**Question 10.1a  Bonnie and Klyde I**

**Bonnie** sits on the outer rim of a merry-go-round, and **Klyde** sits midway between the center and the rim. The merry-go-round makes one complete revolution every 2 seconds.

**Klyde’s angular velocity is:**

- **a)** same as Bonnie’s
- **b)** twice Bonnie’s
- **c)** half of Bonnie’s
- **d)** one-quarter of Bonnie’s
- **e)** four times Bonnie’s

The **angular velocity** \( \omega \) of any point on a solid object rotating about a fixed axis is **the same**. Both Bonnie and Klyde go around one revolution (2\( \pi \) radians) every 2 seconds.
**Question 10.1b  Bonnie and Klyde II**

Bonnie sits on the outer rim of a merry-go-round, and Klyde sits midway between the center and the rim. The merry-go-round makes one revolution every 2 seconds. Who has the larger linear (tangential) velocity?

- a) Klyde
- b) Bonnie
- c) both the same
- d) linear velocity is zero for both of them

**Follow-up:** Who has the larger centripetal acceleration?

Their linear speeds $v$ will be different because $v = r \omega$ and Bonnie is located farther out (larger radius $r$) than Klyde.

$$V_{Klyde} = \frac{1}{2} V_{Bonnie}$$
**Question 10.2**

Suppose that the speedometer of a truck is set to read the linear speed of the truck but uses a device that actually measures the angular speed of the tires. If larger diameter tires are mounted on the truck instead, how will that affect the speedometer reading as compared to the true linear speed of the truck?

- a) speedometer reads a higher speed than the true linear speed
- b) speedometer reads a lower speed than the true linear speed
- c) speedometer still reads the true linear speed

The linear speed is \( v = \omega R \). So when the speedometer measures the same angular speed \( \omega \) as before, the linear speed \( v \) is actually higher, because the tire radius is larger than before.
An object at rest begins to rotate with a constant angular acceleration. If this object rotates through an angle $\theta$ in the time $t$, through what angle did it rotate in the time $\frac{1}{2} t$?

- a) $\frac{1}{2} \theta$
- b) $\frac{1}{4} \theta$
- c) $\frac{3}{4} \theta$
- d) $2 \theta$
- e) $4 \theta$

The angular displacement is $\theta = \frac{1}{2} \alpha t^2$ (starting from rest), and there is a quadratic dependence on time. Therefore, in half the time, the object has rotated through one-quarter the angle.
An object at rest begins to rotate with a constant angular acceleration. If this object has angular velocity $\omega$ at time $t$, what was its angular velocity at the time $\frac{1}{2}t$?

The angular velocity is $\omega = \alpha t$ (starting from rest), and there is a linear dependence on time. Therefore, in half the time, the object has accelerated up to only half the speed.