

Circular Motion Name Key Period _____

Be careful with units – many of the numbers in these problems need to be converted to standard units!

WS 1

Frequency (f) (cycles per second or Hz), time (seconds), and Period (T) (seconds per cycle)

1. Three children are sitting on a spinning merry-go-round. One is at the center, the second is 1 meter from the center and the third is sitting on the outside which is 2 meters from the center. Which child has the fastest angular speed, and which has the fastest tangential (linear) speed? How do you know? *All have same angular, 3rd fastest v_T*

2. A DVD goes at 1530 rpm, while a second DVD goes at 25.5 cycles per second (Hz). Find the Frequency and Period for each.

*f = 25.5 Hz
T = 0.4 sec*

same

Linear or Tangential Velocity ($v = 2\pi r/T = 2\pi r f \rightarrow$ units are m/s)

1. Three children are sitting on a merry-go-round. One is at the center, the second is 1 meter from the center and the third is sitting on the outside which is 2 meters from the center. If the merry-go-round takes 5 seconds to go around, how fast is each traveling in m/s?

*1st: 0 m/s
2nd: 1.26 m/s
3rd: 2.5 m/s*

2. A DVD goes at 1530 rpm. What is its linear velocity if it is 12 cm in diameter?

9.6 m/s

3. A fan whose blades are 21 cm long (radius) takes 0.0166667 seconds to complete one circle. What is its linear velocity?

29.2 m/s

Centripetal Acceleration ($a_c = v^2/r \rightarrow$ units are m/s^2)

1. The Cajun Cliffhanger at Great America is a ride in which occupants line the perimeter of a cylinder and spin in a circle at a high rate of turning. When the cylinder begins spinning very rapidly, the floor is removed from under the riders' feet. What effect does a doubling in speed have upon the centripetal acceleration? Use the equation to guide your thinking. *4x (quadruples) acceleration*

2. What is the minimum radius at which an airplane flying at 3.00×10^2 m/s can make a U-turn if its centripetal acceleration should not exceed $4.0 g$'s (approximately $40 m/s^2$) *2250 m*

3. A fan whose blades are 21 cm long (radius) takes 0.0166667 seconds to complete one circle. What is its centripetal acceleration?

30,000 m/s^2