

Angular and Linear Speed



Imagine a merry-go-round in a school playground. A vertical steel pipe runs through the merry-go-round into the soil beneath it and serves as the axis about which it rotates.

Angular velocity (speed) represents the rate of rotation of the merry-go-round, that is, how much angle it turns through in a given amount of time.

There are two children on this merry-go-round - one is located two feet from the center, while the other is sitting at the edge or perimeter of the merry-go-round, four feet from center. Which child do you think experiences a greater angular velocity?

Linear speed – rate at which linear position changes over time
(measured in units, like miles per hour)

Angular speed – rate at which angular position changes over time
(measured in units, like revolutions per minute)

1 \angle of radian measure
= 1 radius of arc length

Examples:

- 1) If the hard drive in a computer rotates at 3600 rotations per minute. Express the angular speed of a hard drive in radians per minute. (Note: 1 revolution = 2π radians)
- 2) A windmill, used to generate electricity, has blades that are 10 feet in length. The propeller is rotating around at 4 revolutions per second. Find the linear speed, in feet per second of the tips of the blades.

3) A 45-rpm record has an angular speed (or velocity) of 45 revolutions per minute. Find the linear speed in inches per minute at the point where the needle is 1.5 inches from the record's center.

4) Ms. Gonzalez's truck has wheels 36" in diameter and she is driving along Austin Blvd outside Morton East. If her wheels are rotating at 320 rpm, is she speeding? (Note: There are 5280ft per mile.)

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Nautical Miles

A nautical mile is the length of 1 minute of an arc along the earth's equator.

$$1 \text{ statute mile} = \frac{10800}{3956\pi} \text{ nautical miles}$$

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Example

Mr. Januszyk flew from Boston to San Francisco a distance of 2698 statute miles. How many nautical miles is this equivalent to?