# Lecture 1: Educational robotics. MOVE Distance My Block (Move_CM)

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1. Create a useful My Block
2. Learn why creating a My Block that takes measurements made with a ruler can be useful
3. Make a Move_CM My Block

# Why a Move Distance My Block?

- Built-in move blocks will not take inputs (values) in centimeters or inches.

- It is much easier to measure distance with a ruler than degrees or rotations.

- If you change your robot design to have bigger or smaller wheels later on, you don't have to re-measure every movement of your robot
  - Instead of changing distances in every single program you wrote, just go into your new Move Distance Block and change the value for how many inches/cm one motor rotation would take.
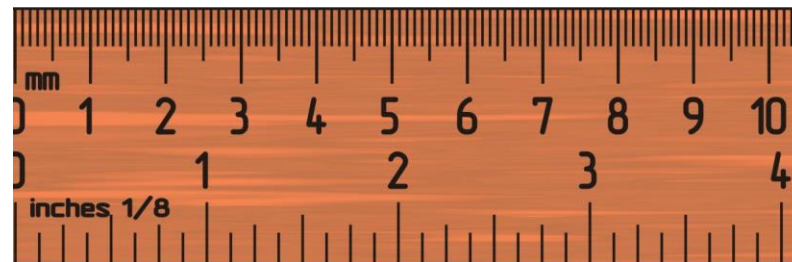
# MOVE_CM IN THREE EASY STEPS

- **STEP 1:** Determine how many motor degrees your robot moves in 1cm
- STEP 1A: Wheel Measurement
- STEP 1B: Program the robot to move 1cm

- **STEP 2:** Add a Math Block to convert centimeters to degrees

- **STEP 3:** Create a Move_CM My Block with 2 inputs (power and degrees)

**Method 1:**
1. Look up the wheel size in mm printed on your tire and divide by 10 to convert to cm (because 1cm=10mm)
2. Multiply the answer in step 1 by π (3.1415…) to compute circumference
3. Divide 360 degrees by value from step 2. This computes degrees in 1cm since you travel one circumference in 1 rotation and 1 rotation is 360 degrees

**Example calculation using the standard EV3 Edu 45544 set wheels:**
1. EV3 EDU (45544) wheels are 56mm = 5.6cm in diameter
2. 5.6cm × π = 17.6cm per rotation
3. 360 degrees ÷ 17.6cm = 20.5 motor degrees per cm

Helpful chart with common LEGO wheels and their diameters.

http://wheels.sariel.pl/

Alternate Method: Use Port View to find the Motor Degrees value. Use this method if you cannot find the diameter value printed on your wheel.

1. Put your ruler next to your wheel/robot at 0 centimeters (whatever part of the robot you use to align with 0, you should use to use to measure distance in step 2)
2. Roll your robot forward any amount of centimeters, making sure your robot does not slip.
3. Take the degree reading you see on the screen for the motor sensor and divide by the amount of centimeters you moved.
4. The answer will be the number of degrees your robot's wheels turn in 1 centimeter.
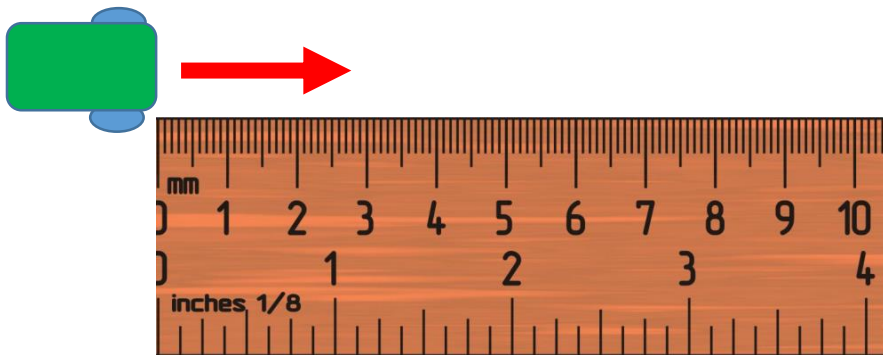
Step 1: This is a program that moves 1 centimeter. The value 20.5 degrees is based on the size of the wheels on DroidBot 2.0. It is the number of motor degrees your robot turns for 1 CM. This was determined in Step 1A of the powerpoint file. You will need to customize this number for your robot/wheels.
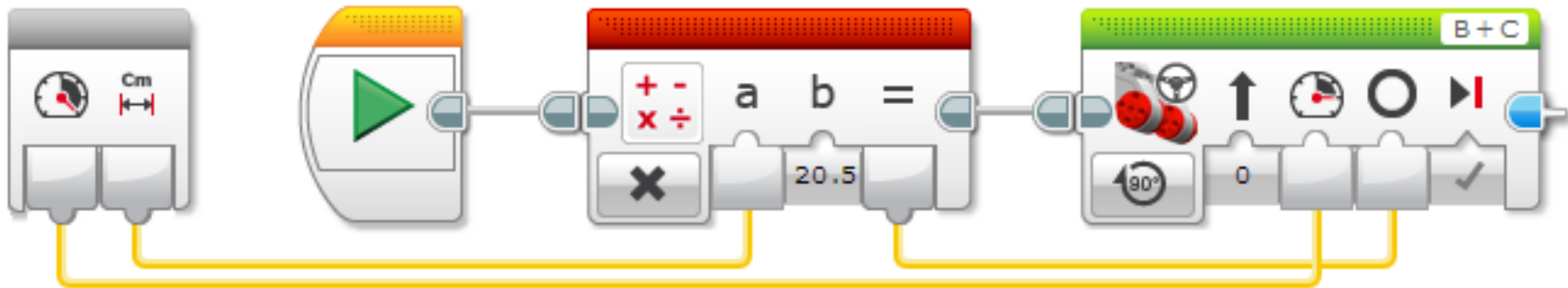


Use the Motor Degrees value you obtained for your robot in slides 5 or 6

- **A. Highlight the two blocks in Step 2 and go to My Block Builder**

**A**

- **B.  Add two inputs: Power and Centimeters and complete the setup process.**

**B**

- If you need help in the My Block Builder, refer to the My Block with Inputs and Outputs Lesson in Intermediate
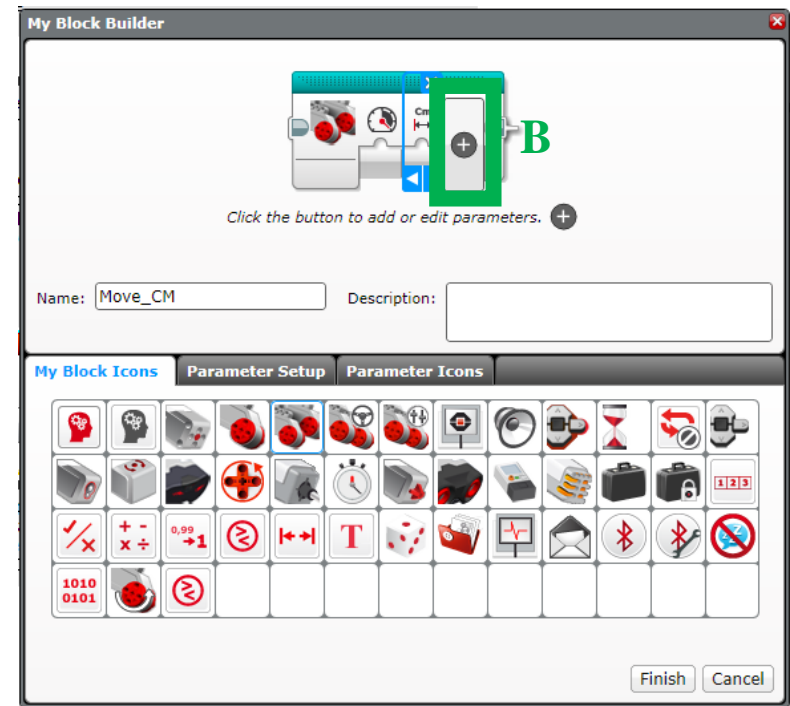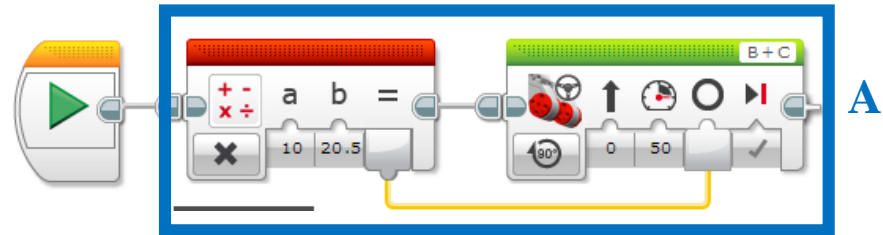
C. Wire the inputs in the grey block. The centimeters input connects to the Math Block. The power goes into the Move Steering Block's power input. The result of the Math Block is wired into the degrees input in the Move Steering Block.

# References

Benedettelli, D. (2014), *THE LEGO® MINDSTORMS® EV3 LABORATORY build, program, and experiment with wicked cool robots*. William Pollock, USA.

Griffin, T. (2014), *THE ART OF LEGO® MINDSTORMS® EV3 PROGRAMMING*. No Starch Press, USA.

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