

Linkbot Motion: Degrees per second vs. Centimeters per second

A. The Linkbot has wheels with a diameter of 9.2 cm. How can we find out how far the wheel will go in one full 360 degree turn?

We will use the formula for the Circumference of a Circle: $C = 2\pi(\text{radius})$

The distance the wheel rolls in one turn is equal to the distance around the wheel.

So the distance is about 28.9 cm.

B. A Linkbot's speed is controlled by the number of degrees it turns in one second. So a speed of 360 degrees per second means the wheel will turn exactly one time every second.

How many times will the wheel turn if it rotates 720 degrees?

How many seconds will it take?

Note: Linkbots do not work too well at speeds over 200 degrees per second. So we will usually use speeds below that.

C. How many times will the wheel turn in 4 seconds, if its speed is 180 degrees per second?

D. How many times will the wheel turn in 8 seconds, if its speed is 90 degrees per second?

E. If a Linkbot's wheels are turning at a speed of 180 degrees per second for 4 seconds, how can we find out how far it will go? Explain the reasoning for each step below.

In four seconds the wheel will turn 4×180 degrees = 720 degrees. _____

720 degrees/ 360 degrees per turn = 2 turns _____

2 turns(28.9 cm per turn)= 57.8 cm _____

F. If a Linkbot's wheels are turning at a speed of 90 degrees per second for 12 seconds, how far it will go?

G. Suppose we need our Linkbot to travel exactly 40 cm in exactly 6 seconds. What speed will the robot have to travel in degrees per second to achieve this?

$$6\text{sec}(s)=40\text{cm}$$

$$s=40\text{cm}/6\text{sec}$$

$$s=6.67 \text{ cm per second}$$

However this speed is in cm per second and we require our speed in degrees per second. Hint: Consider how far the car will move if the wheel only turns one degree?

How can we convert this speed into degrees per second?

(S degrees per second/360 degrees per turn) gives the number of turns the wheel makes in 1 second. There are 28.9 cm per turn.

so...

(S degrees per second/360 degrees per turn)(28.9 cm per turn) gives the number of centimeters per second which in this case is 6.67 cm/sec.

thus we can write the equation:

$$(S \text{ deg per sec}/360 \text{ deg per turn})(28.9 \text{ cm per turn}) = 6.67 \text{ cm per sec}$$

and solve:

$$S \text{ deg per sec} = (6.67 \text{ cm per sec})(360 \text{ deg per turn}) / (28.9 \text{ deg per turn})$$

and simplify:

$$S = 83.08 \text{ degrees per second}$$

H. Suppose we need our Linkbot to travel 80 cm in 10 seconds. What speed will the robot have to travel in degrees per second to achieve this?