Kinematics

Review

Turning point

"Area law": finding position from velocity

Q1. Velocity and acceleration

1. If one is positive the other one has to be positive.
2. If one is equal zero at some time t, the other has to be zero.
3. Their signs are independent.
4. Acceleration is always smaller then velocity.

Turning point for 1D motion

A point where an object reverses its direction. At a turning point, its velocity is zero.

Example: an object is tossed into the air.
 The initial velocity is +9.8m/s and continues to be positive until it reaches a maximal height
 at t=1s. Afterwards, its velocity becomes.

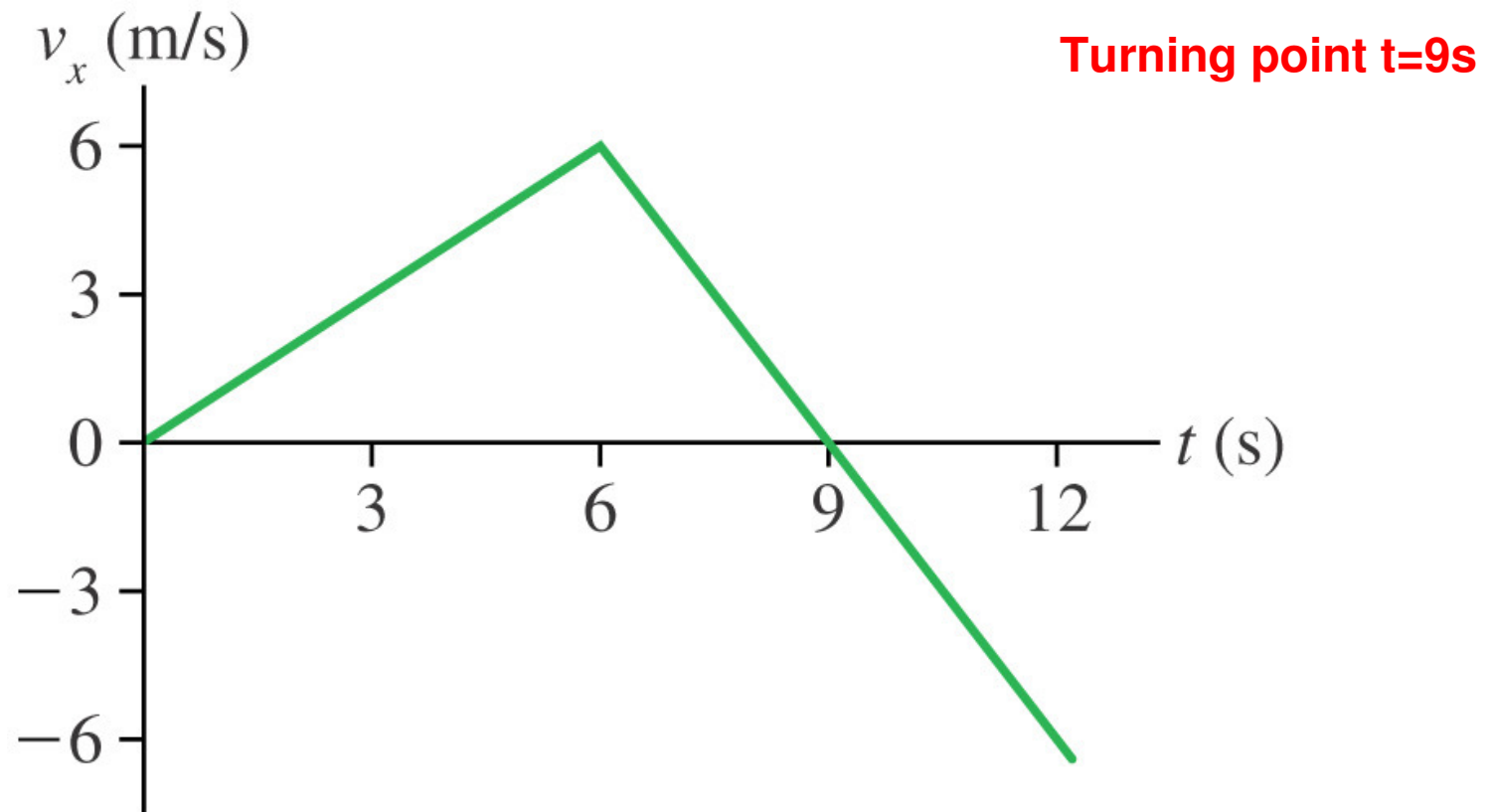 The turning point in this case is the one with a maximal height.
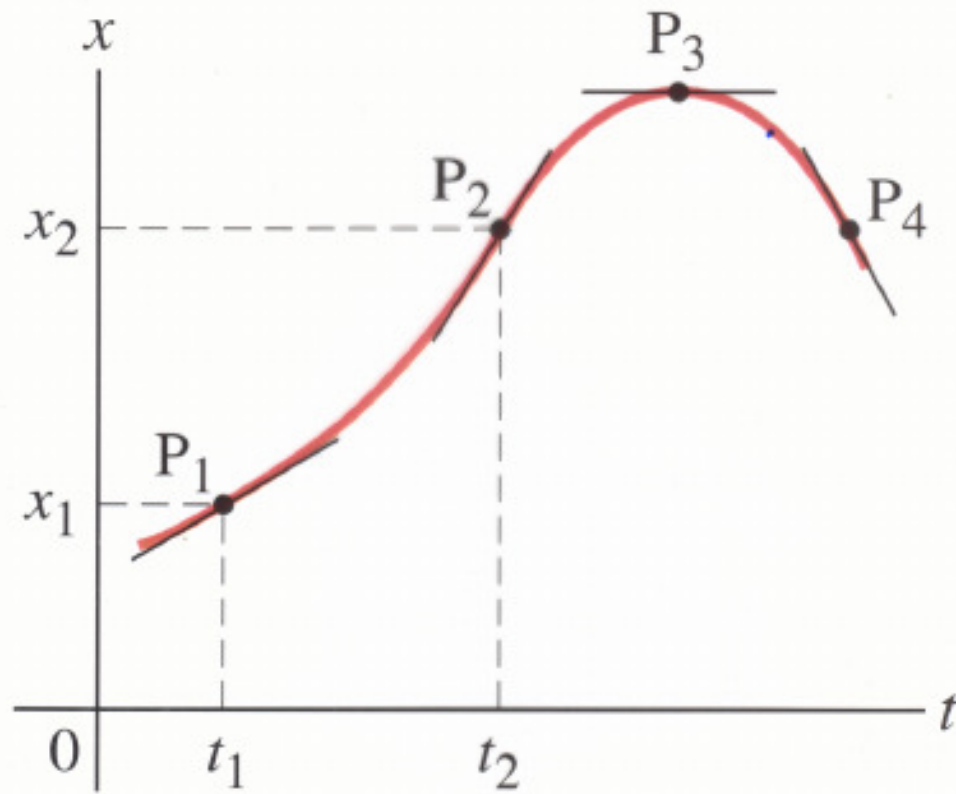
Q2: The turning point in this graph is

1) P1;

2) P2;

3) P3;

4) P4.

Q3

v_x (m/s)

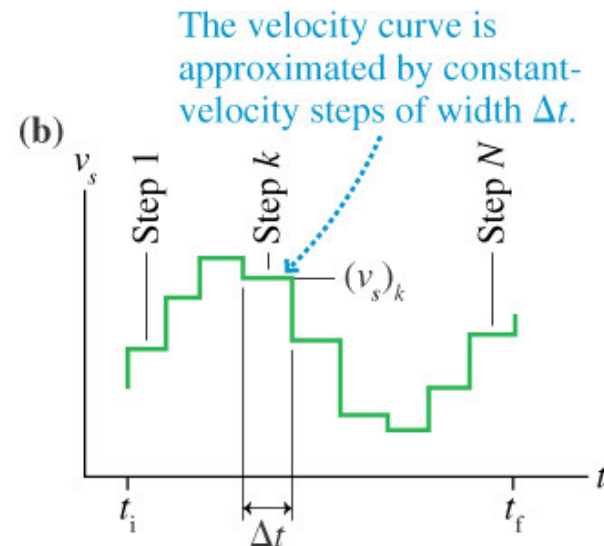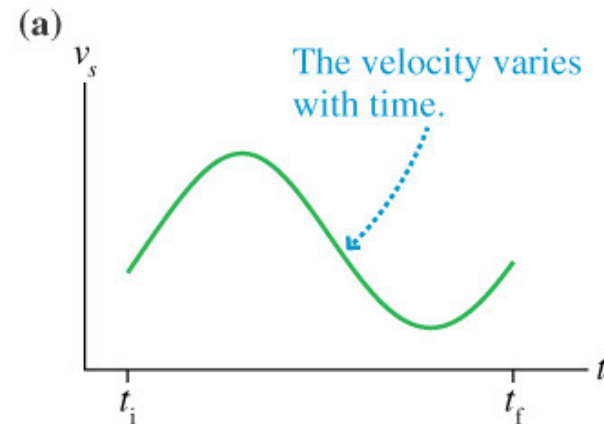Turning point t=9s
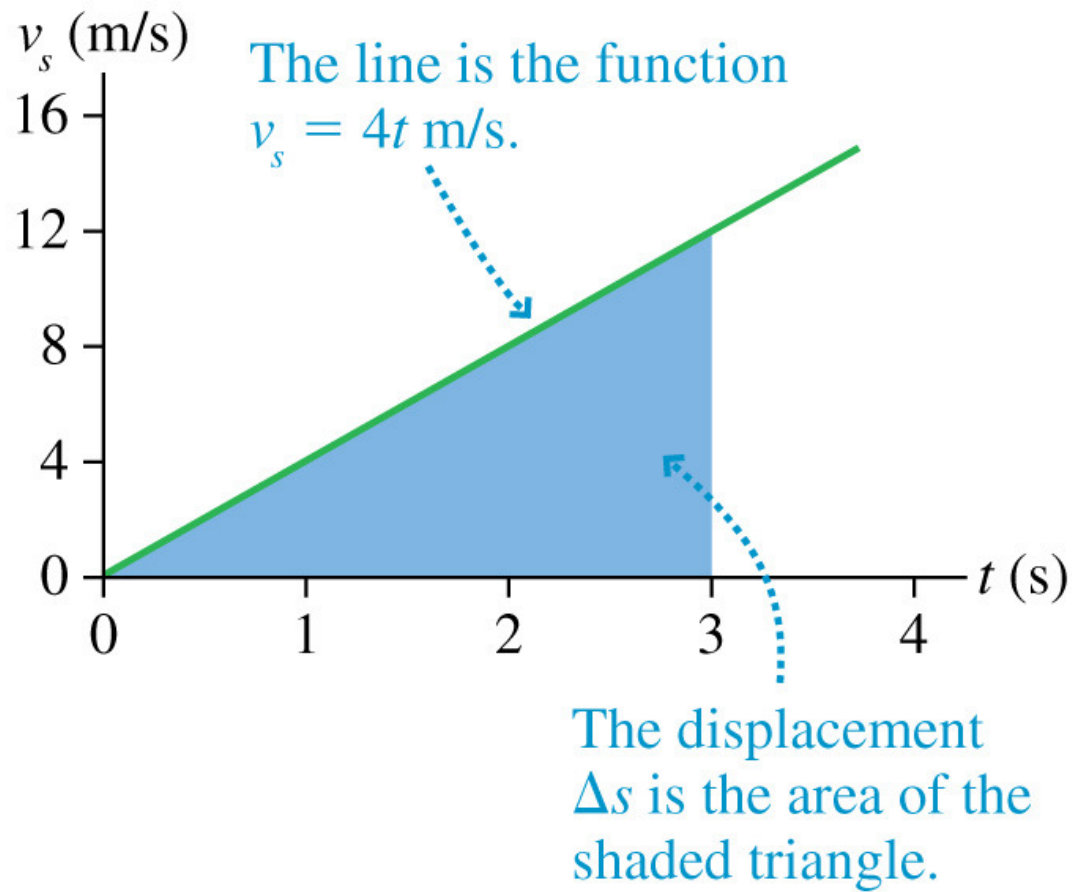
6

3

0

3   6   9   12

t (s)

−3

−6

Finding position from velocity

Displacement is equal
to the area below
a velocity curve.

The area is positive if
 the curve is above
v=0 axis; negative if
  below the axis.

v_s (m/s)

The line is the function $v_s = 4t$ m/s.

16

12

8

4

0

0   1   2   3   4 t (s)

The displacement Δs is the area of the shaded triangle.

Motion of a car.

A person is driving northward along the east mall Blvd with an initial velocity 10m/s starting from in front of the Hebb theatre.

v_x (m/s)

10

0

2   4   6

t (s)

−10
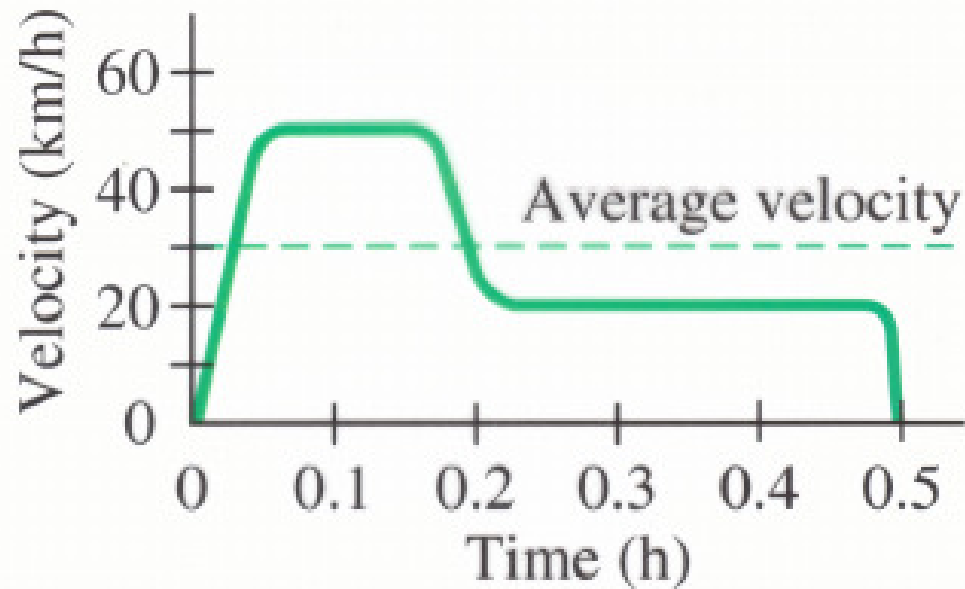
−20

1) Where is the turning point?

2) Where is the person at t=6s?
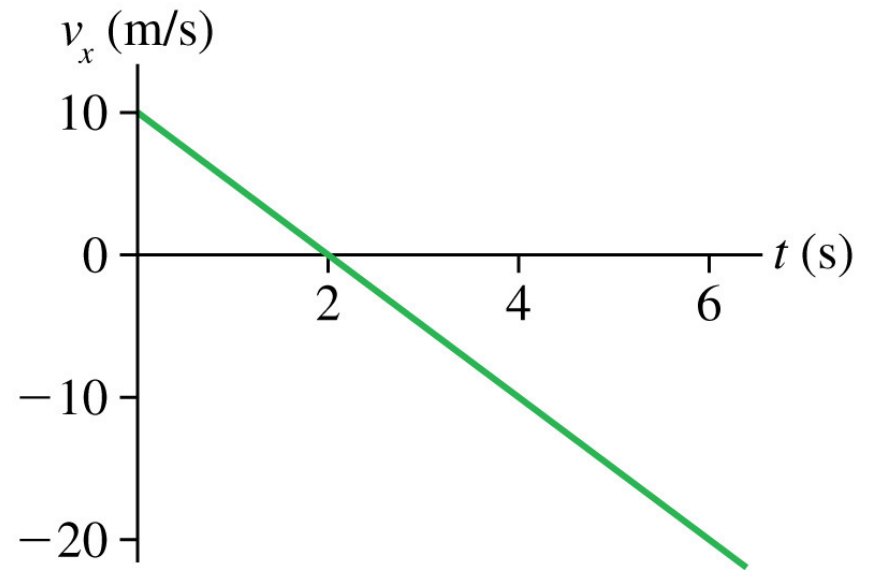
Q3

The average velocity and average speed between t=0 and 6s in this case are, respectively,

1) +10m/s and 15m/s;
2) 8.33 m/s and 8.33 m/s;
3) - 5m/s and 8.33m/s;
4) -5m/s and - 8.33m/s.

Velocity as a function of time.

Calculate the average velocity from such a graph.

Average Velocity = area / t