

# ROBOT LESSON 1: DIFFERENTIAL STEERING

## OAKWOOD FLL

### What is differential steering?

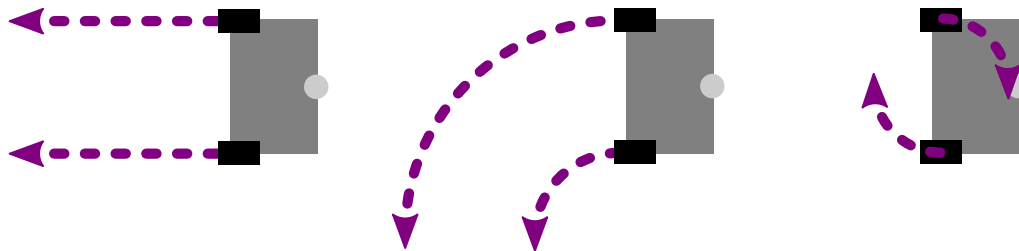
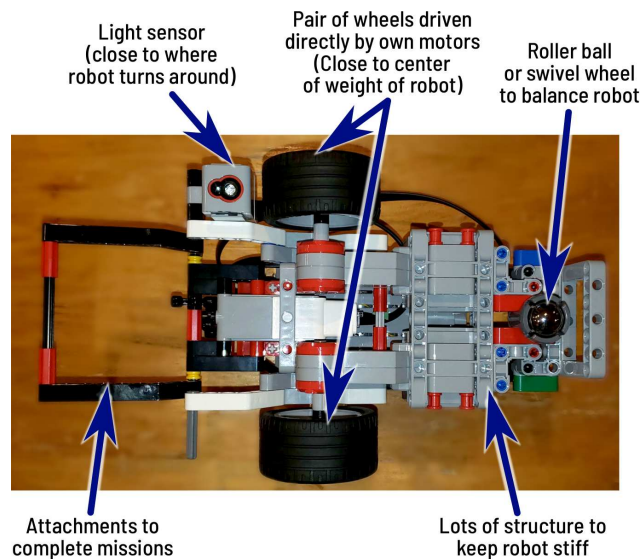
Cars usually steer by turning their front wheels. This is possible to do in LEGO, but it uses lots of pieces and space and tends to be imprecise.

Differential steering turns the robot by spinning wheels on different sides of the robot at different speeds. The wheel that spins **slower** is on the **inside** of a turn. A picture of the bottom of a differential steering robot is at the right.

One of the most important things for a FIRST LEGO robot is that it be able to **drive straight** accurately, and this is easiest to accomplish with differential steering.

Also, differential steering allows the robot to **turn in place**. This is often useful for missions.

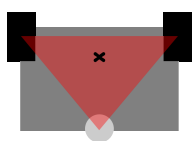
Below, there are top views of a robot that uses differential steering. In the first drawing, both wheels spin at the same speed, and the robot goes straight. In the next example, the robot's right wheel spins faster and travels further than the left wheel, and the robot turns left. Finally, when the left wheel goes forward and the right wheel reverse, the robot turns in place to the right.



The roller ball on the back of the robot is important because the back of the robot needs to be able to slide sideways— especially when turning in place.

### Weight and balance are important.

Heavier robots are **more accurate** because their drive wheels slip less. Lighter robots are **faster**.



The robot must be **stable** (not tip over).

It must have its weight (including **attachments and cargo**) inside the area of the places it touches the ground. This means the center of the robot's weight must be inside the red triangle formed by the wheels and the roller.

If the weight is too close to the edge of the triangle, the robot might still tip when speeding up, slowing down, or turning. On the other hand, it's good for the center of weight to be close to the drive wheels because this helps the robot turn more precisely.

### Bumpers are useful.

Flat, smooth surfaces on the sides and back of the robot can help with steering errors. The robot can drive along a wall to control its direction or back up into a wall for alignment. But bumpers also make the robot larger and could interfere with attachments.

