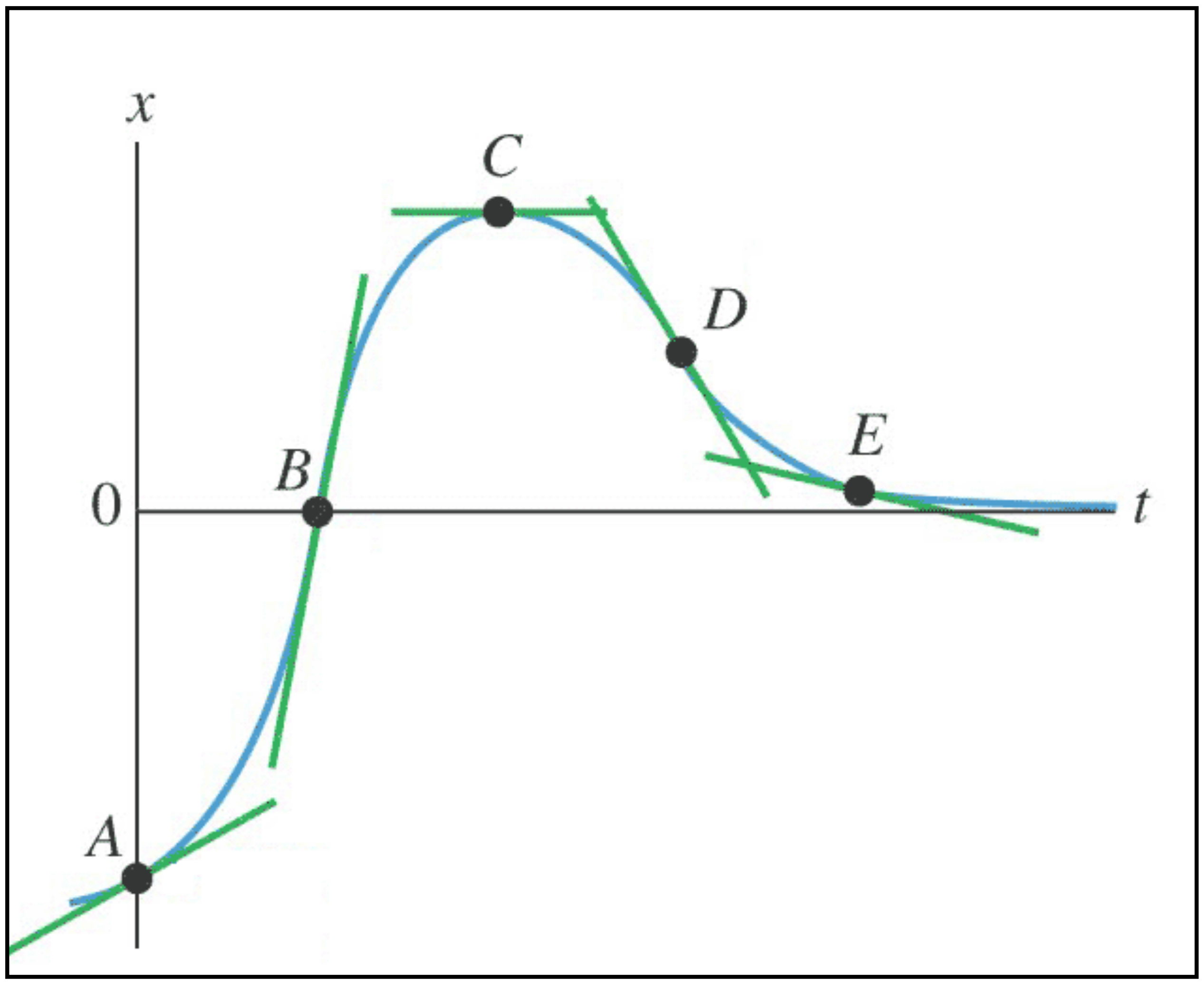
Announcements

- Polleverywhere registration
- ★Exam 1: Thu, March 3, 5-7pm, in **CR 306**.
- ★Exam 2: Thu, **April 7**, 5-7pm, CR 214&222

Society of Physics Students Meeting
on Monday, Feb 1, 4pm in PS 234

Physics, Phood and Phun!

Rank points in order from most negative velocity to most positive velocity



Young & Freedman, Fig. 2.8

First, text 'PHYSJC' to 22333

Then, text your response to 22333

Ch 2.2-2.4: Velocity and Acceleration

PHYS 1210 Prof. Jang-Condell

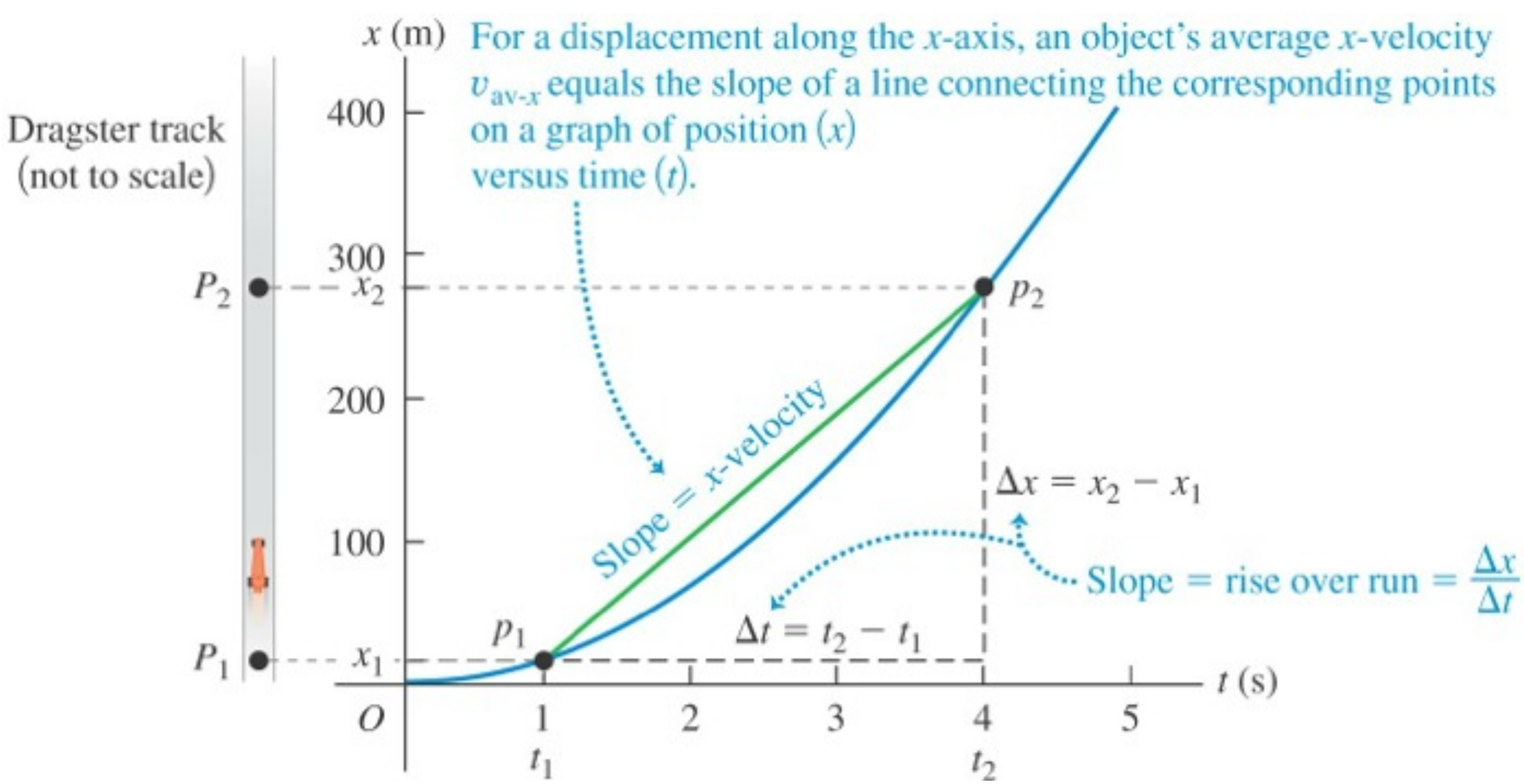
Goals for Chapter 2

- To describe straight-line motion in terms of velocity and acceleration
- To distinguish between average and instantaneous velocity and average and instantaneous acceleration
- To interpret graphs of position versus time, velocity versus time, and acceleration versus time for straight-line motion
- To understand straight-line motion with constant acceleration
- To examine freely falling bodies
- To analyze straight-line motion when the acceleration is not constant

Average and Instantaneous Velocity

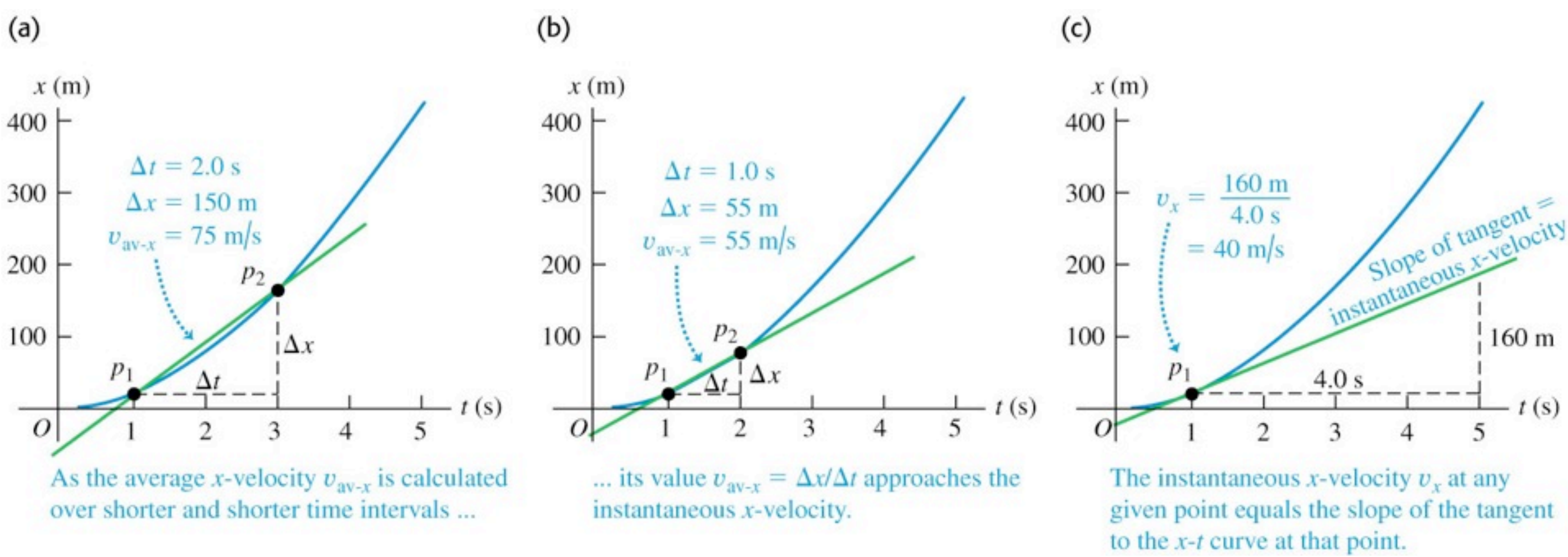
A position-time graph—Figure 2.3

- A position-time graph (an *x-t* graph) shows the particle's position *x* as a function of time *t*.
- Figure 2.3 shows how the average *x*-velocity is related to the slope of an *x-t* graph.



Finding velocity on an *x-t* graph

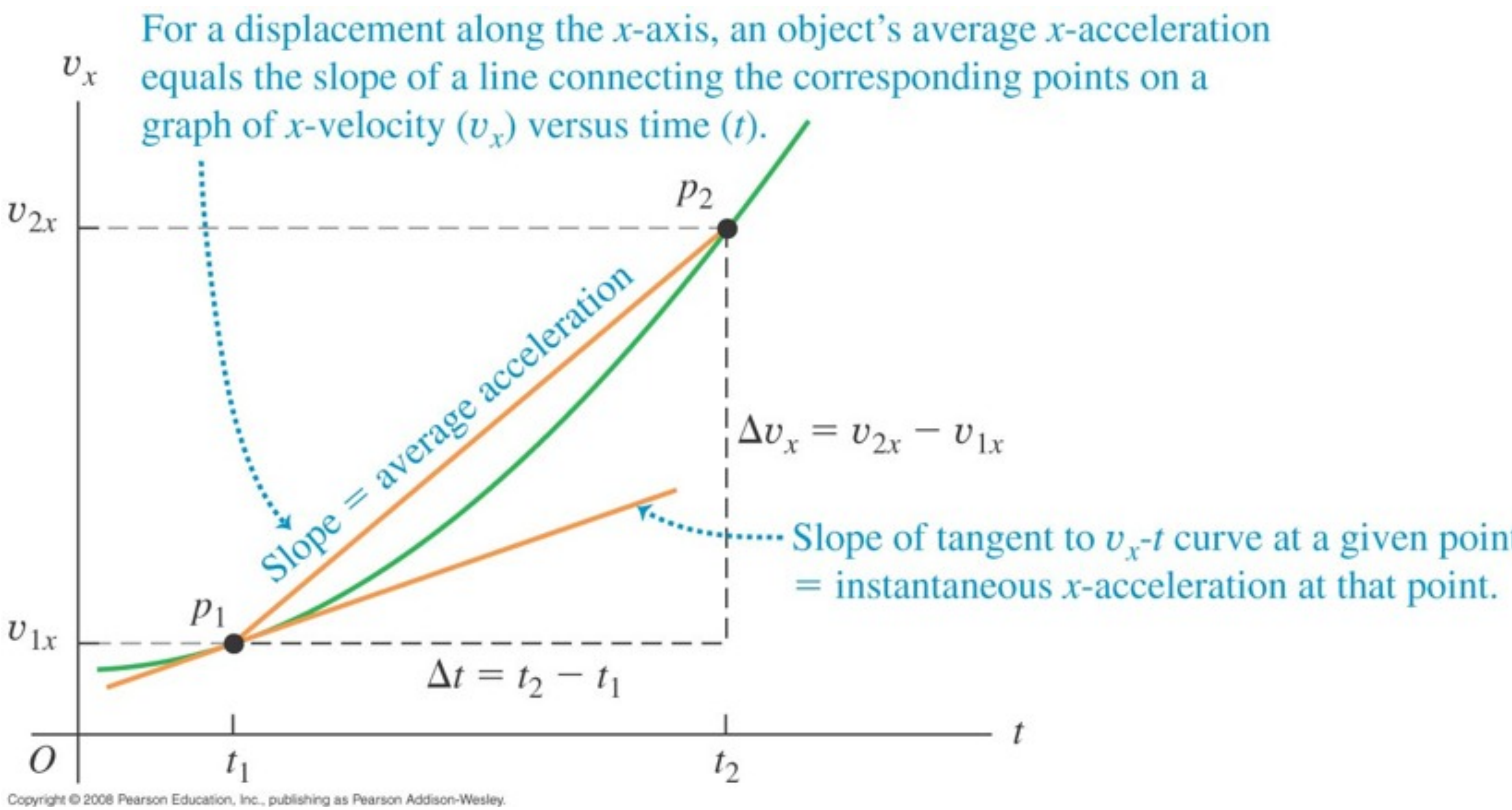
- At any point on an *x-t* graph, the instantaneous *x*-velocity is equal to the slope of the tangent to the curve at that point.



Acceleration = change in velocity over time

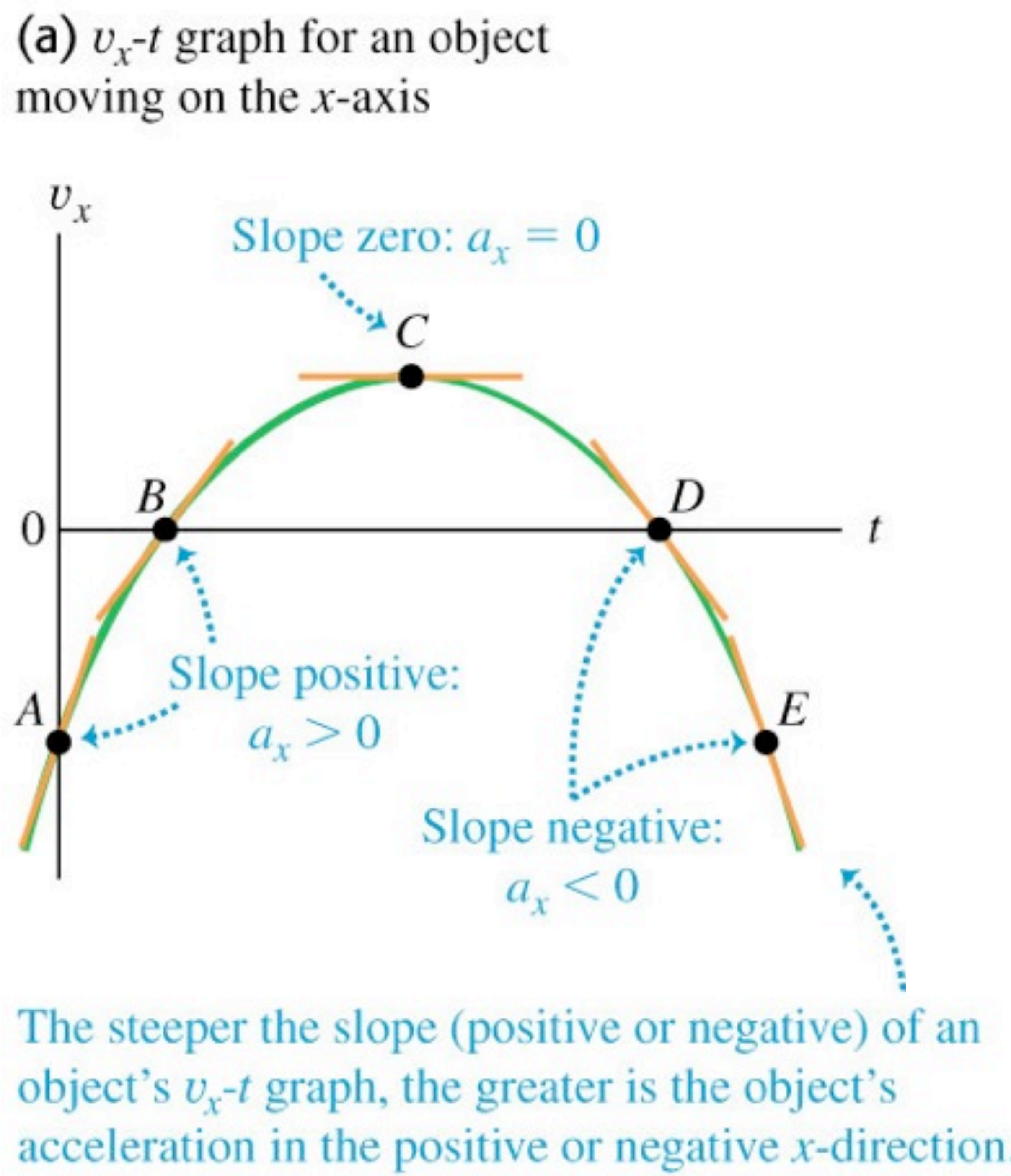
Finding acceleration on a v_x-t graph

- As shown in Figure 2.12, the υ_x-t graph may be used to find the instantaneous acceleration and the average acceleration.



A v_x-t graph

- Figure 2.13 shows the v_x-t graph for a particle.



What are the units for acceleration?

Q. m

R. s

S. m/s

T. m^2/s

U. m/s^2

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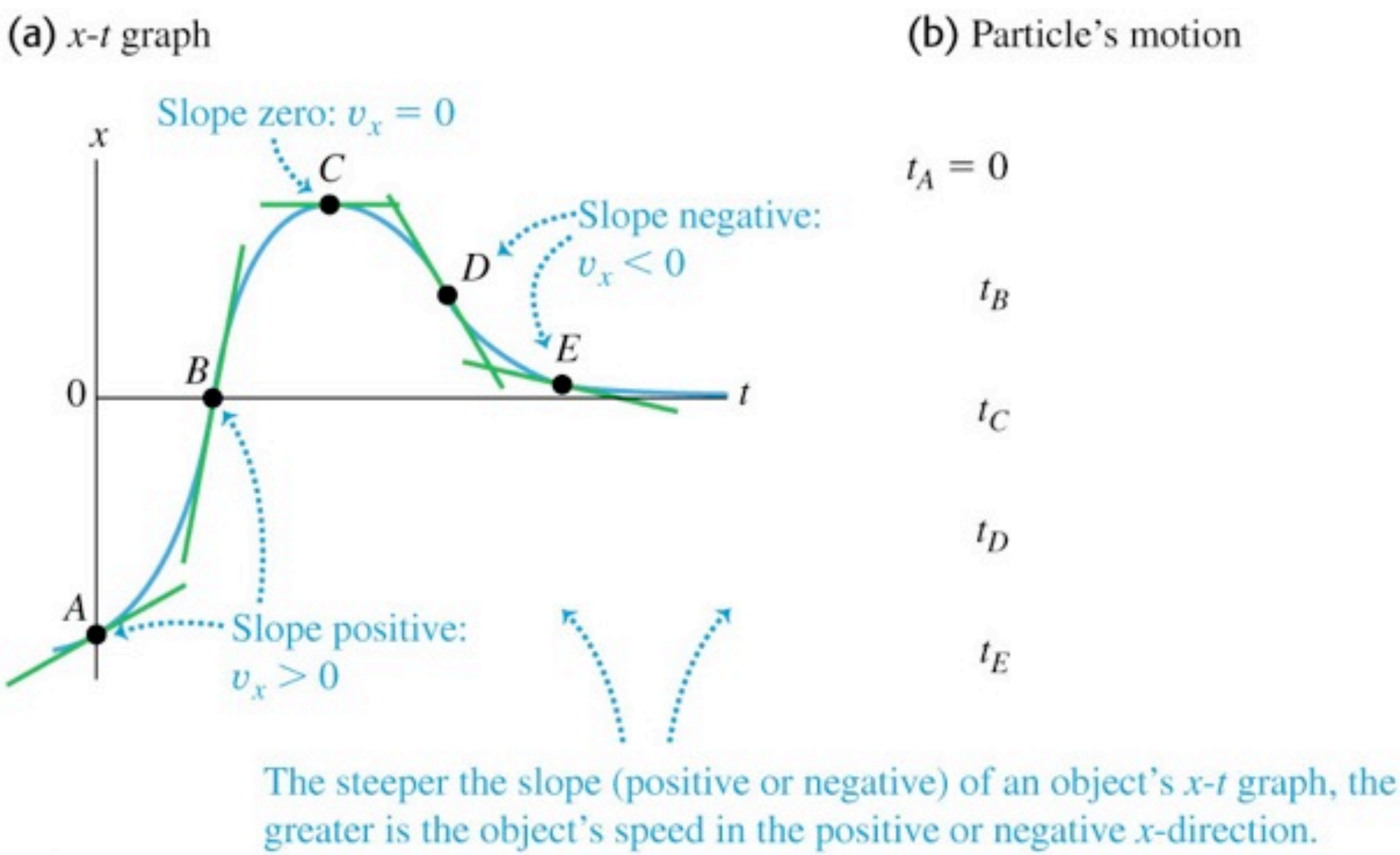
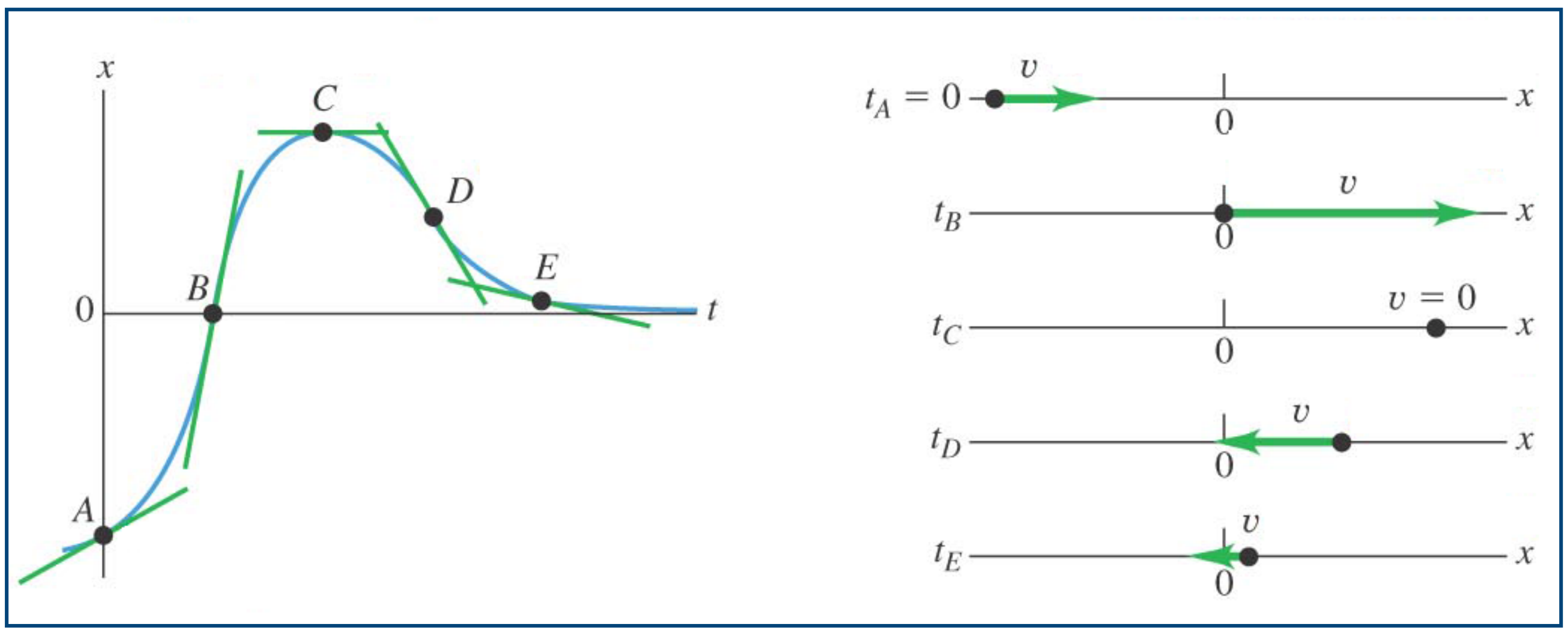
Motion diagrams

- A *motion diagram* shows the position of a particle at various instants, and arrows represent its velocity at each instant.
- Figure 2.8 shows the x-t graph and the motion diagram for a moving particle.




x
C
D
E
B
0
t
A
$t_A = 0$
v
0
x
t_B
v
0
x
t_C
$v = 0$
0
x
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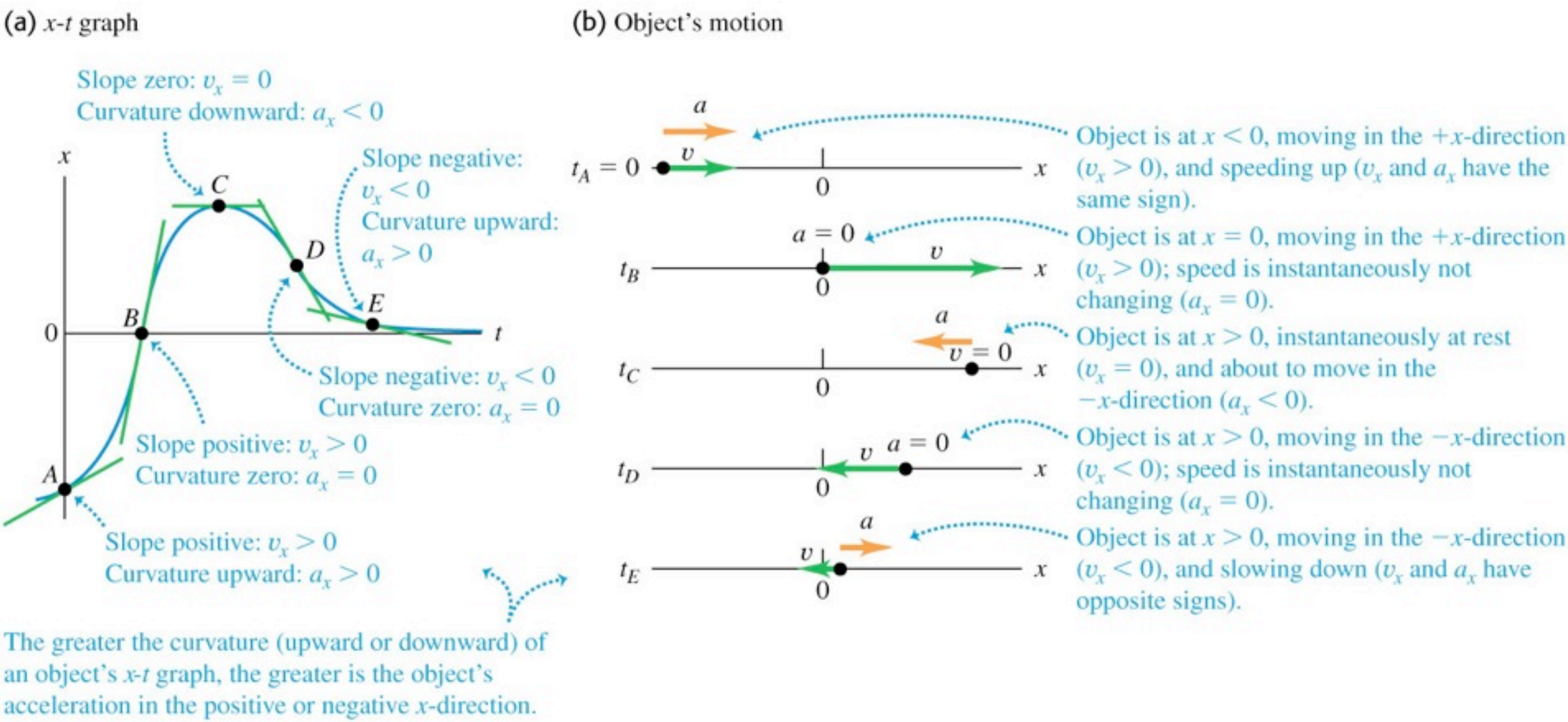
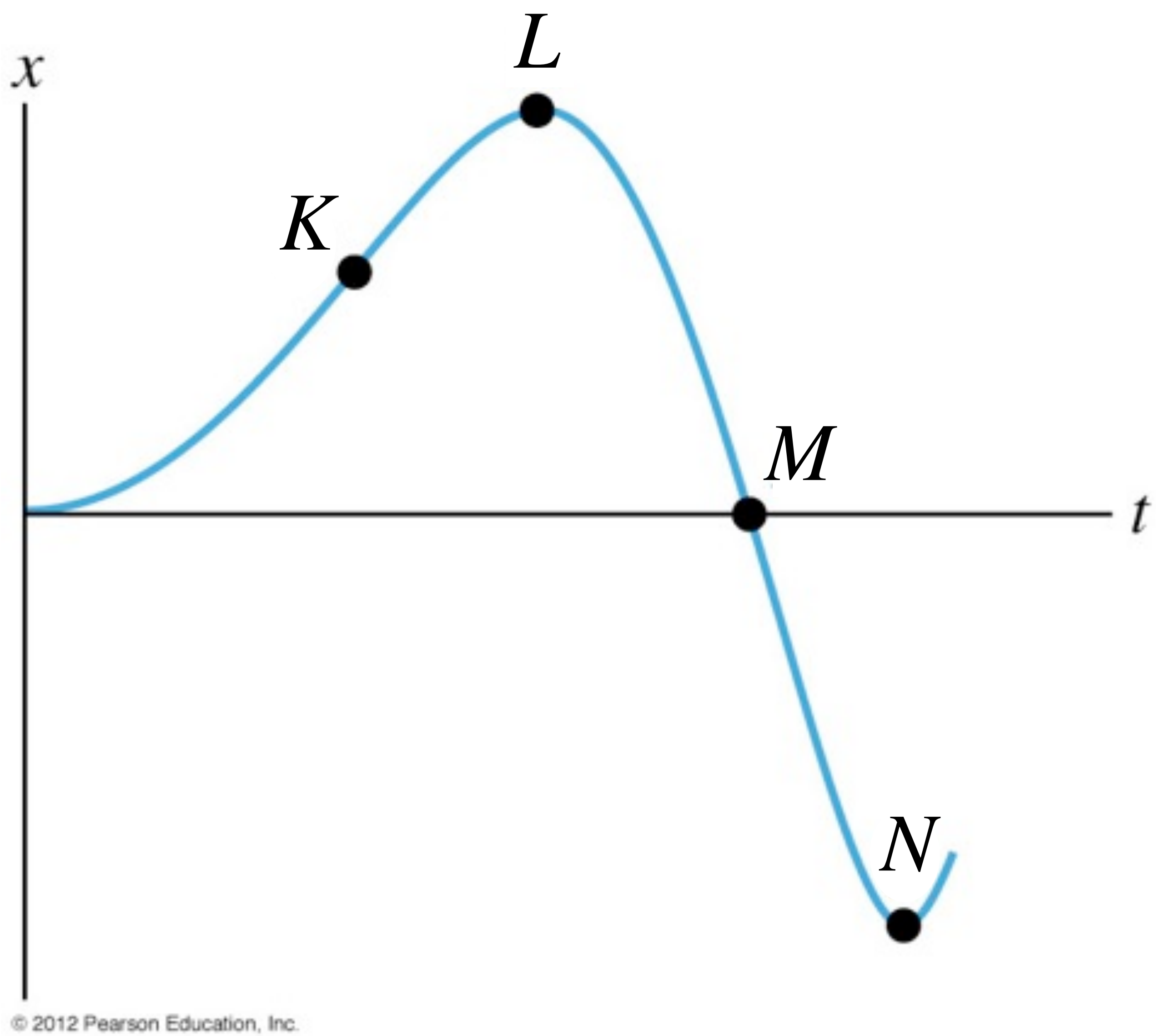
An x-t graph and a motion diagram

- Figure 2.14 shows the x-t graph and the motion diagram for a particle.



Q2.3



This is the *x*-*t* graph of the motion of a particle. Of the four points *K*, *L*, *M*, and *N*, the acceleration a_x is greatest (most positive) at

K. point *K*. L. point *L*. M. point *M*. N. point *N*.

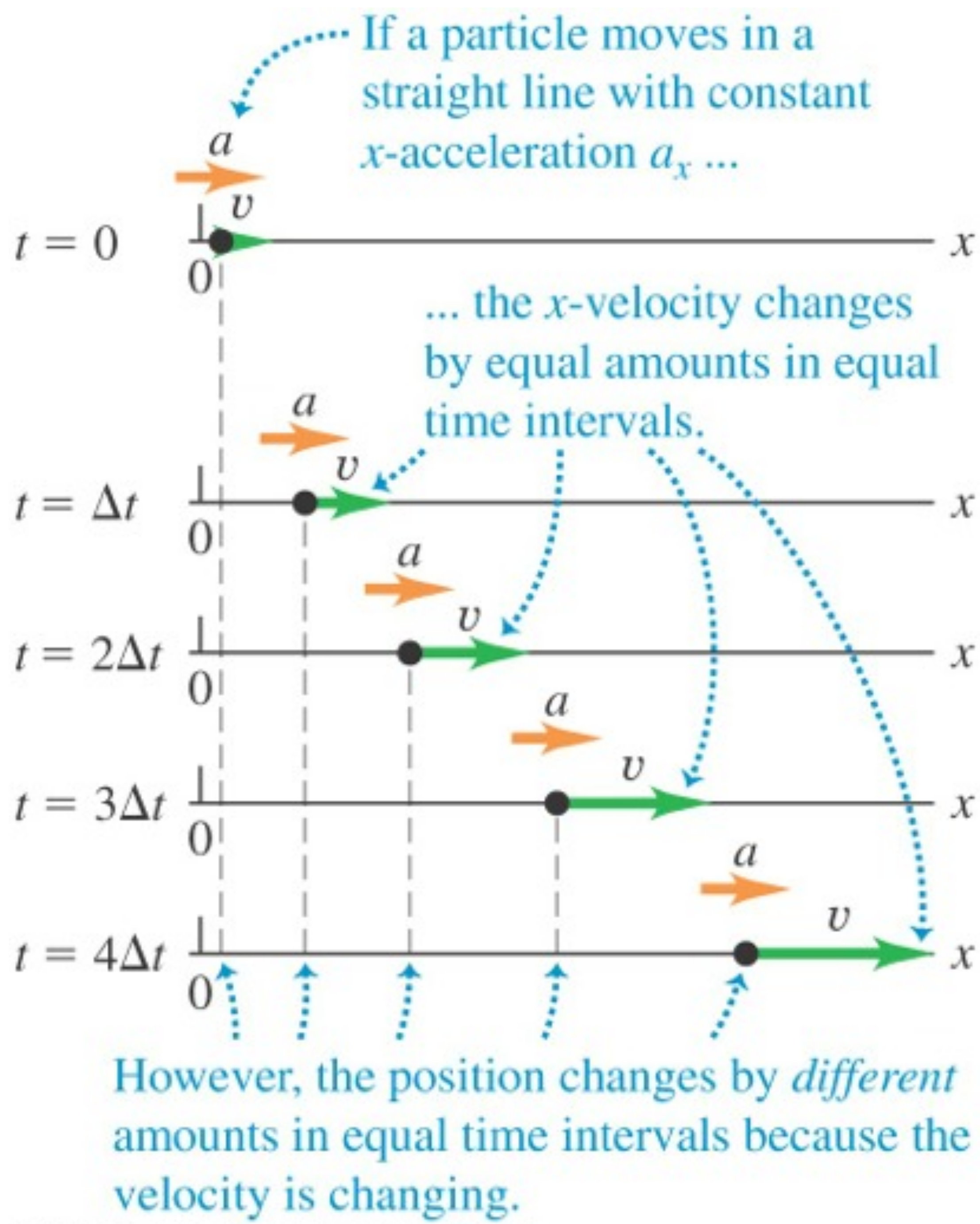
P. not enough information in the graph to decide

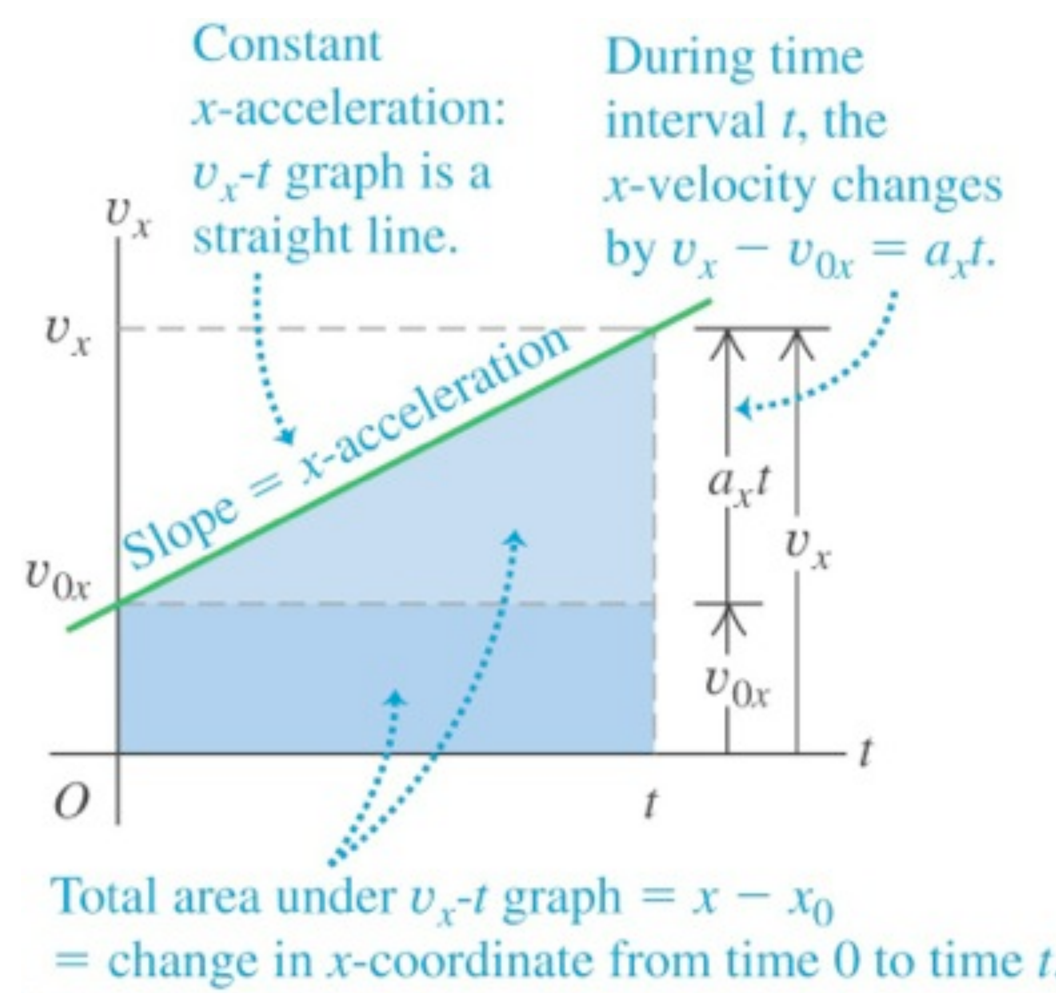
Dance Break

Constant acceleration

Motion with constant acceleration—Figures 2.15 and 2.17

- For a particle with constant acceleration, the velocity changes at the same rate throughout the motion.





The equations of motion with constant acceleration

- The four equations shown to the below apply to any straight-line motion with constant acceleration a_x.

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

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

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

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

Two bodies with different accelerations

- Follow Example 2.5 in which the police officer and motorist have different accelerations.