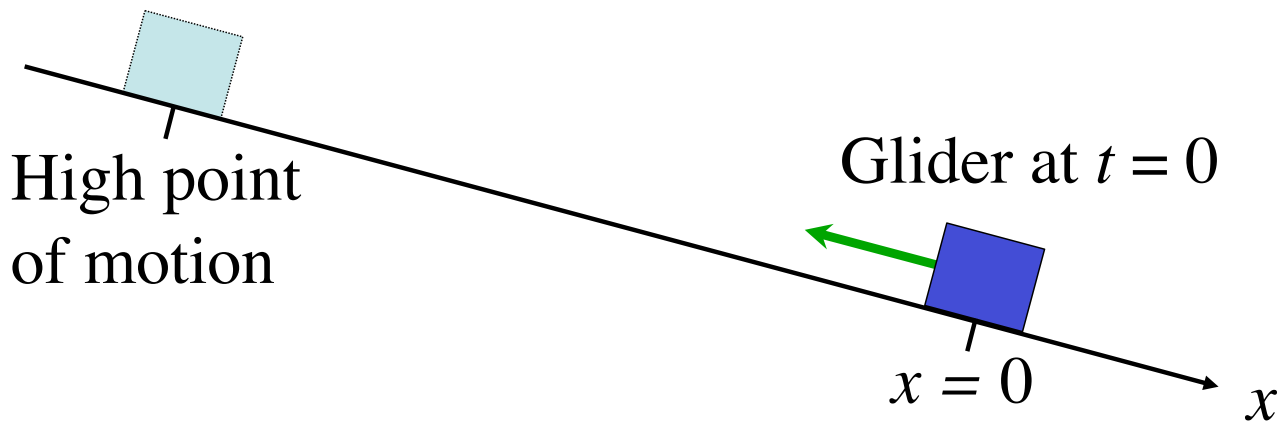
Q2.11

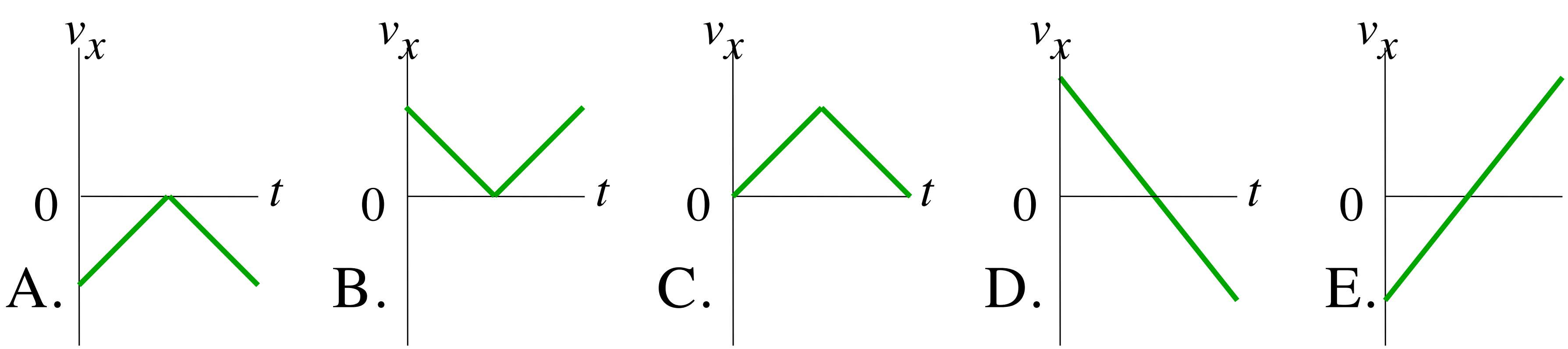
Text ‘PHYSJC’ to 22333 to join polleverywhere session

A glider is on an inclined, frictionless track. The x-axis points downhill. At $t = 0$ the glider is at $x = 0$ and moving uphill.

After reaching the high point of its motion, it moves downhill and returns to $x = 0$.



Which of the following v_x–t graphs (graphs of velocity vs. time) best matches the motion of the glider?



Announcements

- Lab 0 today and tomorrow! Complete the pre-lab before you come to lab
  - The bookstore should be restocked in lab manuals today or tomorrow. Or, pick up a copy of Lab 0 right now.
- Homework #1 is due Friday!
- Check the list of polleverywhere respondants for your name!

Example Problem

You launch a water balloon vertically from the top of a tall building as shown. Neglect air resistance.

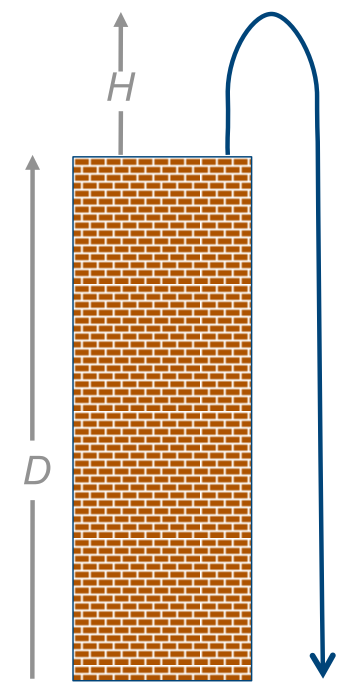
5. Find the initial velocity of the balloon.

$$v_x = v_{0x} + a_x t$$

$$x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2$$

$$v_x^2 = v_{0x}^2 + 2a_x \left(x - x_0\right)$$

$$x - x_0 = \left(\frac{v_{0x} + v_x}{2}\right) t$$



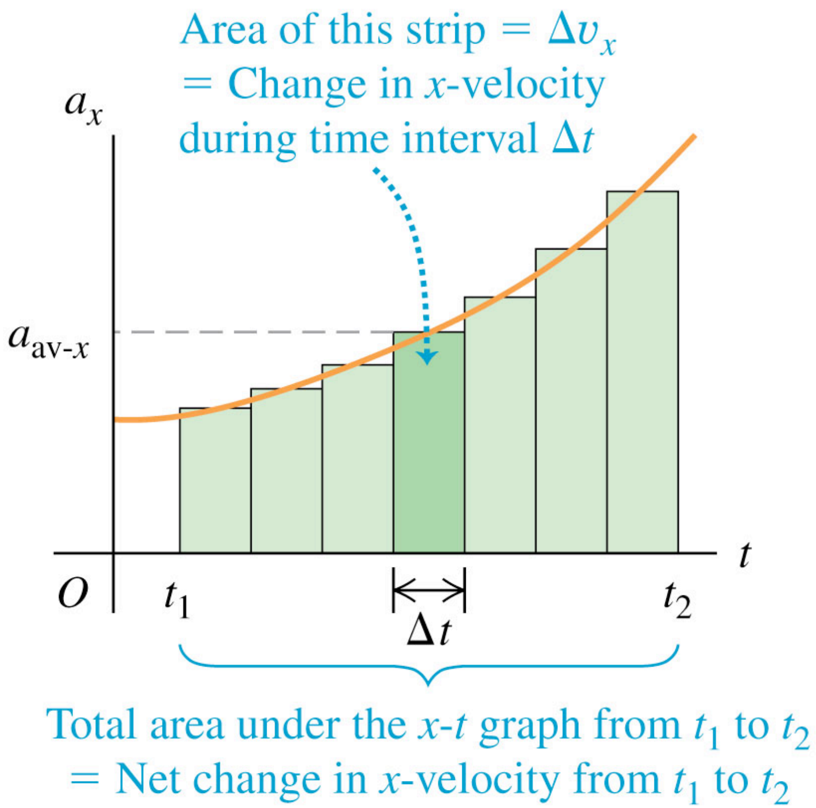
Problem-Solving Strategy

1. Identify the Problem
   - Picture of the problem
   - Given information
   - Problem to be solved
   - General approach
2. Set up the Physics
   - Diagram axes and define variables
   - Target variables
   - Relevant equations
3. Solve the Problem
   - Construct specific equations
   - Outline the solution
   - Solve for target variables
4. Evaluate your Solution
   - Units of solution correct?
   - Insert numerical values
   - Answer reasonable? Correct units?

Velocity and position by integration

- The acceleration of a car is not always constant.
- The motion may be integrated over many small time intervals to give

$$v_x = v_{0x} + \int_0^t a_x dt \quad \text{and} \quad x = x_0 + \int_0^t v_x dt.$$



- http://www.sciencemag.org/news/2016/01/math-whizzes-ancient-babylon-figured-out-forerunner-calculus

Ch 3.1-2: Position, Velocity and Acceleration

in 3D (& 2D)

PHYS 1210 Prof. Jang-Condell

Goals for Chapter 3

- To use vectors to represent the position of a body
- To determine the velocity vector using the path of a body
- To investigate the acceleration vector of a body
- To describe the curved path of projectile
- To investigate circular motion
- To describe the velocity of a body as seen from different frames of reference

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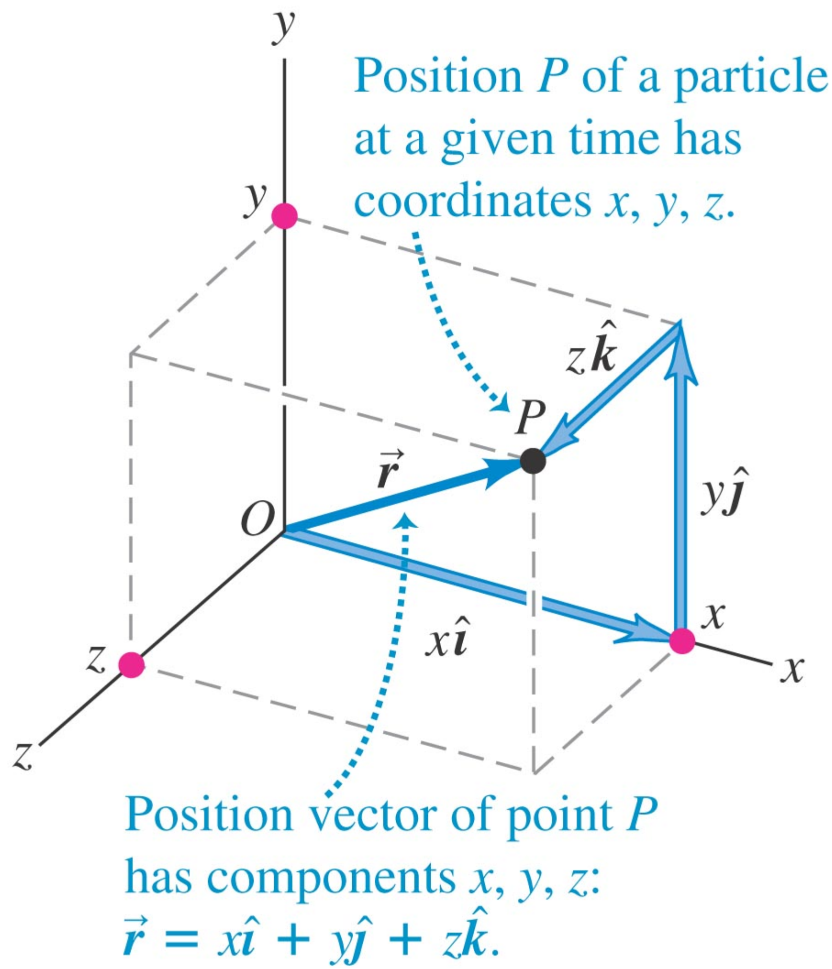
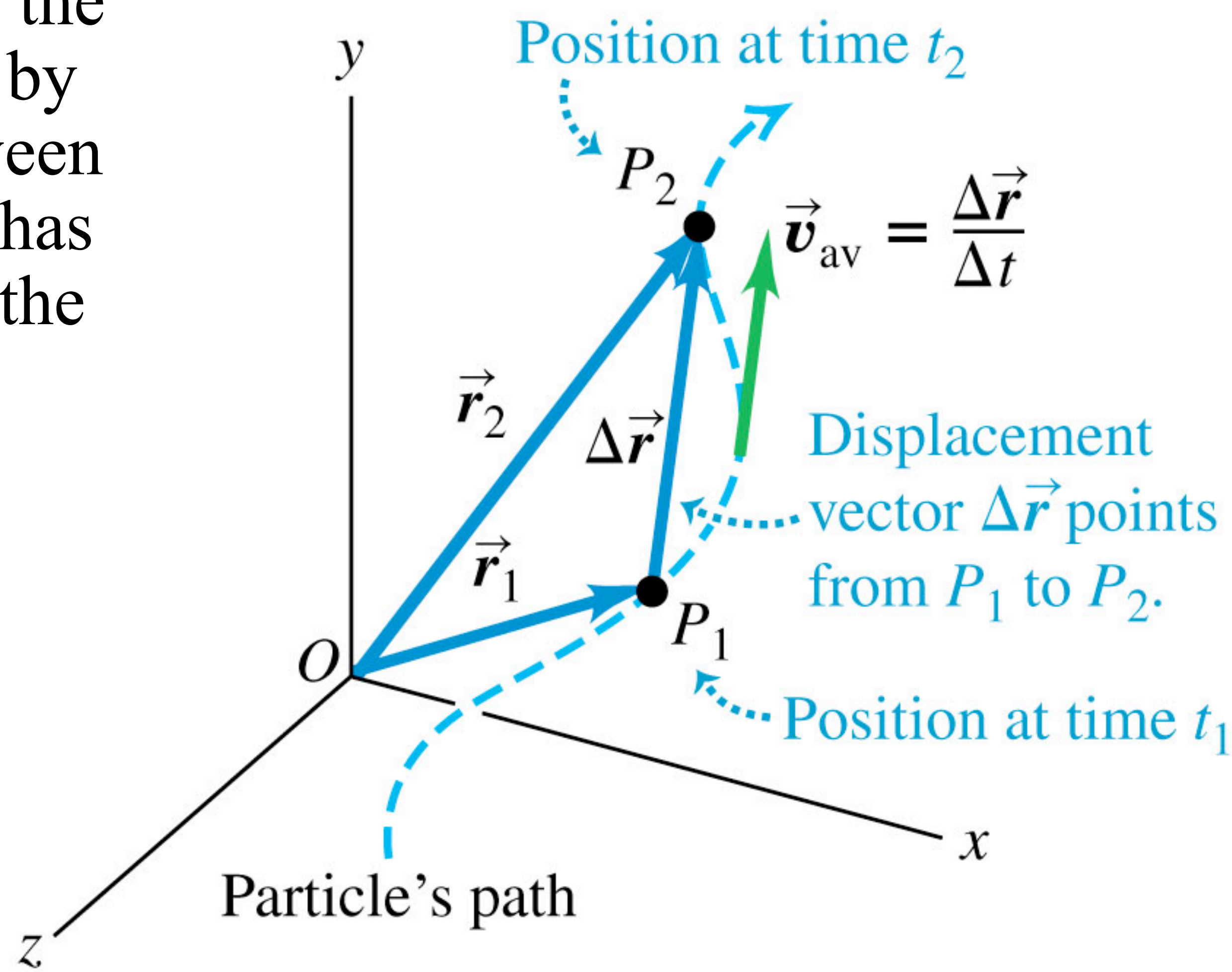
Position vector

- The position vector from the origin to point P has components x, y, and z.



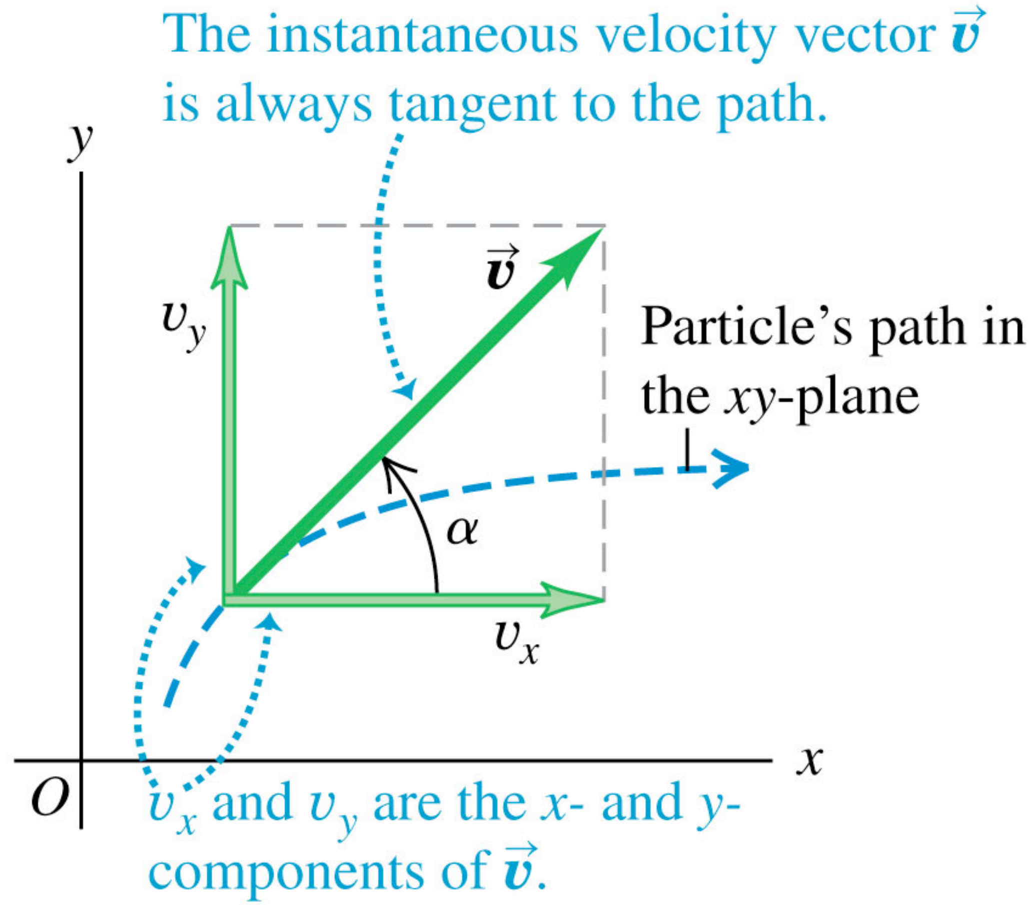
Average velocity—Figure 3.2

- The average velocity between two points is the displacement divided by the time interval between the two points, and it has the same direction as the displacement.



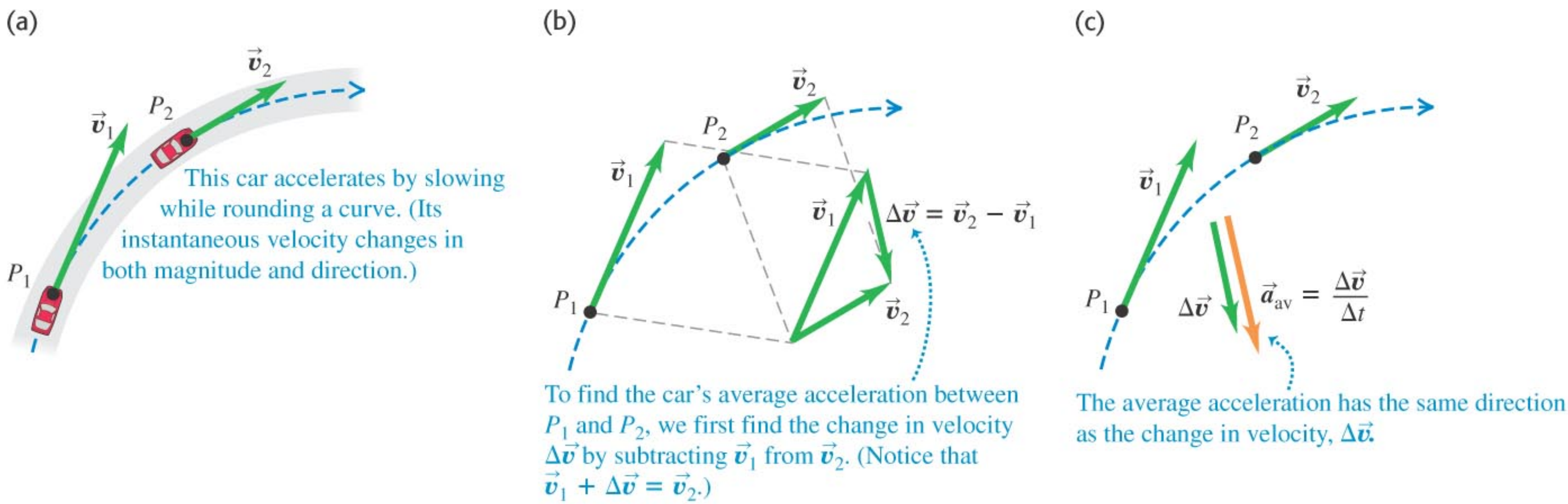
Instantaneous velocity

- The *instantaneous velocity* is the instantaneous rate of change of position vector with respect to time.
- The components of the instantaneous velocity are $v_x = dx/dt$, $v_y = dy/dt$, and $v_z = dz/dt$.
- The instantaneous velocity of a particle is always tangent to its path.



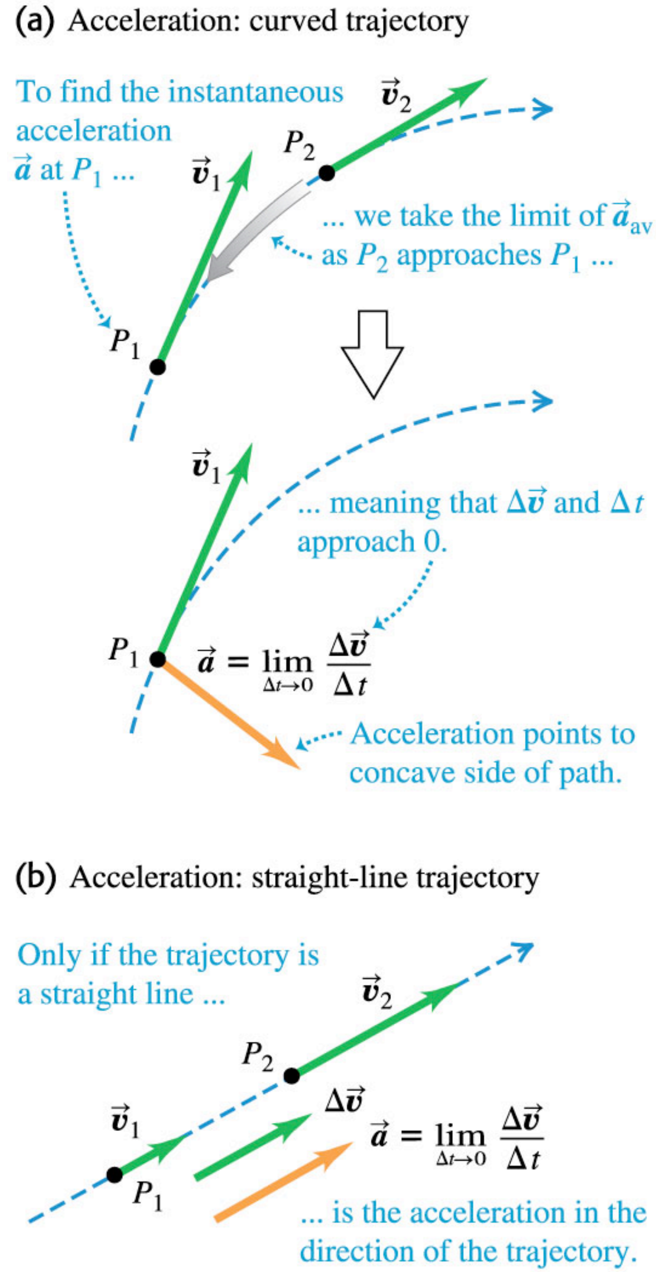
Average acceleration

- The *average acceleration* during a time interval Δt is defined as the velocity change during Δt divided by Δt.



Instantaneous acceleration

- The *instantaneous acceleration* is the instantaneous rate of change of the velocity with respect to time.
- Any particle following a curved path is accelerating, even if it has constant speed.
- The components of the instantaneous acceleration are $a_x = dv_x/dt$, $a_y = dv_y/dt$, and $a_z = dv_z/dt$.



Polleverywhere

A physicist is teaching her son to drive. Lesson 1 begins, “a car has three accelerators.”

Identify these three accelerators.

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Examples of Acceleration

- Coasting on a bicycle down a hill with constant slope
  - acceleration is parallel
- Riding on a merry-go-round moving at constant rotation
  - acceleration is perpendicular

Acceleration and Velocity

- The component of *a* parallel to *v* causes the speed to change.
- The component of *a* perpendicular to *v* causes the direction to change.

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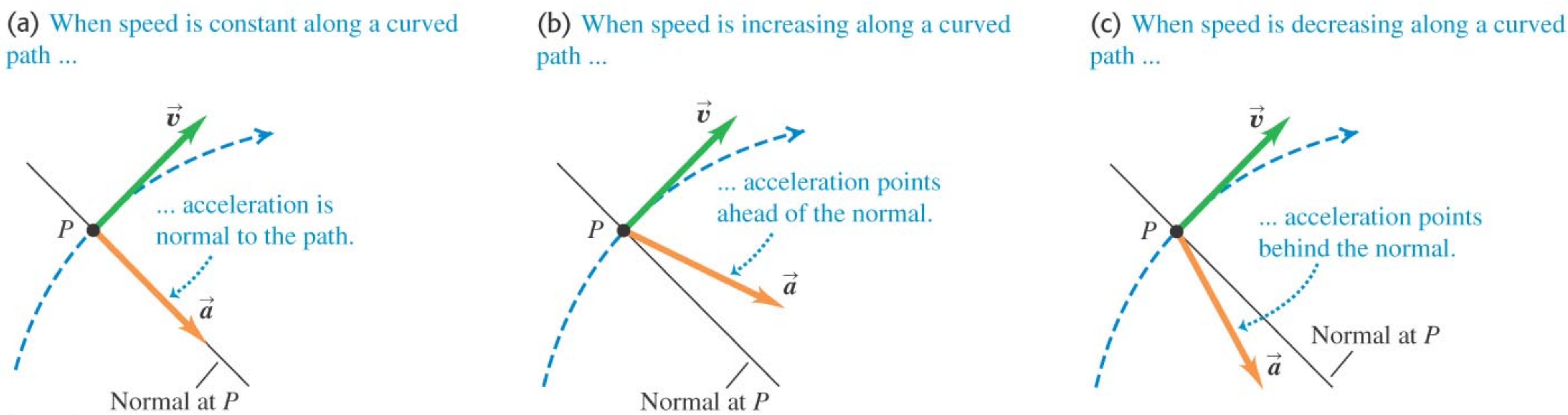
1. True or False: If an object's distance from the origin r does not change, its velocity must be zero.
2. True or False: If an object's speed v does not change, its acceleration must be zero.
3. The rate of change of an object's speed $d|v|/dt$ is the same as the magnitude of its acceleration $|dv/dt|$. Always, Never, or Sometimes?
4. True or False: The acceleration of an object moving at constant speed in a circular path is zero.

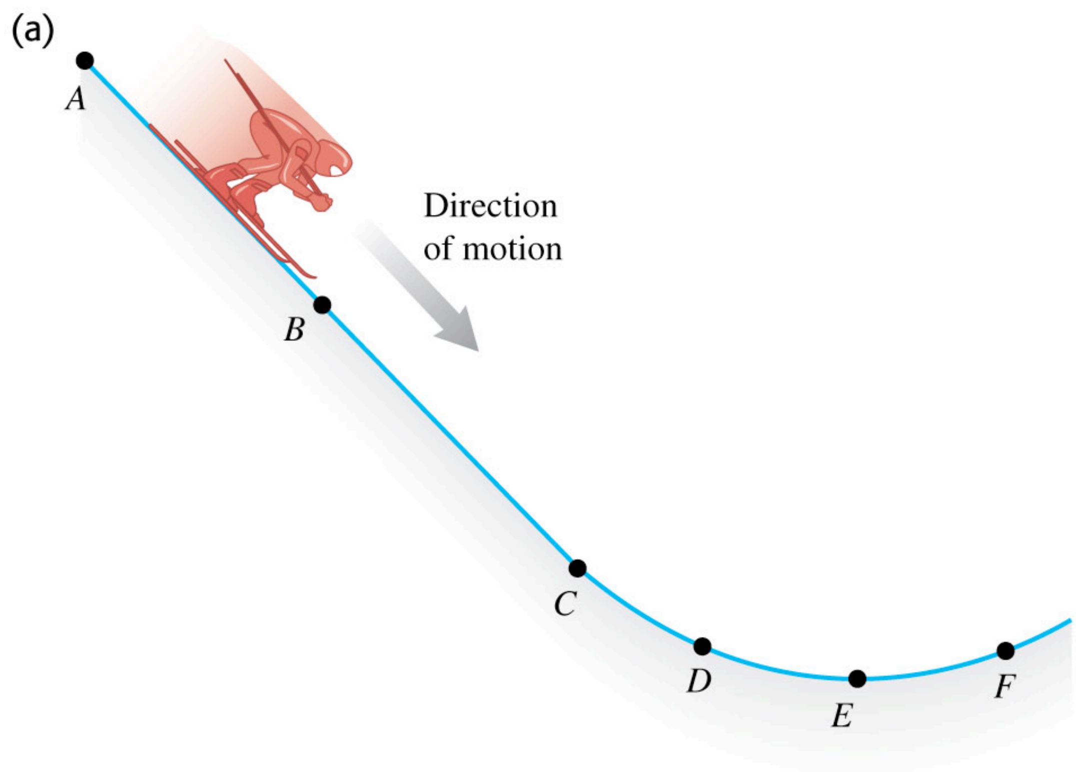
Direction of the acceleration vector

- The direction of the acceleration vector depends on whether the speed is constant, increasing, or decreasing, as shown in Figure 3.12.



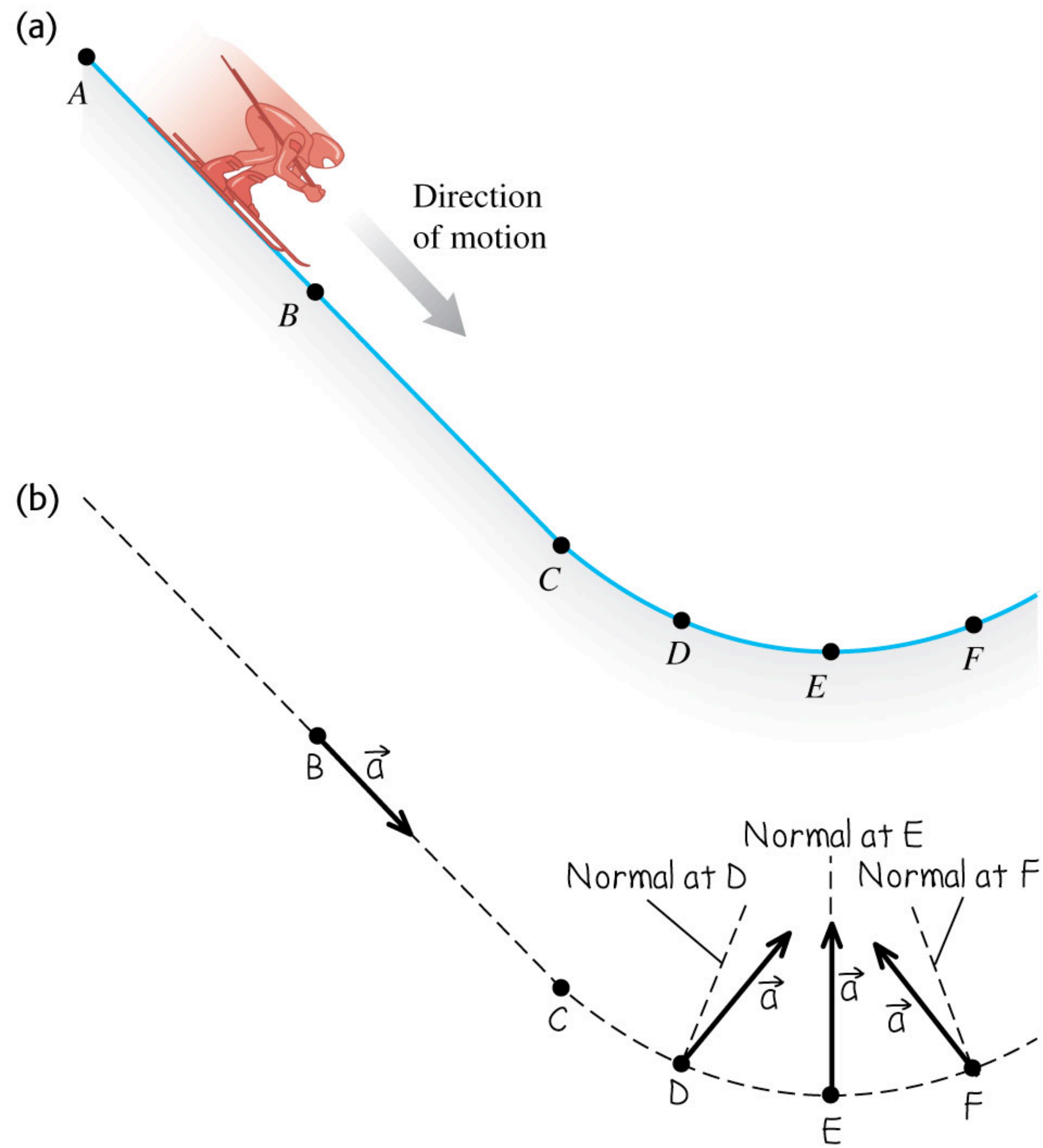
Acceleration of a skier

- Conceptual Example 3.4 follows a skier moving on a ski-jump ramp.



Acceleration of a skier

- Conceptual Example 3.4 follows a skier moving on a ski-jump ramp.
- Figure 3.14(b) shows the direction of the skier's acceleration at various points.



Text your answer to 22333

The direction of the acceleration of an object moving at constant speed in a circular path is:

F. in the direction of its motion.

G. opposite the direction of its motion.

H. toward the center of its circular path.

I. away from the center of its circular path.