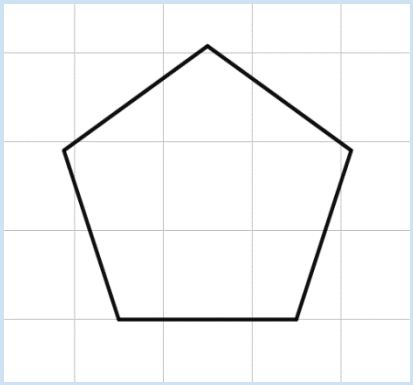
Encourage students to experiment. If the car isn't behaving the way they expect based on their instructions, ask why.

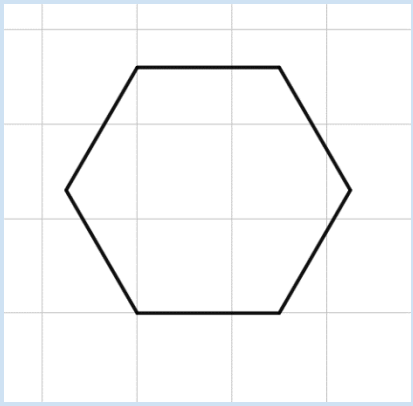
Activity 2: Navigating the cars along scaled up perimeters. (15 minutes)

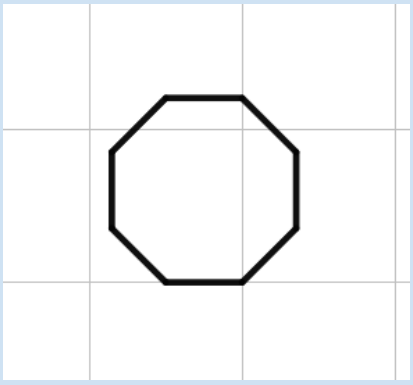
Activity Overview: In this activity, students will …

Activity:
Students repeat Activity 1 using the following scaled versions of the original polygons.



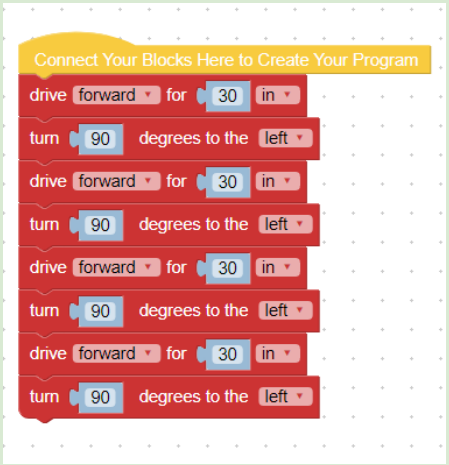




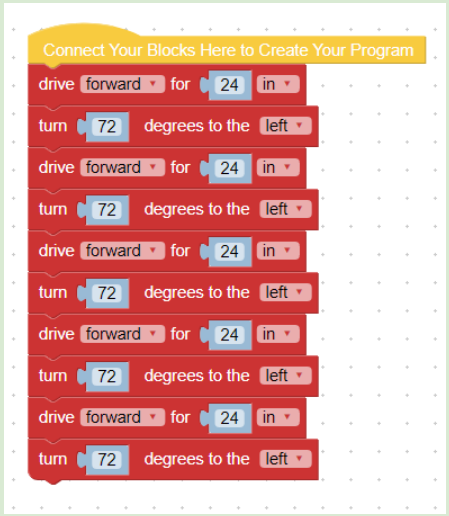


Teaching Tips: Student code may look like the following:

Scaled Square (30 inches on a side)

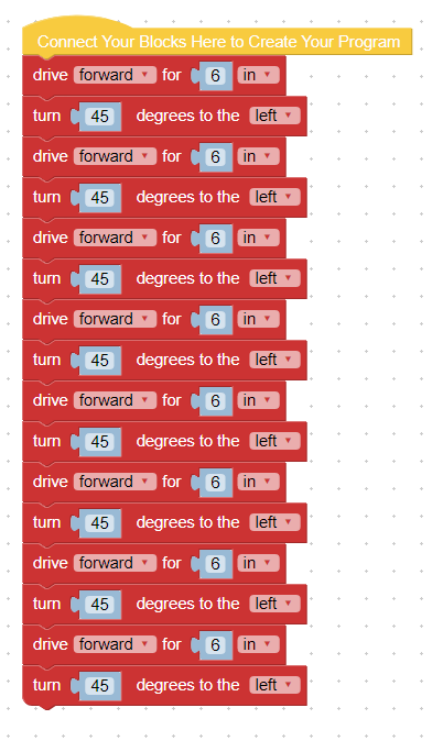


Scaled Pentagon (24 inches on a side)



Scaled Hexagon: (18 inches on a side)

Scaled Octagon (6 inches on a side)

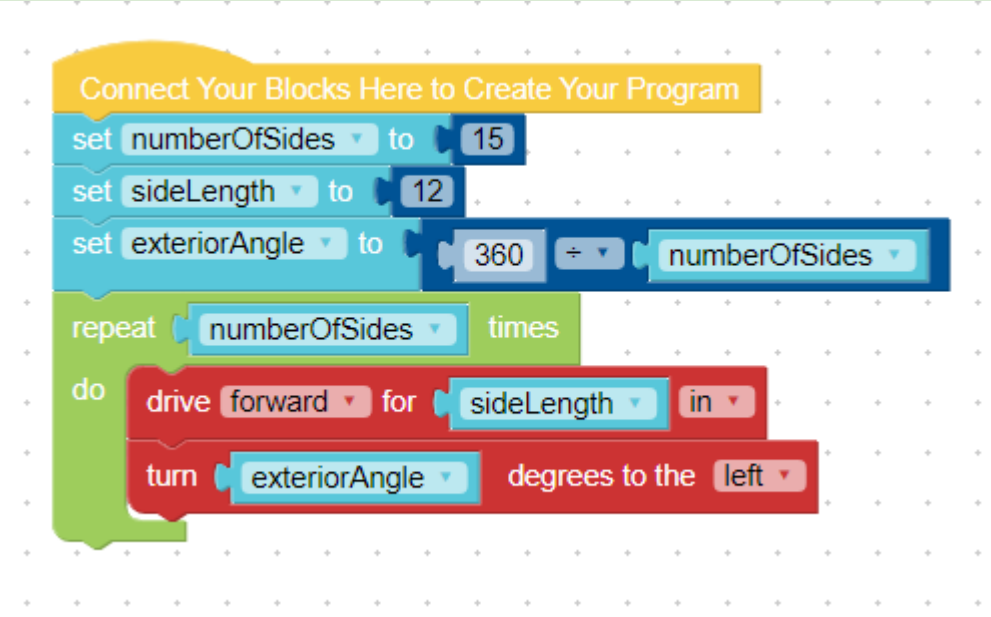


Activity 3: Students write code to direct the smart car to navigate around the perimeter of any regular polygon given the number and length of its sides. (30 minutes)

Activity Overview: In this activity, students will …

Activity:
Students design an algorithm for navigating the smart car around any regular polygon. As an extra challenge, students program the smart car to drive in a circle.

Teaching Tips: Student code may look like the following:



Wrap-up Activity: Analysis and reflection (15 minutes)

Activity Overview: In this activity, students will present findings and discuss methods. Students take a short exit slip formative assessment.

Activity: Teacher will lead students in a whole – class discussion based on the following questions:

1. **What were the instructions for each shape?**
2. **How did you determine the instructions to give the computer? (This question should lead to a discussion of how to calculate the angles).**
3. **What changed**

Assessment: Students take a short formative assessment asking them to describe how to instruct the car to navigate the perimeter of a regular polygon with a large number of sides.

Learning Objectives and Standards

Learning Objectives	**Standards**
Derive the formula for calculating the measure of an external angle of a regular polygon.	
Describe the similarities and differences between similar polygons.	G.SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. G.GMD.5 Understand how and when changes to the measures of a figure (lengths or angles) result in similar and non-similar figures.

Understand angles in terms of rotations.	G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

Additional Information and Resources

Project-based Learning Features

Feature	Where does this occur in the lesson?
Driving Question	How can the smart car be programmed to navigate through a path that takes it back to its starting point?
Investigation and Problem Solving	In Activities 1 and 2, students are given a broad, but well defined problem and determine, using calculations or guess-and-check, how to solve it.
Making Sense of Data and Technology Incorporation	Technology, including programming, are used throughout the lesson. Furthermore, students must interpret the meaning of errors in their results (i.e. why doesn't the car do what I want?)
Computational Thinking	The process of breaking down the task (planning a route around the perimeter of the polygons) into a set of instructions and programming them into the computer (especially making a generic program to make car represents computational thinking.
Collaborative Opportunities	Students will not only work in small groups, but will also be able to communicate with other groups concerning problems they encounter, as well as possible solutions.
Assessment techniques	Assessment will be done through observation, discussion and a short formative assessment.

Computational Thinking Concepts

Concept	Where does this occur in the lesson?
Decomposition	*In Activity 1, the students must take each overall path and break it down into a series of individual directions.*
Pattern Recognition	In Activity 2, students analyze patterns in the measures of the turns required for each regular polygon in order to determine the formula.
Abstraction	In Activity 2, students will need to draw general principles from a set of individual examples (polygons and their exterior angles).
Algorithm Design	In Activity 3, students will write Bloxter code for the smart car to make it travel around the perimeters of the polygons. As an added challenge (and an added level of abstraction), students may build a program that will drive the smart car around the perimeter of any regular polygon using only the number of sides as an input (assume all sides are length 1).

Administrative Details

Contact info: mzeigler@tps.org

Sources: Ohio Content Standards Bloxter

Date Written:

Template adapted from: https://edu.google.com/resources/programs/exploring-computational-thinking/