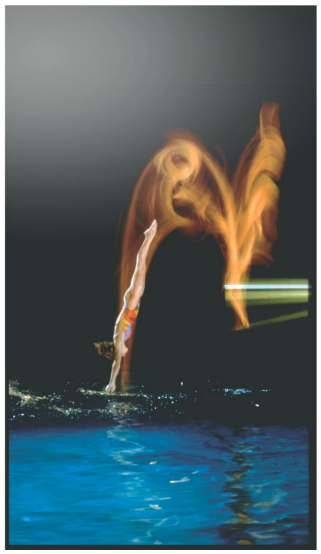
PHY131H1S - Class 6

Today:

- Kinematics in One Dimension
- Kinematics in Two Dimensions
- Projectile Motion
- Relative Motion

MasteringPhysics Problem Set 2 due today, before 11:59pm.



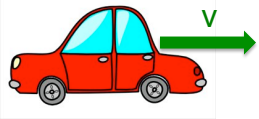
Pre-class Reading Quiz. (Chapter 4)

Last day I asked at the end of class:

- One bullet is fired horizontally at a very high speed. The other bullet is initially at rest, but is dropped at the exact same moment the first bullet is fired. Which bullet hits the ground first?
- ANSWER:

- x-motion and y-motion are independent of each other. All projectiles have

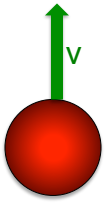
Horizontal Acceleration Example



- A car starts from rest, then drives to the right. It speeds up to a maximum speed of 30 m/s. It coasts at this speed for a while, then the driver hits the brakes, and the car slows down to a stop.

Vertical Acceleration Example (freefall)

- A ball starts with an upward velocity, reaches a maximum height, then falls back down again.



Acceleration in 2-D

The *average acceleration* of a moving object is defined as the vector

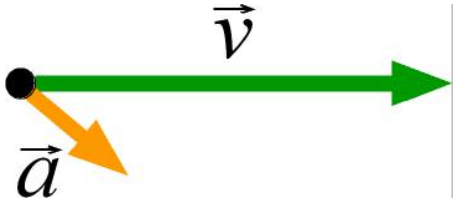
As an object moves, its velocity vector can change in **two** possible ways:

1. The

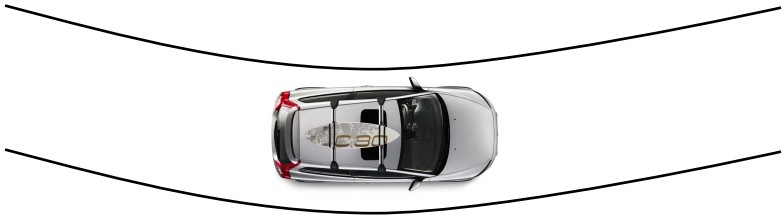
2. The

…or both!

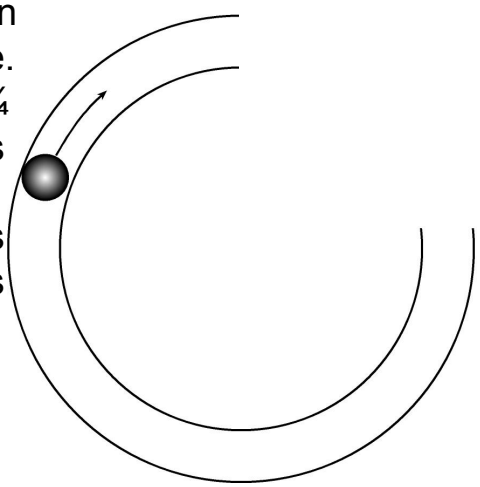
This acceleration will cause the particle to



A car is traveling East at a constant speed of 100 km/hr. Without speeding up of slowing down, it is turning left, following the curve in the highway. What is the direction of the acceleration?



A ball rolls along a frictionless track on a horizontal table, as seen from above in the figure. The track is curved in ¾ of a circle. The ball rolls clockwise around this track and then emerges onto the flat, frictionless table.



Projectile Motion

FIGURE 4.15 The parabolic trajectory of a bouncing ball.

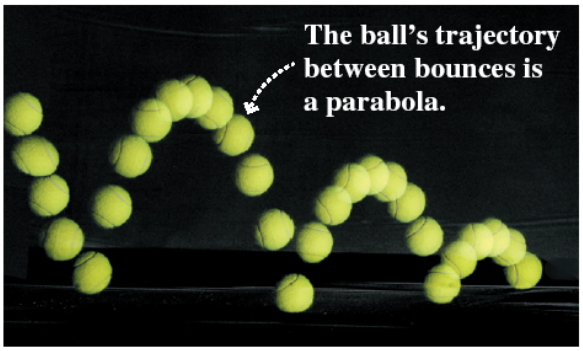
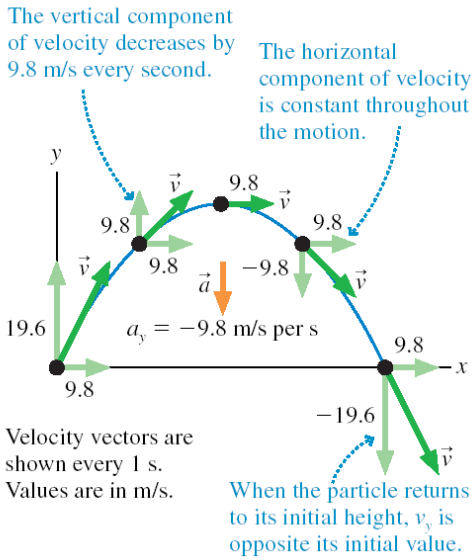


FIGURE 4.17 The velocity and acceleration vectors of a projectile moving along a parabolic trajectory.



Projectile Motion

Projectile motion is made up of two independent motions: uniform motion at constant velocity in the horizontal direction and free-fall motion in the vertical direction. The kinematic equations that describe these two motions are

Relative Motion

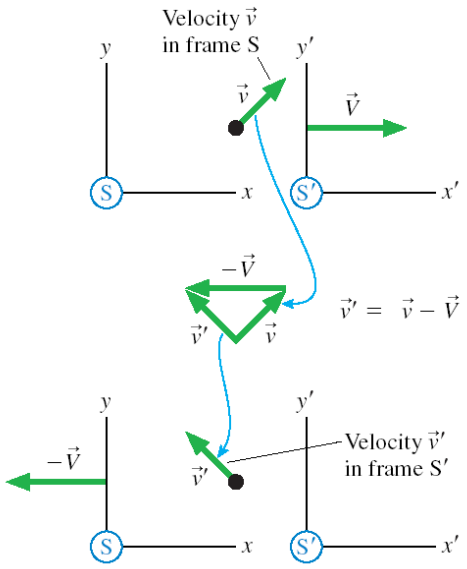


FIGURE 4.29 Velocities $\vec{v}$ and $\vec{v}'$, as measured in frames S and S′, are related by vector addition.

Relative Motion

If we know an object's velocity measured in one reference frame, *S*, we can transform it into the velocity that would be measured by an experimenter in a different reference frame, *S′*, using the Galilean transformation of velocity.

Or, in terms of components,

Before Class 7 on Monday

- Remember there is a MasteringPhysics.com problem set due today. If you haven't already done it, please submit this before 11:59pm tonight.
- Please finish reading Chapter 4.
- Something to think about: You are driving North Highway 427, on the smoothly curving part that will join to the Westbound 401. Your speedometer is constant at 115 km/hr. Your steering wheel is not rotating, but it is turned to the left to follow the curve of the highway. Are you accelerating? If so, in what direction?