

Conversions.rotational

One rotation is the same as one revolution

$$1 \text{ rotation} = 360^\circ = 2\pi \text{ radians} = 6.28 \text{ radians}$$

A radian, like the term “degrees” is the measure of an angle

A turntable goes through 15 rotations. How many radians is this?

$$15 \text{rot} \left(\frac{6.28 \text{rads}}{1 \text{rot}} \right) = 94.2 \text{rads}$$

How many degrees is one radian?

$$1 \text{rad} \left(\frac{360^\circ}{6.28 \text{rad}} \right) = 57.3^\circ$$

A motor runs at 540 rpm. How fast is this in radians per second?

When you convert rpm to rads/s be sure to make the rpm (rotations per minute) look like a proper fraction. You will be less likely to make an error

$$\frac{540 \text{rot}}{\text{min}} \left(\frac{1 \text{min}}{60 \text{s}} \right) \left(\frac{6.28 \text{rads}}{1 \text{rot}} \right) = 56.5 \frac{\text{rads}}{\text{s}}$$

“Radians per second” is the SI unit for angular velocity. It is given the Greek symbol omega ω .

1. A turntable goes through 25 rotations. How many radians is this?
2. A turntable goes through 85.0 radians. How many rotations is this?

3. How many degrees is in 5.0 radians?

4. How many radians is in 470° ? (that is more than one full rotation)

5. A motor runs at 1600 rpm. How fast is this in radians per second? Give your answer to three significant figures.

6. A motor runs at 12,000 rads/s. How fast is this in rpm's? Give your answer to three significant figures.

7. A motor runs at 15,000 rpm. How fast is this in radians per second? Give your answer to three significant figures.

8. A motor runs at 100 rads/s. How fast is this in rpm's? Give your answer to three significant figures.

Answers: 1). 157 radians 2). 14 rotations 3). 287° 4) 8.2 radians 5) 167 rads/s
6) 1.15×10^5 rpm 7) 1.57×10^3 rads/s 8) 955 rpms 9) 45 m/s
10) 7.5 m/s and distance 30 m

The outer edge of a turntable that has an angular velocity of “ ω ” has a “linear” velocity of $\omega \cdot R$ m/s if R is the radius of the turntable in meters.

A merry-go-round is spinning with an angular velocity of 30 radians/s. The merry-go-round has a radius of 2.0 m. How fast is a person going who is standing on the edge of the merry-go-round?

$$v = \omega \cdot R = 30 \text{ rads/s} \cdot 2.0 \text{ m} = 60 \frac{\text{m}}{\text{s}}$$

9. How fast is a person moving in m/s if they are standing 1.5 meters from the center of the same merry-go-round spinning at 30 rads/s?

10. A person is standing 3 meters from the center of a turntable that rotates through an angle of 2.5 rads/s. Through what great an arc does the person travel in 4.0 s?