Topic: Linear and angular velocity

Question: What is the angular velocity ω of a wheel that rotates at a constant rate and sweeps out an angle of 543π radians in 14.6 minutes?

Answer choices:

A $\omega = 37.2$ radians per second

B $\omega = 0.620$ radians per second

C $\omega = 0.620\pi$ radians per second

D $\omega = 1.83$ radians per second

Solution: C

Since the elapsed time t (14.6 minutes) is given in units of minutes and all the answer choices are given in units of radians per second (not radians per minute), we need to convert the elapsed time into seconds.

$$t = (14.6 \text{ min})\left(\frac{60 \text{ sec}}{1 \text{ min}}\right)$$

$$t = 14.6(60) \text{ sec}$$

$$t = 876 \text{ sec}$$

Now we compute the angular velocity in radians per second.

$$\omega = \frac{\theta}{t}$$

$$\omega = \frac{(543\pi) \text{ rad}}{876 \text{ sec}}$$

$$\omega = \frac{543\pi}{876} \text{ radians per second}$$

$$\omega \approx 0.620\pi \text{ radians per second}$$

Topic: Linear and angular velocity

Question: If a disc is rotating at a constant rate of 94.9 revolutions per minute, what is its angular velocity ω in units of radians per second?

Answer choices:

A $\omega = 8.62$ radians per second

B $\omega = 18.7\pi$ radians per second

C $\omega = 3.16\pi$ radians per second

D $\omega = 15.1$ radians per second

Solution: C

To convert from revolutions per minute to radians per second, we need to use the following facts: (a) There are 2π radians in 1 full revolution, and (b) there are 60 seconds in a minute.

$$\omega = \left(94.9 \frac{\text{rev}}{\text{min}}\right)\left(\frac{2\pi \text{ rad}}{1 \text{ rev}}\right)\left(\frac{1 \text{ min}}{60 \text{ sec}}\right)$$

$$\omega = \frac{94.9(2)\pi}{60} \text{ radians per second}$$

$$\omega \approx 3.16\pi \text{ radians per second}$$

Topic: Linear and angular velocity

Question: Michael is running around a circular track. If he runs 5 laps in 20 minutes, what is his angular velocity?

Answer choices:

A 0.5π radians per minute

B 2π radians per minute

C 0.008π radians per minute

D 30π radians per minute

Solution: A

First we need to convert 5 revolutions to radians, remembering that there are 2π radians in 1 full revolution.

$$5 \text{ rev} = 5 \text{ rev} \left(2\pi \ \frac{\text{rad}}{\text{rev}} \right) = 10\pi \text{ rad}$$

Find angular velocity ω.

$$\omega = \frac{\theta}{t}$$

$$\omega = \frac{10\pi \text{ radians}}{20 \text{ minutes}}$$

$$\omega = \frac{\pi}{2} \text{ radians per minute}$$

$$\omega \approx 0.5\pi \text{ radians per minute}$$