Review:

Robots usually use the metric system for measurements

- Meters for measuring distance
- Radians for measuring angles
- Seconds for measuring time

Standard Prefixes:

Smaller			Larger		
centi-	10^{-2}	hundredth	kilo-	10^{3}	thousands
milli-	10^{-3}	thousandth	mega-	10^{6}	millions
mirco-	10^{-6}	millionth	giga-	10^{9}	billions
nano-	10^{-9}	billionth	tera-	10^{12}	trillions

Examples: $1 \times 10^{3} = 1000$ $1 \times 10^{-3} = .001$

Formulas:

$$speed = \frac{distance}{time}$$

$$\sin(\theta) = \frac{opposite}{hypotenuse}$$

$$\cos(\theta) = \frac{adjacent}{hypotenuse}$$

$$\tan(\theta) = \frac{opposite}{adjacent}$$

$$360° = \frac{2\pi}{radians}$$

$$1° = \frac{\pi}{180} \text{ Radians}$$

Conversions/Values:

- ➢ 1 meter = 3.28 feet
- ➢ Light speed = 3×10^{8} meters per second (186,000 miles per second!)
- ➢ Sound speed = 343 meters per second
- ➢ Theta (Greek letter) (abbreviation used for angle) = θ

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Challenge Questions:

If we had a robot with a sonar sensor - how long would it take us to get the return pulse – or echo - from an object?

We know the object is **10 meters** away – and we know that the speed of sound in air is **343 meters per second**.

$$speed = \frac{distance}{time}$$

$$time = \frac{distance}{speed}$$

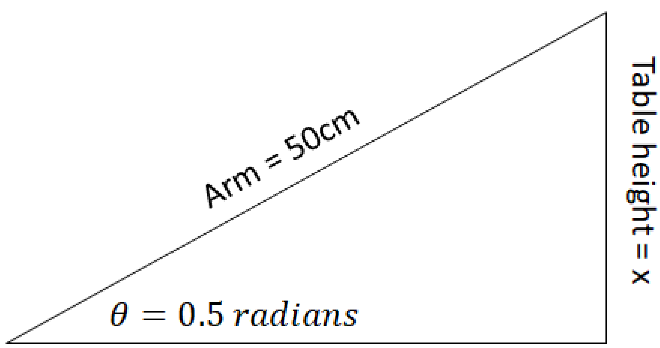
$$time = \frac{20m}{343\,\frac{m}{s}}$$

$$time = \frac{20}{343}s$$

$$time = 0.058s = 58ms$$

We have a robot arm that is **50cm long** and it is at an angle of **0.5 radians** from the floor.

How high of a table can it reach?



$$sin(\theta) = \frac{opposite}{hypotenuse}$$

$$hypotenuse \cdot sin(\theta) = opposite$$

$$0.5m \cdot sin(0.5) = opposite$$

$$0.5m \cdot 0.479 = 0.240m = opposite$$

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24cm is the max table height

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