Summary	Understanding Turning Radius and Driving in Convex Polygon Paths in Introductory Robotics - Learning how to compute the turning radius, which is needed for robots that drive (found in robotics competitions and introductory robotics courses.
Topics	This assignment has basic mathematics (working with circles and convex polygons). Programming is introduced through a motor block (a "black box" function used to turn a motor. Exercises involving simple loops allow for more advanced/autonomous navigation using loops and "my blocks" (a way of defining one's own function).
Audience	Appropriate for all ages but is useful for high school and introductory computer science courses, especially those that want to show examples of how to write code that doesn't run on a desktop.
Difficulty	Introductory with Intermediate options
Strengths	The great strength of this assignment is to show how mathematical principles can be applied to solving an important (and needed) problem in robotics. Even though robotics kits come with motors, building a robot requires you to learn how to think parametrically, since not all robots are designed the same way.
Weaknesses	The current focus is on the Lego EV-3 programming language, which is proprietary and requires very specific, supported versions of an operating system to run. In addition, a student must build a robot in order to do this exercise. This could affect the instructional time a bit, and we don't provide details on building the robot here. However, anyone with a Lego Mindstorms (or other) robot kit can start by building a robotic vehicle. The Lego Mindstorms kit includes full instructions for a starter robot that can be built according to the instructions.
Dependencies	Although this assignment is looks simple, it requires some abstract thinking. Many CS1 students struggle to understand functions and the effect of parameters. Yet more CS1 students struggle with creating their own functions and understanding how variables work. Lego Mindstorm EV-3 is a block-based programming language. This application could be adapted to other block-based programming environments, including AppInventor (used by the US FIRST First Tech Challenge competition) or even simulated in Scratch itself. However, we have not tested in either of these environment.
Variants	Once completed, there are many possible sequels. In our use, we have students practice driving in an imaginary convex polygon path, where you make turns by calculating the interior angle of the polygon (on the robot itself) to make turns. The ideas of this assignment are not useful

| | just to driving. They can also be helpful to designing rotating arms, conveyor belts, and other innovative elements that use motor rotation. |