Phys. 121 B   MWF 2:30   room A102
Instructor: J. Rothberg

Class web page:

**This Week:** Labs and Tutorials start; Study Center open
We start using clickers; you can Register on web page
but will work before you register (we save the data)
Need 6 digit clicker number; any 3 chars for screen name

--- Lecture Components:

→ PreLectures/Checkpoints --- “Lect4” due next Friday 10:30 AM

→ WebAssign Homework --- HW 1 due Tuesday at 11:59 PM
WebAssign Homework --- HW 2 due Tues. Jan 18 11:59 PM

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**Exam 1** Thursday Jan. 20 at 3:30 PM
in Kane Hall – details to be announced
target
\[ y_T = y_{1T} - \frac{1}{2} g t^2 = x_T \tan \theta - \frac{1}{2} g t^2 \]

projectile
\[ y_P = v_{yP} t - \frac{1}{2} g t^2 = (v_P \sin \theta) t - \frac{1}{2} g t^2 \]
\[ x_P = v_{xP} t = (v_P \cos \theta) t \]
\[ t = \frac{x_P}{(v_P \cos \theta)} \]
\[ y_P = (v_P \sin \theta) \frac{x_P}{(v_P \cos \theta)} - \frac{1}{2} g t^2 \]
\[ = x_P \tan \theta - \frac{1}{2} g t^2 \]

Conclusion: when \( x_P = x_T \)  \( y_P = y_T \)
The woman standing on the beltway sees the man moving with a slower speed than does the woman observing the man from the stationary floor.

Figure 4.19 Two observers measure the speed of a man walking on a moving beltway.
Figure 4.21 (Example 4.8) (a) A boat aims directly across a river and ends up downstream. (b) To move directly across the river, the boat must aim upstream.
A girl **stands** on a moving sidewalk that moves to the right at 2 m/s relative to the ground. A dog runs toward the girl in the opposite direction along the sidewalk at a speed of 8 m/s relative to the sidewalk.

What is the speed of the dog relative to the **girl**?

\[ v_{\text{dog,belt}} = 8 \text{ m/s} \]

\[ v_{\text{belt,ground}} = 2 \text{ m/s} \]

A) 6 m/s \hspace{1cm} B) 8 m/s \hspace{1cm} C) 10 m/s
A girl stands on a moving sidewalk that moves to the right at 2 m/s relative to the ground. A dog runs toward the girl in the opposite direction along the sidewalk at a speed of 8 m/s relative to the sidewalk.

What is the speed of the dog relative to the ground?

\[ v_{\text{dog, belt}} = 8 \text{ m/s} \]
\[ v_{\text{belt, ground}} = 2 \text{ m/s} \]

A) 6 m/s  
B) 8 m/s  
C) 10 m/s
Three swimmers can swim equally fast relative to the water. They have a race to see who can swim across a river in the least time. Relative to the water, Beth swims perpendicular to the flow, Ann swims upstream at 30 degrees, and Carly swims downstream at 30 degrees.

Who gets across the river first?

A) Ann  B) Beth  C) Carly
What is the speed of the dog relative to the girl?

A (10.9%) 6 m/s
B (59.1%) 8 m/s
C (30.0%) 10 m/s

A girl stands on a moving sidewalk that moves to the right at a speed of 2 m/s relative to the ground. A dog runs toward the girl in the opposite direction along the sidewalk at a speed of 8 m/s relative to the sidewalk.

In the reference frame of the **moving sidewalk**

\[ V_{girl} = 0 \quad V_{dog} = -8 \]

Relative velocity is \[ V_{dog} - V_{girl} = -8 \]

In the reference frame of the **ground**

\[ V_{girl} = +2 \quad V_{dog} = +2 - 8 = -6 \]

Relative velocity is \[ V_{dog} - V_{girl} = -6 - 2 = -8 \]
Original + Change = Final

Change = Final – Original

\[ \Delta V = V_2 - V_1 \]

\[ \frac{\Delta V}{\Delta t} = \frac{V_2 - V_1}{\Delta t} \]
L is length of a chord; 
s is arc length

\[ s = R \theta \]

The circle has radius \( R \)
Approximately \( L = R \theta \) where \( \theta \) is in radians

A particle is moving around a circle with speed \( v \):

\[
\frac{ds}{dt} = R \frac{d\theta}{dt} = R \omega
\]

Speed is \( \frac{ds}{dt} \) so \( v = R \omega \)
FIGURE 3–32 Determining the change in velocity, $\Delta v$, for a particle moving in a circle.
Use \( s = R \theta \)

\[ \Delta v = |v| \Delta \theta \]

\[ a = \frac{\Delta v}{\Delta t} = |v| \frac{\Delta \theta}{\Delta t} = |v| \omega \]

Use \( v = R \omega \)

\[ a = \frac{v^2}{R} \]

The inward acceleration