

Fractional Equivalents

Fourth grade

Overview

Students will create a visual representation of equivalent fractions.

Standards

Common Core Standards:

Math

4.NF.1 (fractional equivalence)

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)

Materials

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

Time

2.5 - 3 hrs.

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

- congruent
- duration
- maneuver
- negative number
- positive number
- representation
- subsequent

Lesson

Students should design a visual representation of equivalent fractions using a rectangle. Before programming students should create a hand-drawn draft of their idea. They should also write in words the intended movements (including speed, velocity, turns, etc...) of the robot in a step-by-step plan and/or plan the steps using the programming sequence organizer.

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.

Part 1 – Create the first rectangle

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.
4. Choose a duration using the stopwatch. You can..... (Don't forget to think about the size of your paper!)
5. Use positive numbers to move forward or negative numbers to move backwards.
6. *Critical Thinking: Determine which kind of turn is needed to create a rectangle with the correct corners. Look through the programming instructions below for **Turns 1 and 2**. Predict which turn you should use. Write about why you have selected the turn you chose. Now try using Turn 1 or Turn 2 and see what happens. Where you correct. Why or why not?*
7. After choosing and programming Turn 1 or Turn 2, come back to Step 5 here.
8. So far your robot should have completed one straight line and one turn.
9. Now, on the left side of the screen locate the Action Block, "Insert a move command", again like you did in Step 1 above. (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet.
10. You are going to create another side of the rectangle. Like before set the speed of

each wheel to the same value (make sure it's positive) and the duration for the motor to run. (See steps 1 and 2 if you don't remember how.)

11. Use the same turn (1 or 2) that you chose in Step 6.
12. Repeat Steps 7-9 two more times to complete your rectangle.
13. Upload your program to the robot. In order to upload the program you'll need to plug in the cable. As soon as you hit start the robot will start moving, so let's add a delay at the beginning of the program so you'll have time to unplug the cord. In the Action Bar find the Hourglass icon, called "Insert a pause". Click on it, move the cursor to place the grey bar just after the red Start block and click to place the new block in the beginning of your program just ahead of the first "Move" block. A "Wait awhile" window appears, set it to pause for 7 seconds. You can use the slider or click above the slider to input a time. Press "OK".
14. Did it work? Your robot should be facing the same way it started, and you should have a rectangle. If it's not, check through the steps to make sure you have them all correct. If you can't figure it out, ask a buddy.

Part 2 – Create the fractional parts

Now comes the tricky part! You need to draw a line to divide your shape in two pieces to show the fraction $\frac{1}{2}$. You need to program your robot to move halfway across the end of the rectangle, turn and draw a line across. Let's begin.

15. Now you're going to add to the program. Problem-solving: How will you program your robot to move halfway down the line? How do you tell your robot how far to go? (Hint: How many seconds did your robot move in Step 2 above?)
16. Once you have figured out how to get your robot to the correct spot, on the left side of the screen locate the Action Block, "Insert a move command", again. (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet.
17. Set the speed of each wheel to the same value (make sure it's positive) and the duration for the motor to run. (See Steps 1 and 2 from Part 1 if you don't remember how.)
18. Use the instructions below for the correct type of turn, either Turn 1 or Turn 2. Remember you want the robot to turn so it can draw a line across the rectangle
19. Insert another Action Block, "Insert a move command".
20. Set the distance and speed to move the robot across the rectangle to stop at the other side.
21. The robot should be ready to draw the first full rectangle with the fractional parts for $\frac{1}{2}$.
22. Name and save the program.
23. Upload the full program, place the marker in the S2 and try it out. If it works move on to **Part 3**. If it doesn't, go back through the program step by step to locate the problem.

Part 3 – Create the second rectangle and fractional parts

24. Now you need to copy the first program and add on to the end of it.
25. After the last step you need to add two more lines across the rectangle. Use the Turn 1 directions from below and the same speed and duration you've been using

to make the correct right angle turn.

26. *Critical Thinking: How will you program your robot to move one-fourth the way down the line? How do you tell your robot how far to go? (Hint: How many seconds did your robot move in Step 2 of Part 1 above?)*
27. Once you have figured out how to get your robot to the correct spot, on the left side of the screen locate the Action Block, "Insert a move command", again. (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet.
28. Set the speed of each wheel to the same value (make sure it's positive) and the duration for the motor to run. (See Steps 1 and 2 from Part 1 if you don't remember how.)
29. Use the Turn 1 directions from below and the same speed and duration you've been using to make the correct right angle turn to the left.
30. Your robot will now move back across the rectangle the same distance as before. On the left side of the screen locate the Action Block, "Insert a move command", again. (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet.
31. Set the speed of each wheel to the same value (make sure it's positive) and the duration for the motor to run. (See Steps 1 and 2 from Part 1 if you don't remember how.) Use the duration from Step 9 above.
32. Repeat Steps 23-28.
33. Name and save the program.
34. Upload the program, place the marker and run the program.

Part 4 – Shading

Your robot should have now drawn 2 congruent rectangles, one divided into halves and one into fourths.

1. Shade one-half ($1/2$) of the first rectangle and two-fourths ($2/4$) of the second rectangle.
2. Are the shaded pieces the same amount of the rectangle or different? Why or why not?

Turn 1

35. On the left side of the screen locate the Action Block, "Insert a move command", like you did in step 1 above. (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet.
36. Set the speed of each wheel to the same number but make one of them positive and one of them negative.
37. Experiment with the speed of the moving wheel and the time to achieve the turn you're looking for. Remember, it should be a rectangle, so what type of angle should the robot turn through?
38. Keep track of what you've tried so you know what works and what doesn't work. Suggestion: Upload and run your program at this point until you have the correct amount of turn.

Turn 2

39. On the left side of the screen locate the Action Block, "Insert a move command", like you did in step 1 above. (It looks like the top of the S2 with a white arrow on it.) Click on the block to place in on your worksheet.
40. Set the speed of one wheel to 0 and the speed of the other wheel to a positive number. Remember this will determine how fast this wheel turns, so don't make it too fast or too slow.
41. Experiment with the speed of the moving wheel and the time to achieve the turn you're looking for.
42. Keep track of what you've tried so you know what works and what doesn't work. Suggestion: Upload and run your program at this point until you have the correct amount of turn.

Extensions and Optional Activities

- Create a rectangle and fractional equivalents other than $\frac{1}{2}$.
- Create a fractional equivalent using a more complex shape (Ex: triangle, circle, octagon?)