AP Physics B
Chapters 1 - 2
1 dimensional kinematics

Chapter 1

Introduction, Measurement, Estimating

Unit conversions

- Unit cancellation method
- Example – convert 100 miles/hour into feet/sec

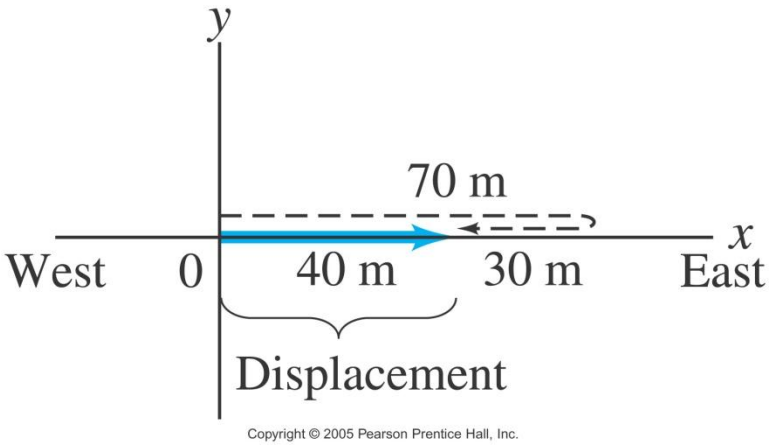
Chapter 2

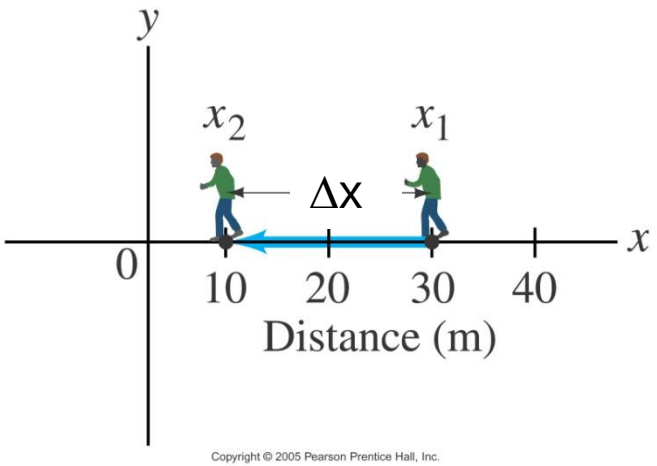
Describing Motion: Kinematics in One Dimension

Kinematic Vectors and Scalars

- 2 scalar quantities (magnitude only)
  - distance
  - speed
- 3 vector quantities (magnitude and direction)
  - displacement
  - velocity
    - average
    - instantaneous
  - acceleration

Distance and Displacement

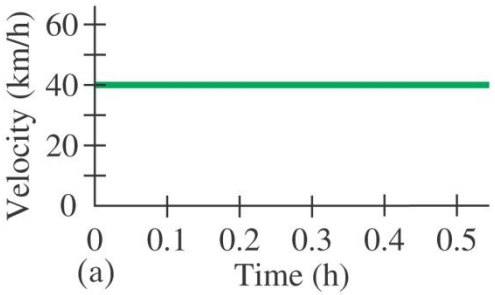


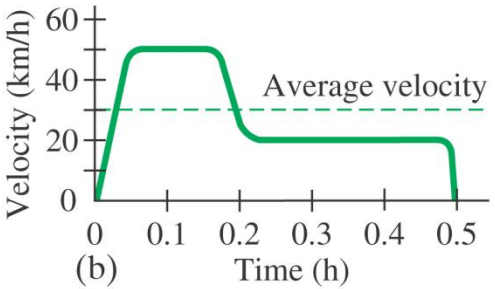


- distance walked = 100 m, 20 m
- displacement = + 40 m, – 20 m
  - – Δ means “change in”
  - – always calculated as (final – initial)
  - – $\Delta x = 40 - 0$ or $\Delta x = 10 - 30$

Speed and Velocity

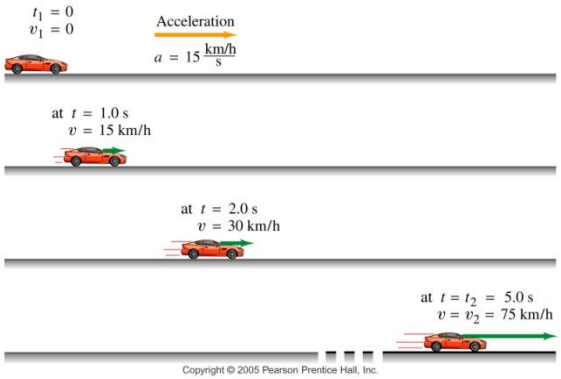
- average speed = distance/time
- average velocity $\bar{v} = \frac{displacement}{time} = \frac{\Delta x}{t} = \frac{x_f - x_0}{t}$
  - negative velocity means motion in negative direction
- instantaneous velocity – at an instant in time





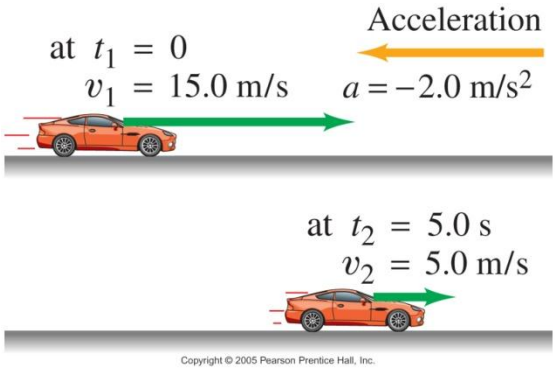
Acceleration

$$\bar{a} = \frac{\Delta v}{t} = \frac{v - v_0}{t}$$



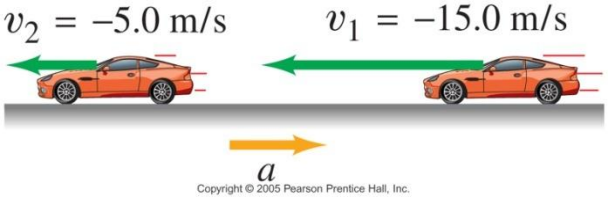
1) + acceleration

increasing speed in + direction



2) – acceleration

decreasing speed in + direction



3) + acceleration

decreasing speed in – direction

4) – acceleration

increasing speed in – direction

Kinematic equations – constant acceleration only

$$1)\ v_f = v_0 + at$$

$$2)\ \Delta x = \bar{v} \bullet t = \left(\frac{v_f + v_0}{2}\right)t$$

$$3)\ \Delta x = v_0 t + \frac{1}{2}at^2$$

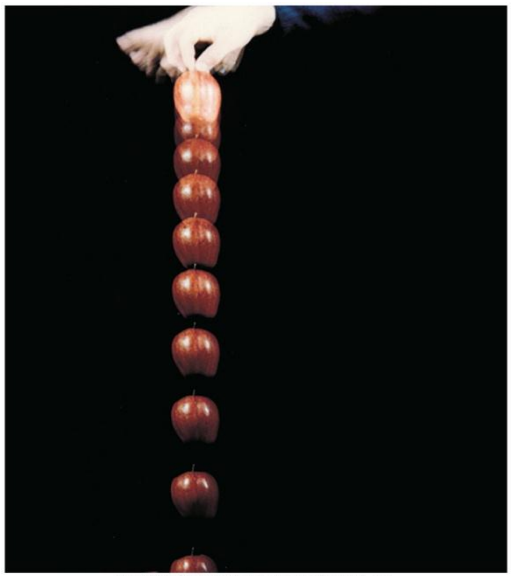
$$4)\ v_f{}^2 = v_0^2 + 2a\left(x_f - x_0\right)$$

- 5 kinematic variables
  - one variable missing from first 3 equations
- key to solving kinematic problems is identifying givens and choosing correct equation to solve for desired quantity

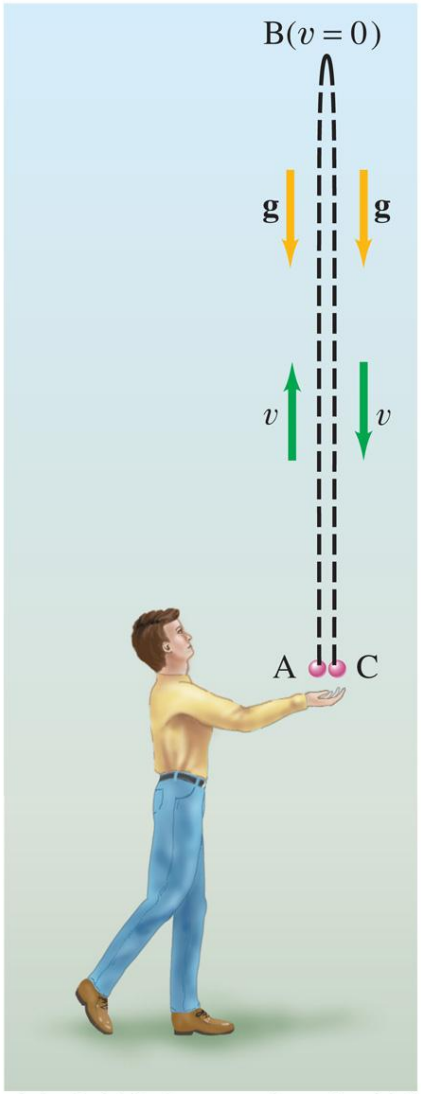
must be able to solve problems for algebraic solutions

Free Fall

- demo
- all objects accelerate at same rate if air resistance is neglected $g = 9.8\ m/s^2$
- replace $a = -g$ in kinematic equations



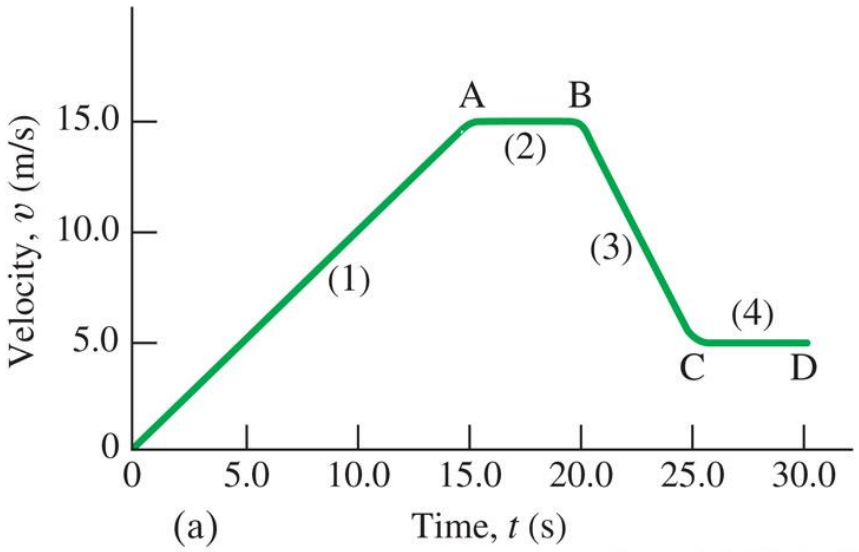
(a) (b)

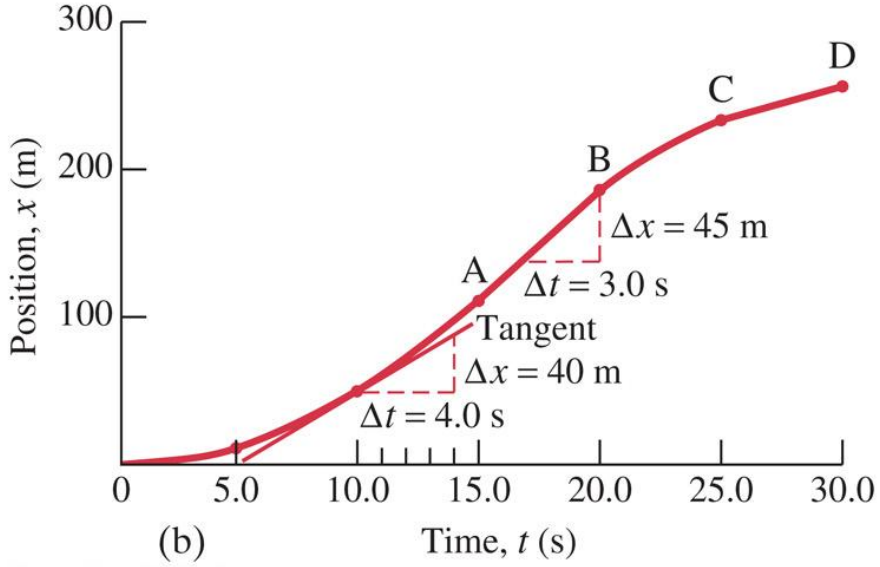


- vectors pointing up are +
- vectors pointing down are –
- motion is symmetrical
  - paths up and down are identical and opposite
- object stops at maximum height for an instant
- acceleration vector is always negative – always pointing down – no matter what direction object is moving

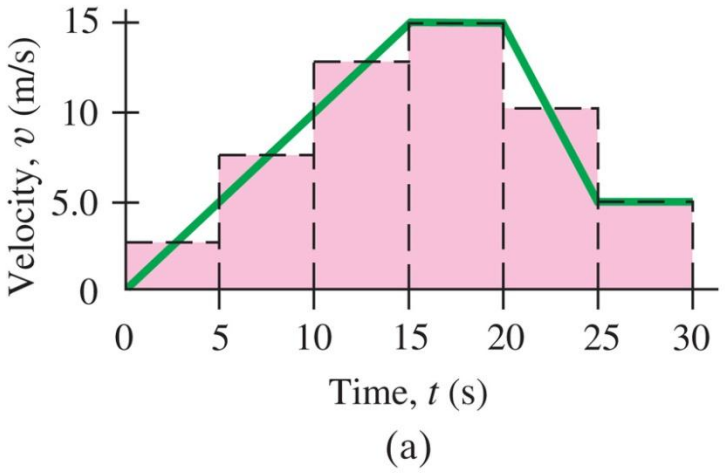
2-8 Graphical Analysis of Linear Motion

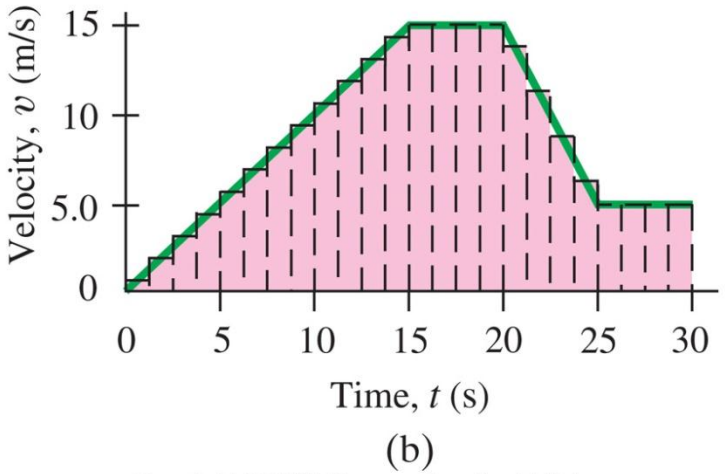
- slope of position – time graph = average velocity
- slope of velocity – time graph = average acceleration

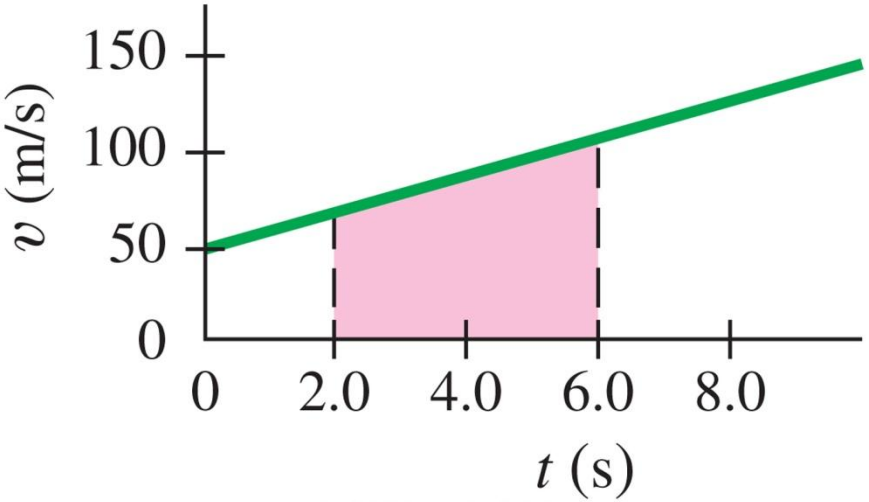




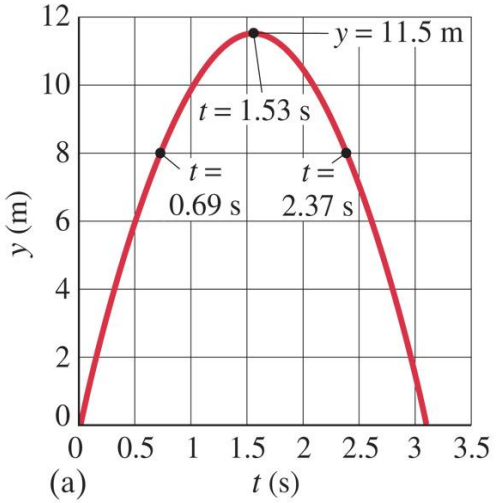
- area under velocity – time graph = displacement

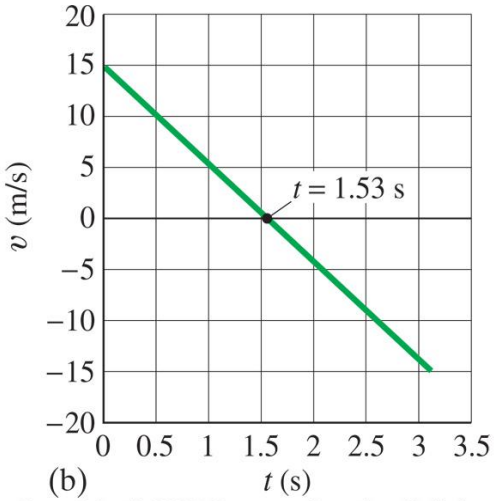


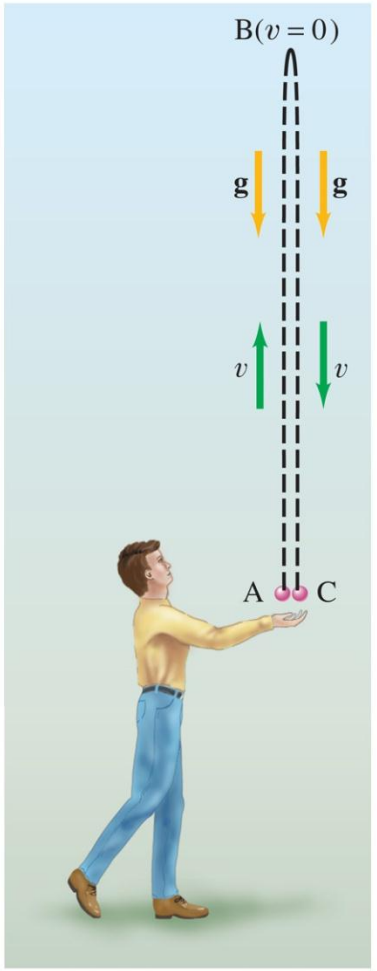


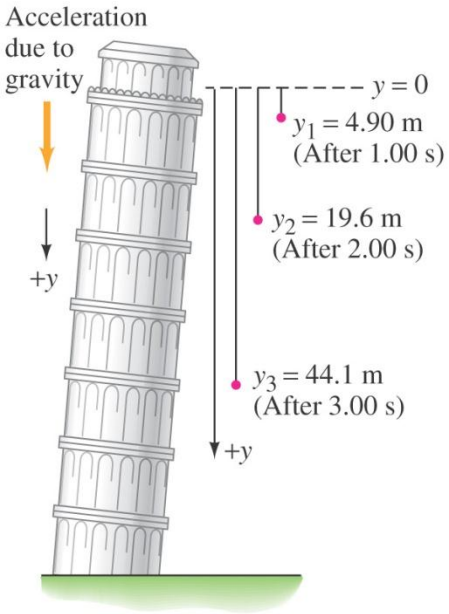


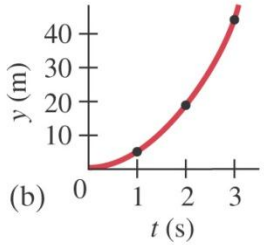
Shapes of kinematic graphs



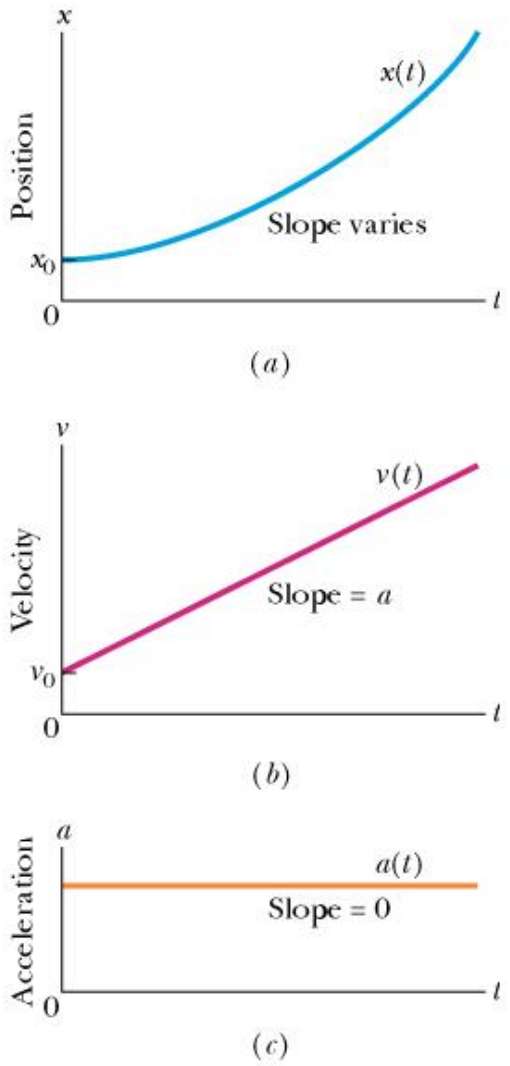




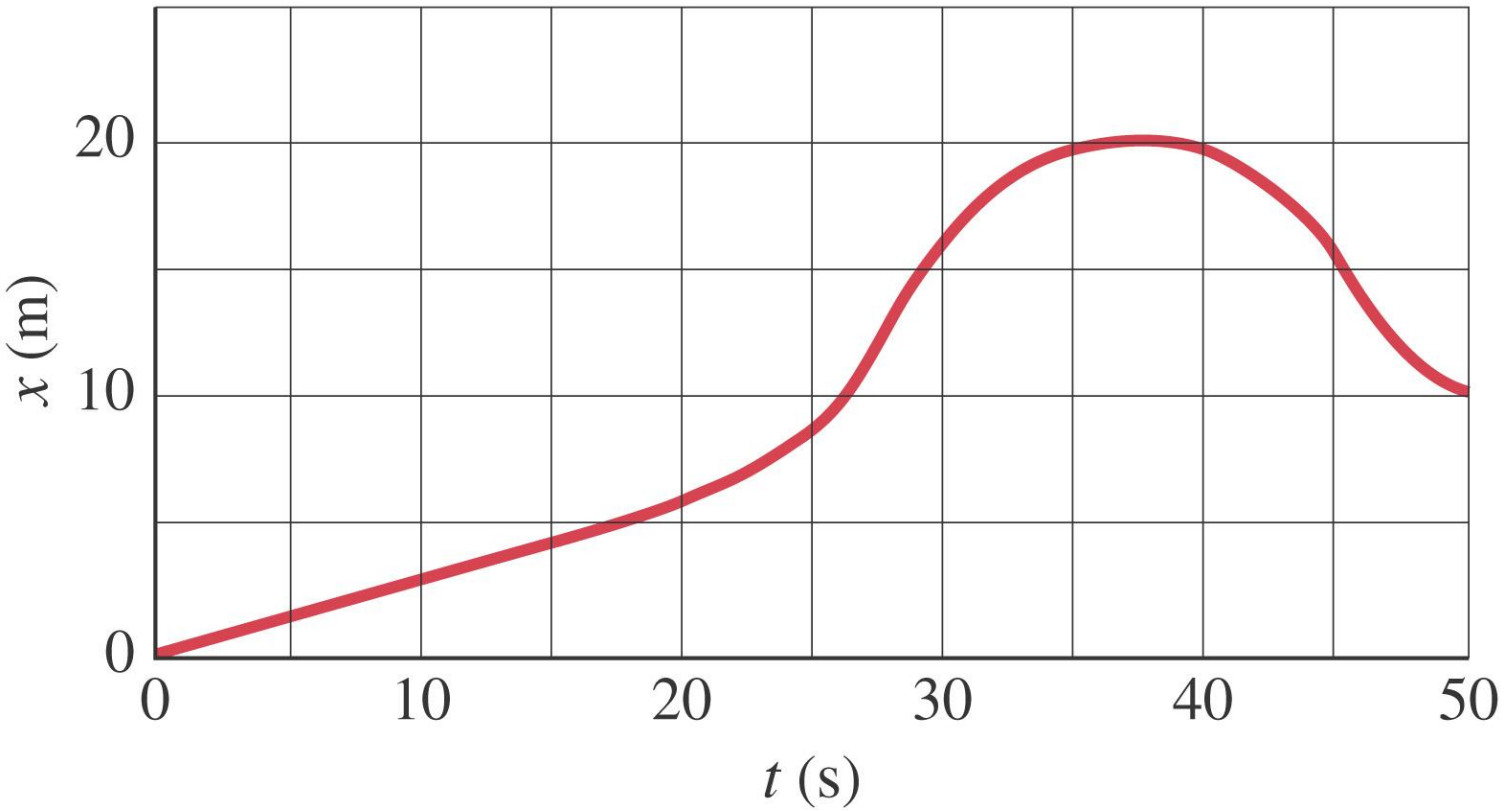


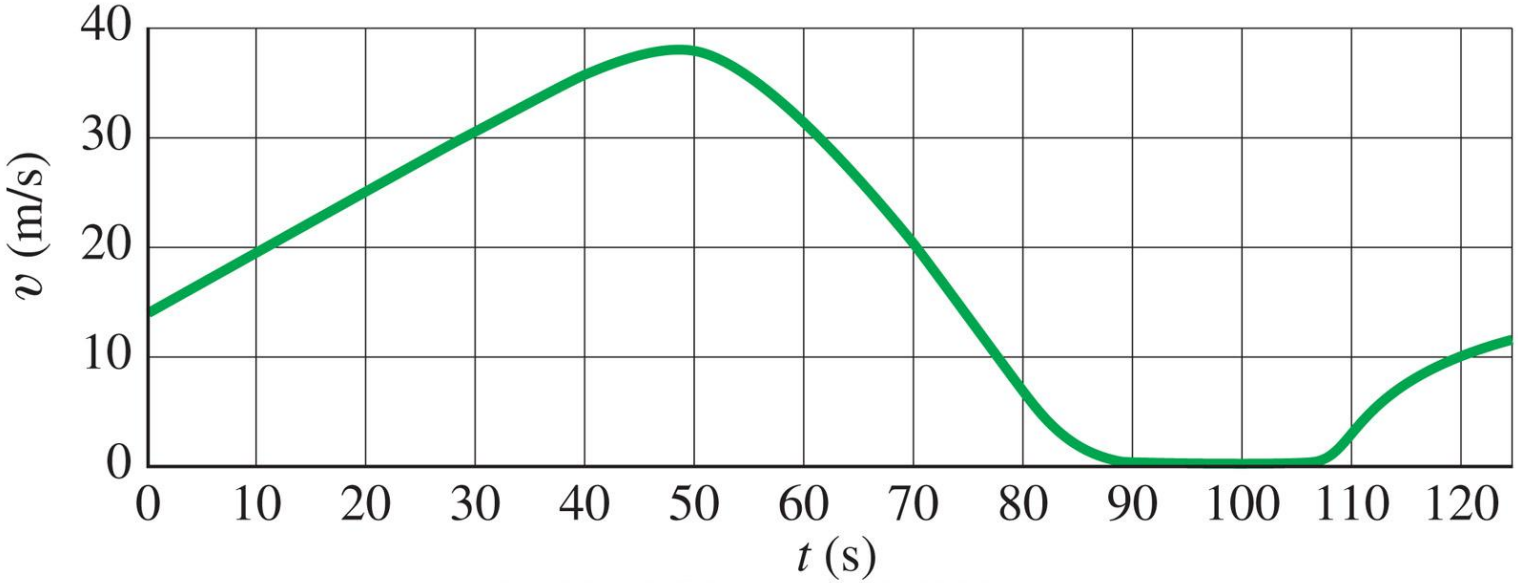


Kinematic graphs for constant acceleration



- position – time graph is parabolic
- velocity – time graph is linear
- acceleration – time graph is constant





Problem 2 – 56