**360 Degrees**

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| **4th grade** |
| **Overview** |
| **Objectives/Standards**<br>Common Core Standards:<br>Math<br>4. MD. 5 a,b  (angle size in relationship to circle)<br>Reading<br>4.RI.3  (explain procedures in technical text)<br>4.RI.4 (determine meaning of domain specific words)<br>4.RI.7  (interpret diagrams)<br>4.RI.10 (comprehend technical texts)<br>Language<br>4.L.4 a, c  (determine and clarify meaning for words)<br>4.L.6  (use domain specific words) |
| **Materials**<br>❏ **S2 Robot**<br>❏ **marker**<br>❏ **large paper**<br>❏ **programming instructions** |
| **Time:**<br>**1.5 hrs** |
| **Teacher suggestions:**<br>● Have students stop, save and run their programs after each turn to make sure the program is one course.<br>● Students may want to experiment with adding a sound after certain steps to help them troubleshoot their program.<br>● Have students keep a journal of what they are learning and what is and isn't working along the way. |
| **Vocabulary**<br>❏ **block**<br>❏ **default**<br>❏ **degrees**<br>❏ **icon**<br>❏ **ray**<br>❏ **rotate**<br>❏ **template**<br>❏ **uploading**<br>❏ **worksheet** |

**Lesson**

The Problem:

You need to create a template for cutting pieces of pizza. You'll need to draw a circle with a pie shaped piece (slice) in it. Estimate the degrees of the angle of the piece and then measure with a protractor. Determine how many servings you can get out of the pizza with your slice size.

Programming Instructions: Follow the basic instructions to starting and saving programs. Your S2 robot has 3 wheels, each driven by a small motor. For this program, you're going to program your robot to turn on the motor to drive those wheels in order to move straight, stop and make several turns. You'll use the Action Blocks to get it moving. Just follow the steps.

**To make your circle choose one of the options below. See which one works best for you.**

**Rotate around one wheel**

1. Start with a clean worksheet. On the left side of the screen locate the Action Block, "Insert a Move Command". (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet. You'll see a window pop-up. The information in this window will let you set how the robot will move; the speed of each wheel, the direction the wheels turn (velocity) and the duration. The red arrow controls the left wheel and the green arrow, the right. Up is for forward and down is for a reverse motion. To change the numbers, click and hold on the black circle in the middle of the S2 figure. Move it around and see how the red and green arrows change in size and direction. Also notice how the numbers in the bottom section change as you hold and move your mouse there. A negative number means the wheel will rotate backwards. Use the yellow stopwatch on the right to set the time or distance of motion.

2. To program a tight rotation around one wheel, set the speed for that wheel to 0. Set the speed for the other wheel to a positive number to rotate forward or a negative number to rotate backwards around the wheel you've set to 0.

3. Experiment with the speed of the moving wheel and the time to achieve the turn you're looking for.

4. Keep track of what you've tried so you know what works and what doesn't work.

**Curved Turn**

1. Start with a clean worksheet. On the left side of the screen locate the Action Block, "Insert a move command". (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet. You'll see a window pop-up. The information in this window will let you set how the robot will move; the speed of each wheel, the direction the wheels turn (velocity) and the duration. The red arrow controls the left wheel and the green arrow, the right. Up is for forward and down is for a reverse motion. To change the numbers, click and hold on the black circle in the middle of the S2 figure. Move it around and see how the red and green arrows change in size and direction. Also notice how the numbers in the bottom section change as you hold and move your mouse there. A negative number means the

wheel will rotate backwards. Use the yellow stopwatch on the right to set the time or distance of motion.

2. To program a curved turn set either the red or green arrow larger than the other or make the red and green numbers in the bottom section different.  Depending on the difference between the two numbers (or the size of the arrows) the robot will make a wider or tighter turn.
3. Play with different number (or arrow size combinations) to get the turn for which you're looking.
4. Keep track of what you've tried so you know what works and what doesn't work.

You'll need to make an angle inside your circle to create your pizza slice. Draw two rays from the center of the circle. Find the center of the circle and place the robot pen there when it's time to draw. Follow the programming below. Repeat twice, once for each ray.

**Move Straight**
1. On the left side of the screen locate the Action Block, "Insert a move command".  (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet. You'll see a window pop-up. The information in this window will let you set how the robot will move; the speed of each wheel, the direction the wheels turn (velocity) and the duration. The red arrow controls the left wheel and the green arrow, the right. Up is for forward and down is for a reverse motion. To change the numbers, click and hold on the black circle in the middle of the S2 figure.  Move it around and see how the red and green arrows change in size and direction.  Also notice how the numbers in the bottom section change as you hold and move your mouse there. A negative number means the wheel will rotate backwards. Use the yellow stopwatch on the right to set the time or distance of motion.  *Insert picture of Action Block window with labels*
2. To program the robot to move straight, set the speed of each wheel to the same value. You can either use the joystick or set the red and green numbers at the bottom. Set both sides to a speed of (positive) 50. This is the default setting.
3. Use positive numbers to move forward or negative numbers to move backwards.

**Extensions and Optional Activities**
● Determine the fraction the pizza slice is of the whole circle.
● Create a slice that fits evenly inside the pizza when repeated.