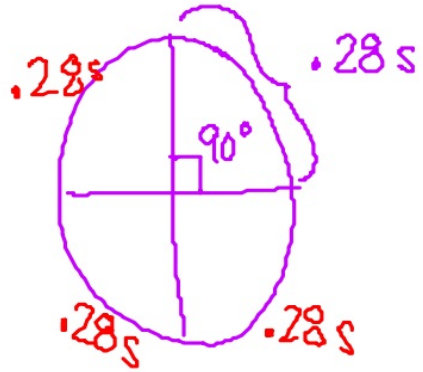
The blade of a windshield wiper moves through an angle of 90 degrees in 0.28 seconds. The tip of the blade moves on the arc of a circle that has a radius of 0.76m. What is the magnitude of the centripetal acceleration of the tip of the blade?

$a = 24\ m/s^2$

Given:

$r = 0.76\ m$

$t = 0.28\ s$ (90° of circle)



Unknown:

$a = \_\_\_\_\ m/s^2$ $V = \_\_\_\ m/s$ $T = \_\_\ s$

Equation:

$$a = \frac{V^2}{r}$$

$$V = \frac{2\pi r}{T}$$

$T = 4t$

$T = 4(.28)$

$T = 1.12\ s$

$$V = \frac{2(3.14)(.76)}{1.12}$$

$V = 4.26\ m/s$

$$a = \frac{(4.26)^2}{.76}$$

$a = 23.92\ m/s^2$

A child is sitting on the outer edge of a merry-go-round that is 18 m in diameter. If the merry-go-round makes 8.3 rev/min, what is the velocity of the child in m/s?

$d = 18\text{ m}$ $(r = 9\text{ m})$

$f = 8.3\text{ rev/min}$ * convert!

$$\frac{8.3\text{ rev}}{\text{min}} \left| \frac{1\text{ min}}{60\text{ sec}} \right. = .1383\text{ rev/s}$$

$.1383\text{ Hz}$

$V = 7.8\text{ m/s}$

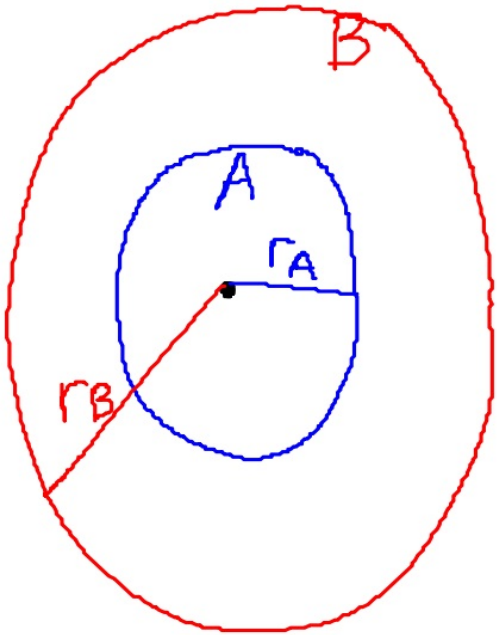
$V = \_\_\_\_\text{ m/s}$

$V = 2\pi rf$

$V = 2(3.14)(9)(.1383)$

$V = 7.8167$

Two particles, A and B, are in uniform circular motion about a common center. The acceleration of particle A is 4.7 times that of particle B. Particle B takes 2.4 times as long for a rotation as particle A. The ratio of the radius of the motion of particle A to that of particle B is closest to:



$a_A = 4.7\, a_B$

$T_B = 2.4\, T_A$

$\frac{r_A}{r_B} = ?$

$a_A = \frac{4\pi^2 r_A}{T_A^2}$

$a_B = \frac{4\pi^2 r_B}{T_B^2}$

$a = \frac{v^2}{r}$ $\quad v = \frac{2\pi r}{T}$

$a = \frac{\left(\frac{2\pi r}{T}\right)^2}{r}$

$a = \frac{\frac{4\pi^2 r^2}{T^2}}{\frac{r}{1}} = \frac{4\pi^2 r^2}{T^2} * \frac{1}{r}$

$a = \frac{4\pi^2}{T^2} r$

$$a_A = 4.7\, a_B$$

$$\left(\frac{4\pi^2 r_A}{T_A^2}\right) = 4.7\left(\frac{4\pi^2 r_B}{T_B^2}\right)$$

$$\frac{r_A}{T_A^2}\cdot\frac{1}{r_B} = 4.7\left(\frac{r_B}{T_B^2}\right)\frac{1}{r_B}$$

$$\frac{r_A}{r_B T_A^2} * T_A^2 = 4.7\left(\frac{1}{T_B^2}\right)\cdot T_A^2$$

$$\frac{r_A}{r_B} = 4.7\left(\frac{T_A^2}{T_B^2}\right)$$

$$T_B = 2.4\, T_A$$

$$\frac{r_A}{r_B} = \frac{4.7\, T_A^2}{(2.4\, T_A)^2}$$

$$\frac{r_A}{r_B} = \frac{4.7}{5.76}\cdot\frac{T_A^2}{T_A^2}$$

$$\frac{r_A}{r_B} = \frac{4.7}{5.76}$$

$$\frac{r_A}{r_B} = .8160$$

An aircraft performs a maneuver called an aileron roll. During this maneuver, the plane turns like a screw as it maintains a straight flight path, by using its ailerons to set the wings in circular motion. If it takes the plane 35 s to complete the circle and each wing length is 4.6 m, what is the acceleration of the wing tip?

$a = .15\ m/s^2$

$r = 4.6\ m$ ($d =$

$T = 35\ s$

$a = \_\_\_\ m/s^2$

$V = \_\_\_\ m/s$

$V = \frac{2\pi r}{T} = \frac{2(3.14)(4.6)}{(35)}$

$V = .8254\ m/s$

$a = \frac{V^2}{r} = \frac{(.8254)^2}{(4.6)}$

$a = .1481$