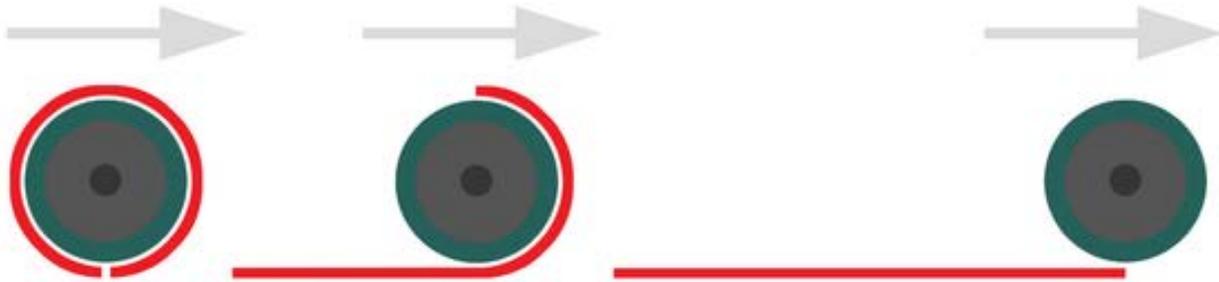


NAME: \_\_\_\_\_

PERIOD: \_\_\_\_\_

## Lego Mindstorms NXT Unit

$2\pi r = \text{Circumference of Wheel} = \text{Total distance traveled in one full rotation}$



**Directions: Find the circumference of the following wheels.**

1. Radius = **10mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
2. Radius = **17mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
3. Radius = **21mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
4. Radius = **28mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
5. Radius = **31mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
6. Radius = **8mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
7. Radius = **60mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
8. Radius = **25mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
9. Radius = **12mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm
10. Radius = **43mm**  
Circumference =  $2 \times \pi \times$  \_\_\_\_\_ = \_\_\_\_\_ mm

# Calculating Distance

The robot needs to be able to travel a certain distance and be able to either stop or complete another command after it reaches this distance. The robot cannot make a decision where to stop without receiving specific information from us. We need to tell it how far to go by telling it how many times it needs to rotate it's wheels. We can identify the number of rotations through the following formula:

$$\# \text{ of Rotations} = \frac{\text{Distance to be traveled}}{\text{Circumference}_{\text{wheel}}}$$

Using the skills gained while calculating the circumference from the first page of this assignment, calculate the number of rotations needed to accomplish the tasks indicated in the following questions.

1. A robot with wheels with a radius of **10mm** must travel exactly **1000mm** and then stop. How many rotations does it need to go?  
Circumference= $2 \times \pi \times r$   
Circumference=  $2 \times \pi \times$  \_\_\_\_\_  
**Circumference**<sub>wheel</sub>= \_\_\_\_\_  
# of rotations=distance to be traveled÷circumference of wheel  
# of rotations= $\frac{\text{_____}}{\text{_____}}$   
**# of rotations**= \_\_\_\_\_
2. A robot with wheels with a radius of **17mm** must travel exactly **256mm** and then stop. How many rotations does it need to go?  
Circumference= $2 \times \pi \times r$   
Circumference=  $2 \times \pi \times$  \_\_\_\_\_  
**Circumference**<sub>wheel</sub>= \_\_\_\_\_  
# of rotations=distance to be traveled÷circumference of wheel  
# of rotations= $\frac{\text{_____}}{\text{_____}}$   
**# of rotations**= \_\_\_\_\_
3. A robot with wheels with a radius of **21mm** must travel exactly **365mm** and then stop. How many rotations does it need to go?  
Circumference= $2 \times \pi \times r$   
Circumference=  $2 \times \pi \times$  \_\_\_\_\_  
**Circumference**<sub>wheel</sub>= \_\_\_\_\_  
# of rotations=distance to be traveled÷circumference of wheel  
# of rotations= $\frac{\text{_____}}{\text{_____}}$   
**# of rotations**= \_\_\_\_\_
4. A robot with wheels with a radius of **28mm** must travel exactly **45mm** and then stop. How many rotations does it need to go?  
Circumference= $2 \times \pi \times r$   
Circumference=  $2 \times \pi \times$  \_\_\_\_\_  
**Circumference**<sub>wheel</sub>= \_\_\_\_\_  
# of rotations=distance to be traveled÷circumference of wheel  
# of rotations= $\frac{\text{_____}}{\text{_____}}$   
**# of rotations**= \_\_\_\_\_

## Lego Mindstorms NXT Unit Turning

The robot that we use has three wheels and in order to make a 90° turn one wheel must remain stationary while the other wheel rotates a certain number of rotations. The wheel must travel a certain distance which can be input into the previous formula to determine the number of rotations needed. Finding that distance is a new skill that will be discussed momentarily.

With one wheel remaining stationary and the other rotating, the robot will trace a large circle. We need to determine the circumference of that large circle to figure out the distance for our turn.

The radius of the large circle is the wheel base, or the distance between wheels. Using the formula for Circumference, we can figure the distance around the large circle.

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \text{radius (wheel base)}$$

The robot only needs to turn 90° and the circumference is 360°, so we need to divide the Circumference<sub>Large Circle</sub> by 4 to get the length of the 90° arc.

$$\text{Total Distance Wheel Must Travel} = \text{Circumference}_{\text{Large Circle}} \div 4$$

Once the total distance has been determined, we can input that number into the previous formula to determine the number of rotations.

$$\# \text{ of Rotations} = \text{Distance to be traveled} \div \text{Circumference}_{\text{Wheel}}$$

Use the previous information to determine the number of rotations needed in each of the following questions.

1. A robot with a wheel with a radius of **24mm** and a wheel base of **75mm** needs to turn 90°. How many rotations does the wheel need to turn to accomplish this turn?

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \text{radius}$$

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Wheel}} = \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \text{radius (wheel base)}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = \underline{\hspace{2cm}}$$

$$\text{Total Distance Wheel Must Travel} = \text{Circumference}_{\text{Large Circle}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \text{distance to be traveled} \div \text{Circumference}_{\text{Wheel}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}} \div \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}}$$

2. A robot with a wheel with a radius of **24mm** and a wheel base of **90mm** needs to turn 90°. How many rotations does the wheel need to turn to accomplish this turn?

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \text{radius}$$

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Wheel}} = \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \text{radius (wheel base)}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = \underline{\hspace{2cm}}$$

$$\text{Total Distance Wheel Must Travel} = \text{Circumference}_{\text{Large Circle}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \text{distance to be traveled} \div \text{Circumference}_{\text{Wheel}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}} \div \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}}$$

3. A robot with a wheel with a radius of **24mm** and a wheel base of **100mm** needs to turn 90°. How many rotations does the wheel need to turn to accomplish this turn?

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \text{radius}$$

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Wheel}} = \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \text{radius (wheel base)}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = \underline{\hspace{2cm}}$$

$$\text{Total Distance Wheel Must Travel} = \text{Circumference}_{\text{Large Circle}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \text{distance to be traveled} \div \text{Circumference}_{\text{Wheel}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}} \div \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}}$$

4. A robot with a wheel with a radius of **24mm** and a wheel base of **150mm** needs to turn 90°. How many rotations does the wheel need to turn to accomplish this turn?

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \text{radius}$$

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Wheel}} = \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \text{radius (wheel base)}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = \underline{\hspace{2cm}}$$

$$\text{Total Distance Wheel Must Travel} = \text{Circumference}_{\text{Large Circle}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \text{distance to be traveled} \div \text{Circumference}_{\text{Wheel}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}} \div \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}}$$

5. A robot with a wheel with a radius of **24mm** and a wheel base of **48mm** needs to turn 90°. How many rotations does the wheel need to turn to accomplish this turn?

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \text{radius}$$

$$\text{Circumference}_{\text{Wheel}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Wheel}} = \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \text{radius (wheel base)}$$

$$\text{Circumference}_{\text{Large Circle}} = 2 \times \pi \times \underline{\hspace{2cm}}$$

$$\text{Circumference}_{\text{Large Circle}} = \underline{\hspace{2cm}}$$

$$\text{Total Distance Wheel Must Travel} = \text{Circumference}_{\text{Large Circle}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}} \div 4$$

$$\text{Total Distance Wheel Must Travel} = \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \text{distance to be traveled} \div \text{Circumference}_{\text{Wheel}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}} \div \underline{\hspace{2cm}}$$

$$\# \text{ of rotations} = \underline{\hspace{2cm}}$$