

Place Value - Times 10

4th grade

Overview

Students will create a visual representation of place value as 10x greater.

Objectives/Standards

Common Core Standards:

Math

4. NBT. 1 (recognize place value as 10x)

4. NBT. 2 (read and write in multiple forms)

Reading

4.RI.3 (explain procedures in technical text)

4.RI.4 (determine meaning of domain specific words)

4.RI.7 (interpret diagrams)

4.RI.10 (comprehend technical texts)

Language

4.L.4 a, c (determine and clarify meaning for words)

4.L.6 (use domain specific words)

Extension and optional activity

Math

4. NBT. 2 (compare)

Materials

- S2 Robot
- marker
- large paper
- programming instructions
- basic programming instructions: starting, saving and uploading

Time

1.5 - 2 hrs. (depending on complexity of designs)

Teacher suggestions:

- Have students stop, save and run their programs after each turn to make sure the program is one course.
- Students may want to experiment with adding a sound after certain steps to help them troubleshoot their program.
- Have students keep a journal of what they are learning and what is and isn't working along the way.

Vocabulary

- default
- duration
- maneuver
- negative numbers

- positive numbers
- representation
- rotation
- velocity

Lesson

Student should design a visual representation of place value for a multi-digit number, showing how the value of the subsequent places are 10x the current place. Students will write the number in numeral, number name and expanded form. Before programming students should create a hand-drawn draft of their idea. Students can then follow the instructions below for each type of maneuver they would like to use (move: straight, rotate, curved turn or turn on: sound or lights).

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.

Move Straight

1. Start with a clean worksheet.
2. 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*
3. 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.
4. Use positive numbers to move forward or negative numbers to move backwards.

Rotate around itself

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 rotation around the S2 itself, set the speed of each wheel the same number but make one of them positive and one of them negative.
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.

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.

Extensions and Optional Activities

- Use visuals to compare relative size of two numbers, using $<$ $>$ or $=$.

Optional Assessment Rubric

	No Understanding Demonstrated	Minimal Understanding Demonstrated	Modest Understanding Demonstrated	Full Understanding Demonstrated
Digits		Used a 2 digit number.	Uses a 3 digit number.	Uses a number with more than 3 digits.
Representation in written plan	Show unclear differences or no difference.	Show some difference but not 10x.	Shows some but not all at 10X different.	Clearly shows each place as 10X different.
Notation	0 of 3 correct.	1 of 3 correct.	2 of the 3 correct.	Numeral, number name and expanded form correct.
Programming according to the written plan	Performs far from task.	Performs the general task.	Performs nearly as expected.	Performs exactly as expected.