Read 3.1-3.4

- Group tomorrow
- Action Center tomorrow 5-7 p.m
  Wagner 145
- my office hours 9:30-10:30 today
- Hw #1 solutions on class web page
- Lots of clicker questions today
- "extra" clicker questions posted with today's lecture
- Grp 1 on D2L

If you drop a brick from a building in the absence of air resistance, it accelerates downward at 9.8 m/s^2. If instead you throw it downward, its downward acceleration after release is

A) less than 9.8 m/s^2

B) 9.8 m/s^2

C) more than 9.8 m/s^2

D) impossible to determine with the information given

Interactive Question

Ball **A** is dropped from a window. At the same instant, ball **B** is thrown downward and ball **C** is thrown upward from the same window. Which statement concerning the balls is necessarily true if air resistance is neglected?

A) At one instant, the acceleration of ball **C** is zero.
B) All three balls strike the ground at the same time.
C) All three balls have the same velocity at any instant.
D) All three balls have the same acceleration at any instant.
E) All three balls reach the ground with the same velocity.

Interactive Question

A person standing at the edge of a cliff throws one ball straight up and another ball straight down at the same initial speed. Neglecting air resistance, the ball that hits the ground below the cliff with the greater speed is the one initially thrown

A) upward
B) downward
C) neither, they both hit at the same speed.
D) It is impossible to tell with the information given.

Interactive Question

Two balls are thrown straight up. The first one takes twice as long to return to earth as the second one. Ignore air resistance. How much faster was the first ball thrown?

A) $\sqrt{2}$ times as fast.
B) Twice as fast.
C) Three times as fast.
D) Four times as fast.
E) Impossible to tell without knowing the exact times.

Interactive Question

Two balls are thrown straight up. The first is thrown with twice the initial speed of the second. Ignore air resistance. How much longer will it take for the first ball to return to earth?

A) $\sqrt{2}$ times as long.
B) Twice as long.
C) Three times as long.
D) Four times as long.
E) Eight times as long.

Interactive Question

Two balls are thrown straight up. The first one takes twice as long to return to earth as the second one. Ignore air resistance. How much faster was the first ball thrown?

A) $\sqrt{2}$ times as fast.
B) Twice as fast.
C) Three times as fast.
D) Four times as fast.
E) Impossible to tell without knowing the exact times.

Interactive Question

Two balls are thrown straight up. The first is thrown with twice the initial speed of the second. Ignore air resistance. How much higher will the first ball rise?

A) $\sqrt{2}$ times as high.
B) Twice as high.
C) Three times as high.
D) Four times as high.
E) Eight times as high

Interactive Question

Two rocks are dropped into two different deep wells. The first one takes three times as long to hit bottom as the second one. Ignore air resistance. How much deeper is the first well than the second?

A) $\sqrt{3}$ times as deep.
B) Three times as deep.
C) Four and a half times as deep.
D) Six times as deep.
E) Nine times as deep.

Interactive Question

Two balls are thrown straight up. The first is thrown with twice the initial speed of the second. Ignore air resistance. How much higher will the first ball rise?

A) $\sqrt{2}$ times as high.
B) Twice as high.
C) Three times as high.
D) Four times as high.
E) Eight times as high

Interactive Question

Ball A is dropped from the top of a building. One second later, ball B is dropped from the same building. Neglecting air resistance, as time progresses the *distance* between them

A) increases.
B) remains constant.
C) decreases.
D) depends on the size of the balls.

Interactive Question

Ball A is dropped from the top of a building. One second later, ball B is dropped from the same building. Neglecting air resistance, as time progresses the *difference* in their speeds

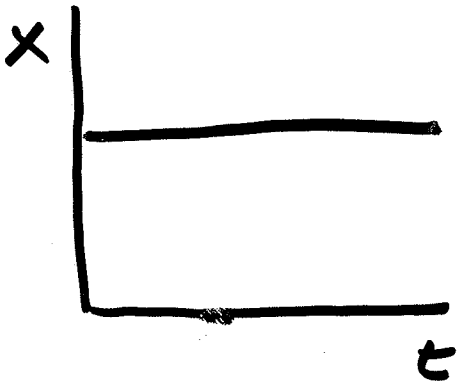
A) increases.
B) remains constant.
C) decreases.
D) depends on the size of the balls.

Analyzing Motion on a Graph

- Look carefully at what the axes represent

- Look carefully at what is constant and what is changing

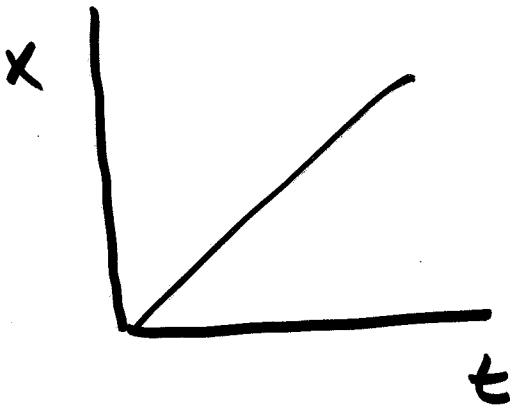
- what does the slope represent?



$v_{avg} = 0$

slope = 0

$\frac{\Delta x}{\Delta t}$ = slope = v_{avg}



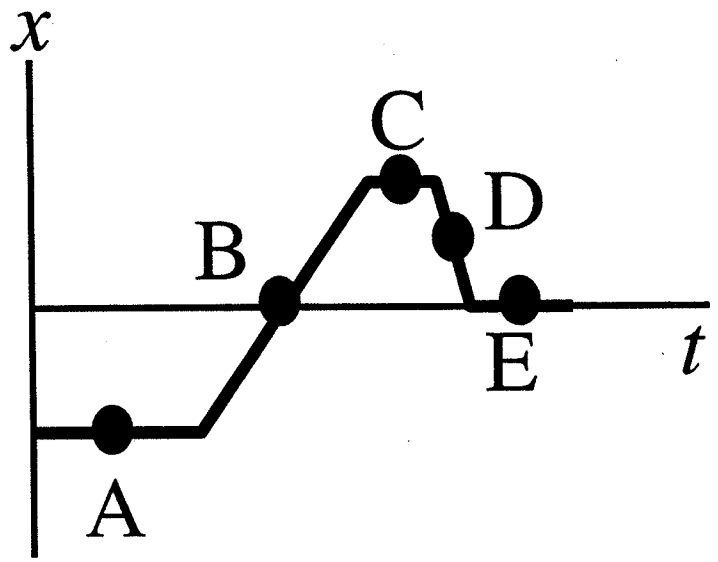
slope = constant

v_{avg} = constant

slope → v_{avg}

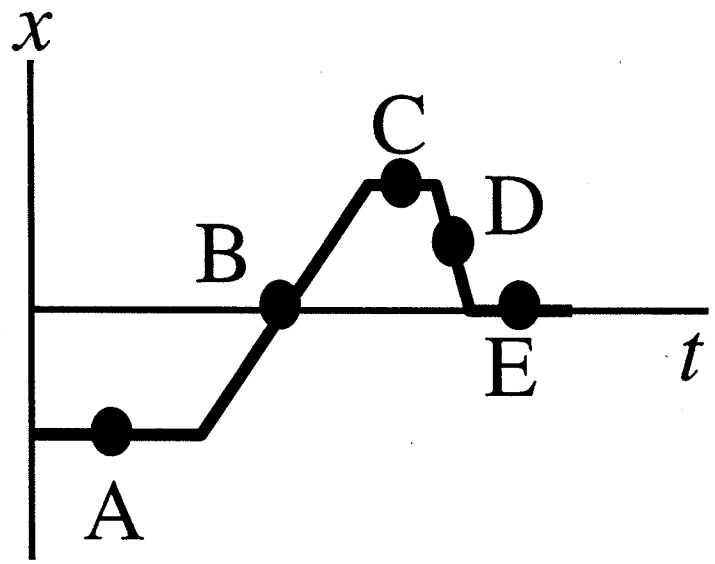
tangent is velocity

Consider the plot of x vs t at the right, at which point(s) is the motion fastest?



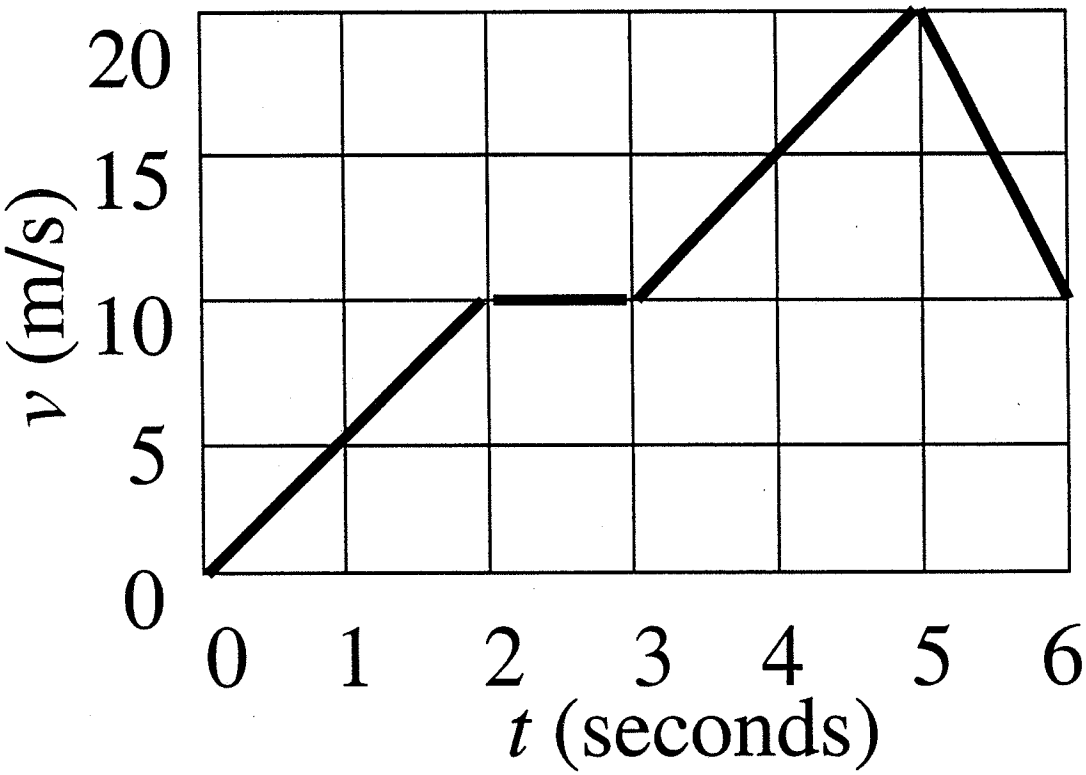
A) A
B) B
C) C
D) D
E) E

Consider the plot of x vs t at the right, at which point(s) is the object turning around?



A) A
B) B
C) C
D) D
E) E

An object is moving along a straight line. The graph at the right shows its velocity as a function of time.



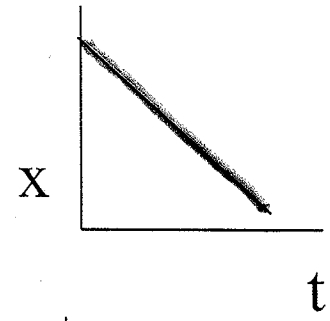
During which interval(s) of the graph does the object travel ***equal distances in equal times***?

A) 0 to 2 s
B) 2 s to 3 s
C) 3s to 5 s
D) 0 to 2 s and 3 s to 5 s
E) 0 to 2 s, 3 s to 5 s, and 5 s to 6 s

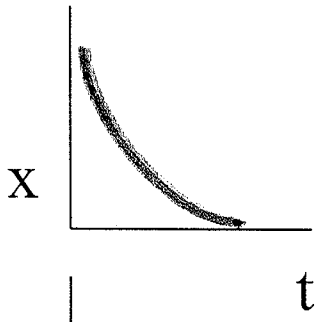
An object is dropped from a building. What graph describes its motion

+ ↑

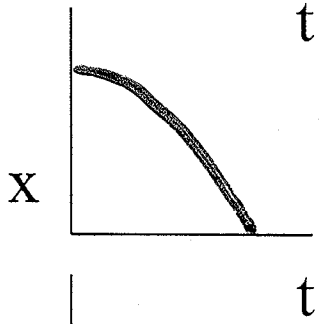
A



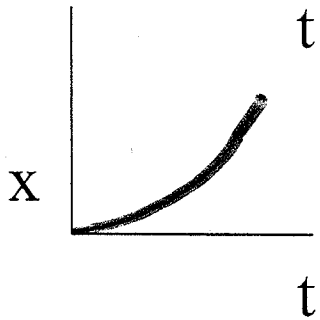
B



C

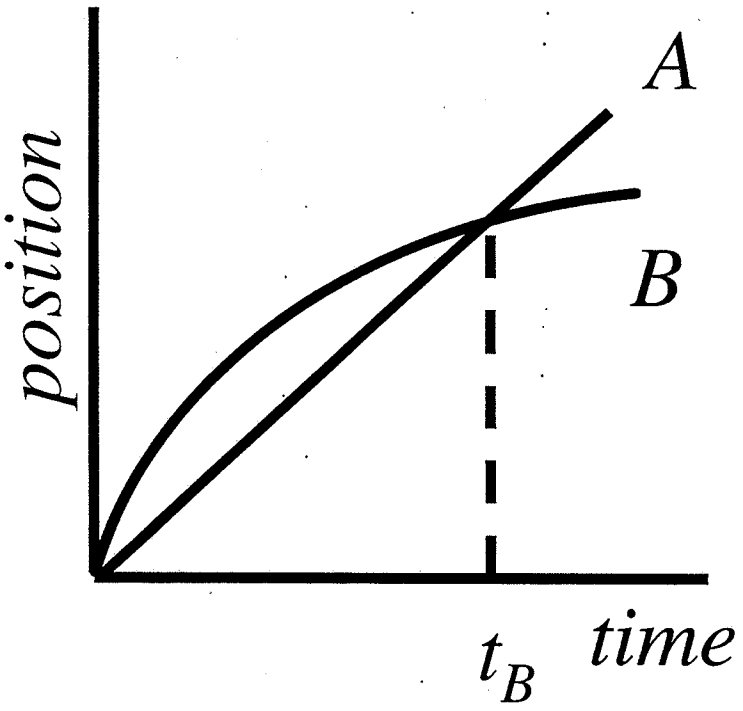


D



Interactive Question

The graph shows position as a function of time for two trains running on parallel tracks. Which is true:



A) At time t_B both trains have the same velocity.

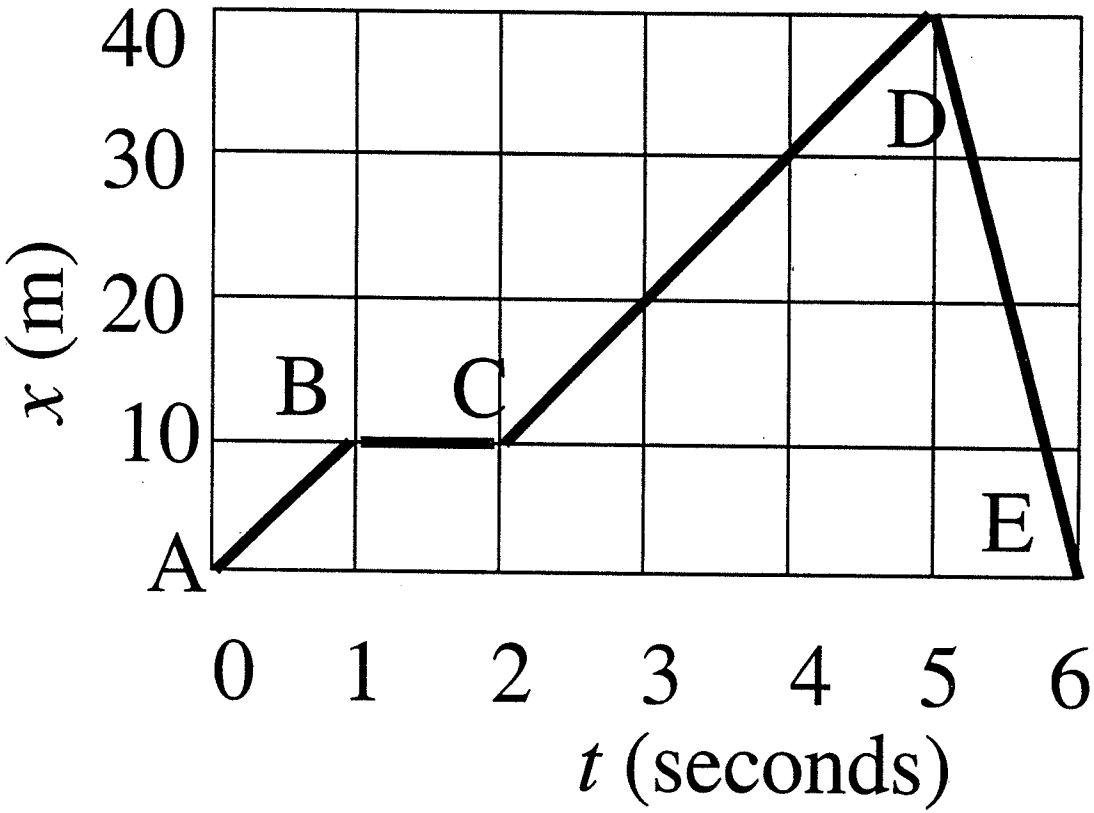
B) Both trains speed up all the time.

C) Both trains have the same velocity at some time before t_B.

D) Somewhere on the graph, both trains have the same acceleration.

E) More than one of the above is true.

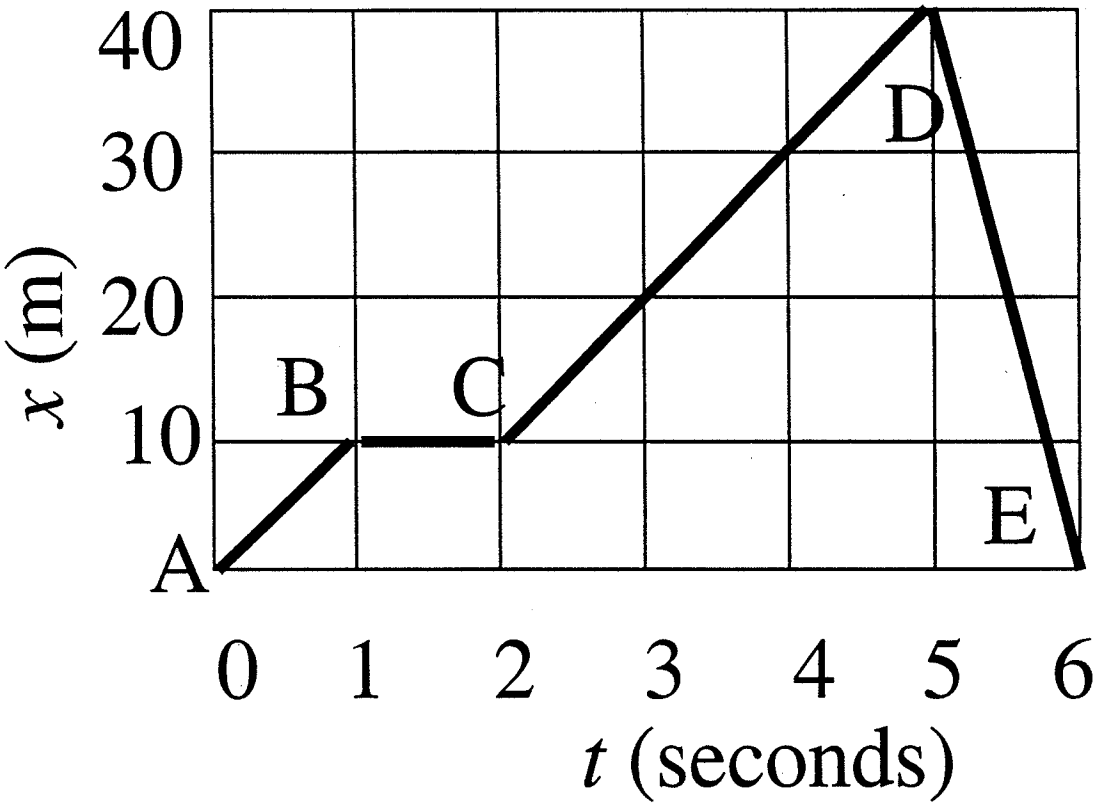
An object is moving along a straight line. The graph at the right shows its position from the starting point as a function of time.



What was the instantaneous velocity of the object at $t = 4$ seconds?

A) +6.0 m/s
B) +8.0 m/s
C) +10.0 m/s
D) + 13.3 m/s
E) +40 m/s

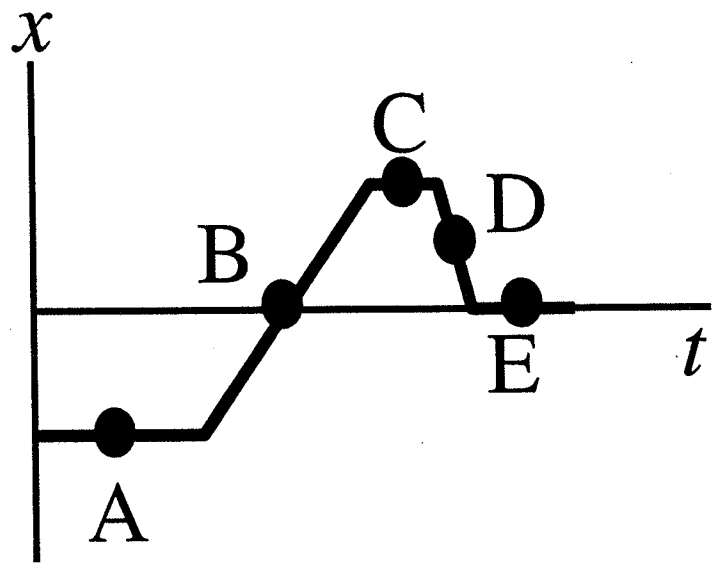
An object is moving along a straight line. The graph at the right shows its position from the starting point as a function of time.



In what section of the graph does the object have the fastest speed?

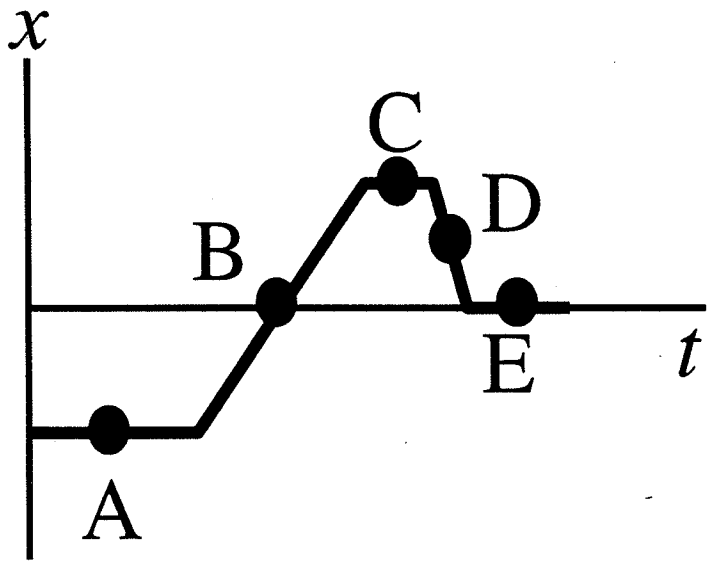
A) AB
B) BC
C) CD
D) DE
E) AB and CD

Consider the plot of x vs t at the right, at which point(s) is the motion slowest?



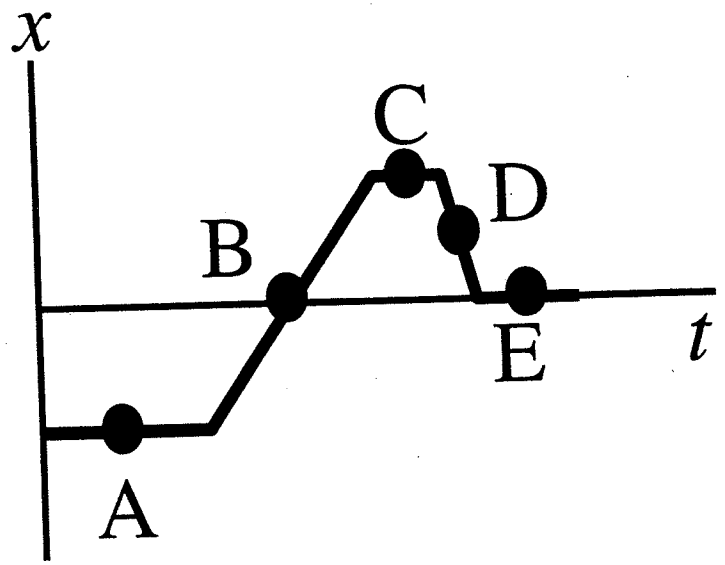
A) A
B) B
C) D
D) E
E) More than one of the above answers

Consider the plot of x vs t at the right, at which point(s) is the object moving in the negative x direction?



A) A
B) B
C) C
D) D
E) E

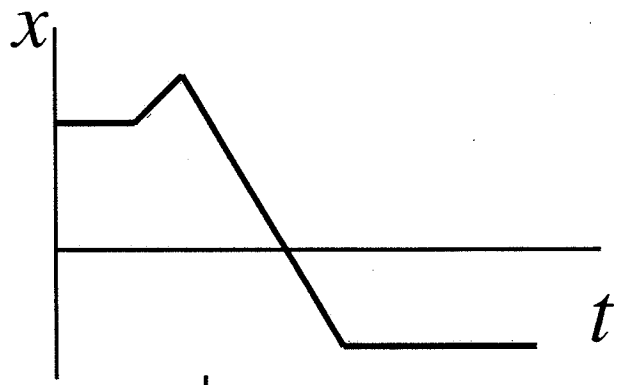
Consider the plot of x vs t at the right, at which point(s) is the object moving at a constant non-zero velocity?

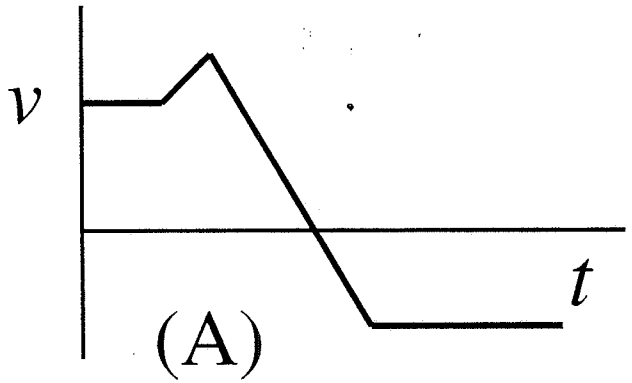


A) A and C
B) A, C and D
C) C only
D) D only
E) B and D

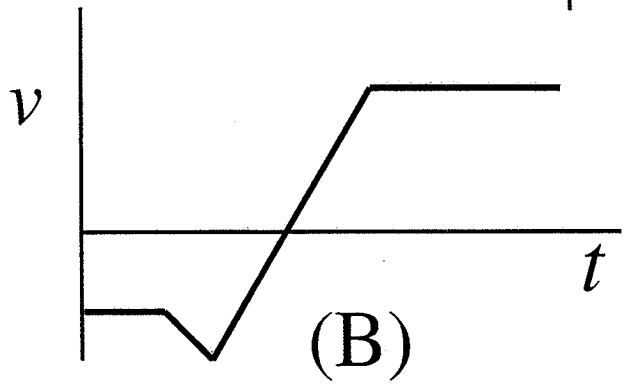
Interactive Question

Consider the graph to the right. Which graph below represents the same motion?

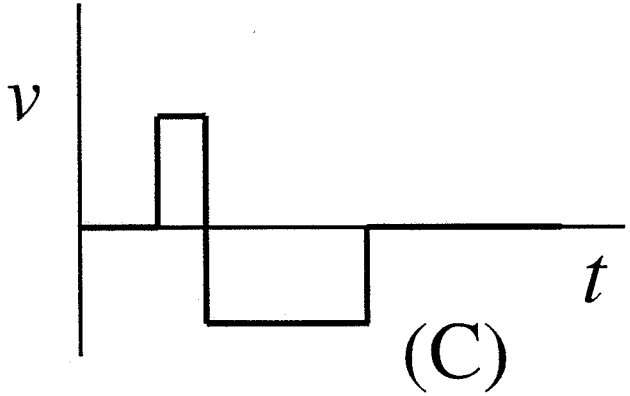




(A)



(B)



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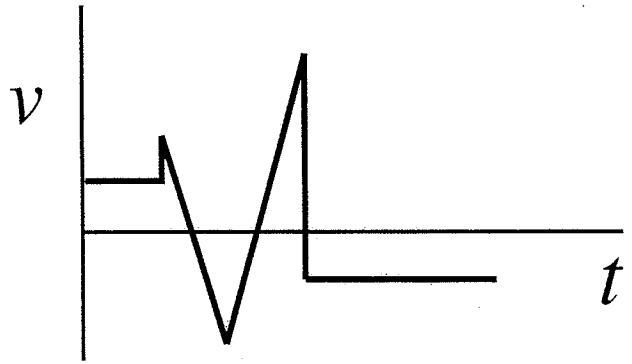
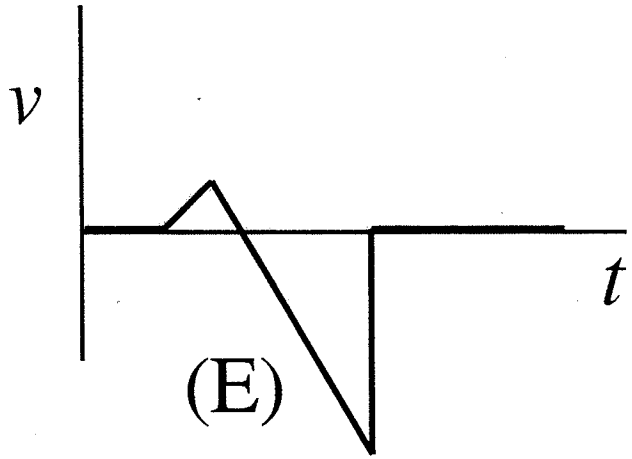


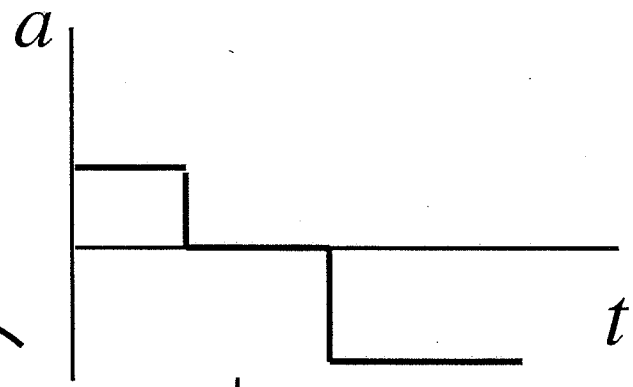
(D)

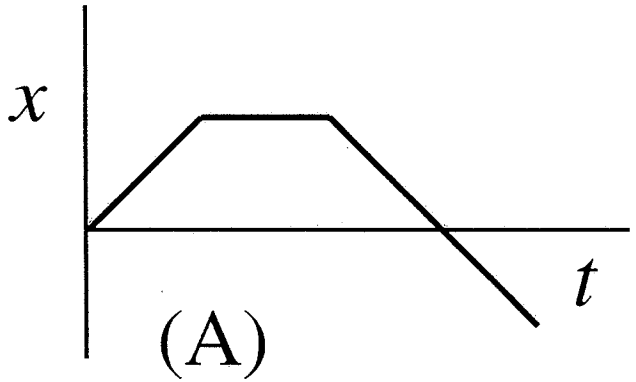


(E)

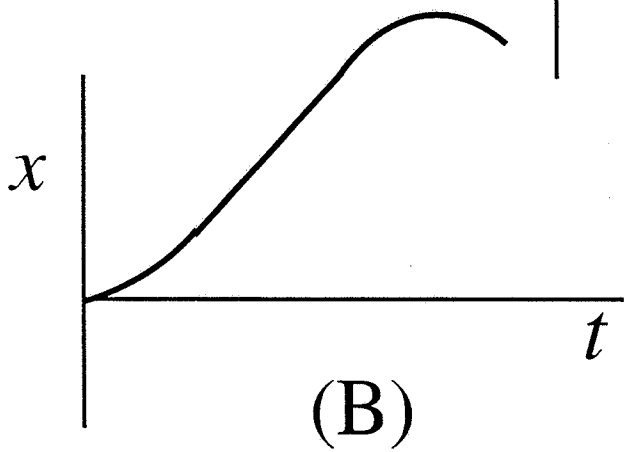
Interactive Question

Consider the graph to the right. Which graph below represents the same motion?

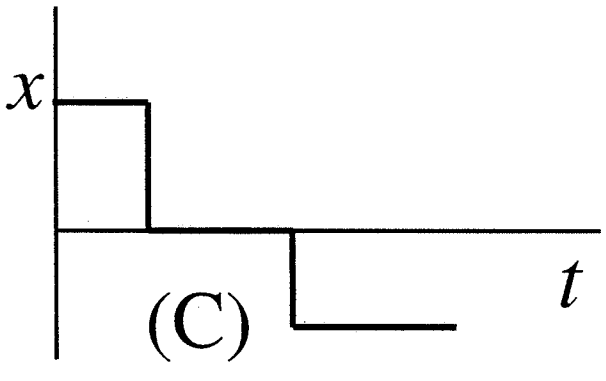




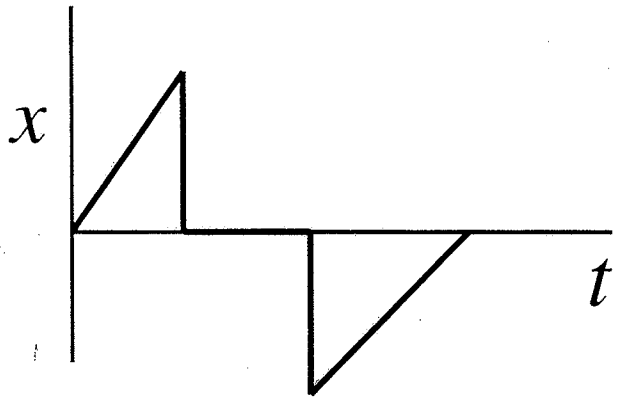
(A)



(B)



(C)



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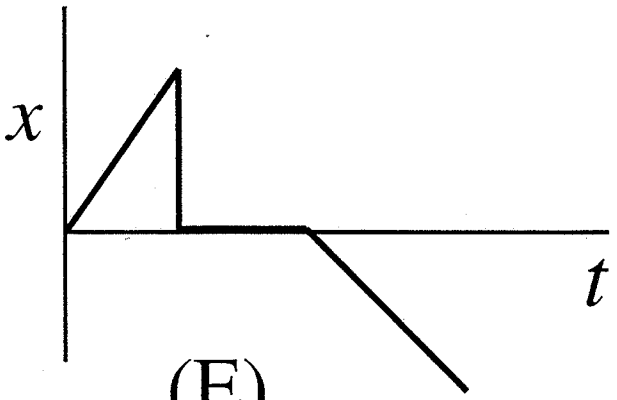
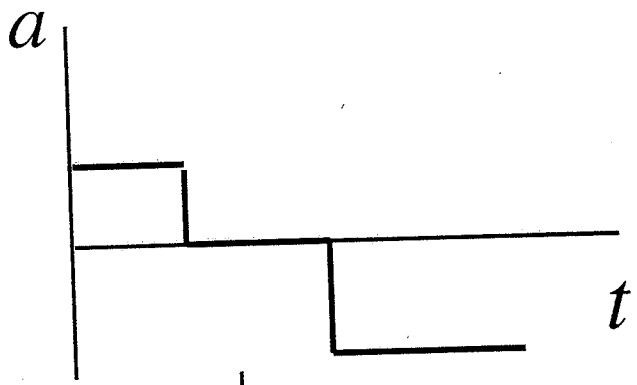
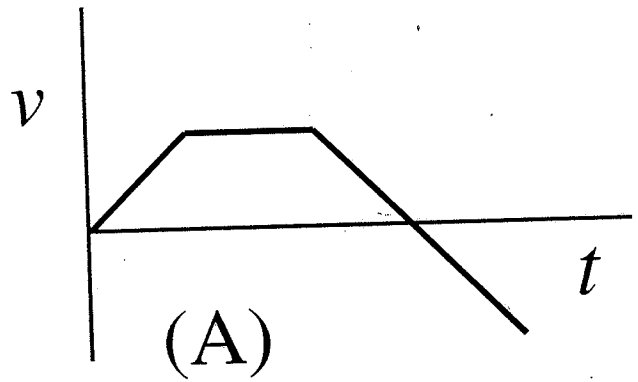


(E)

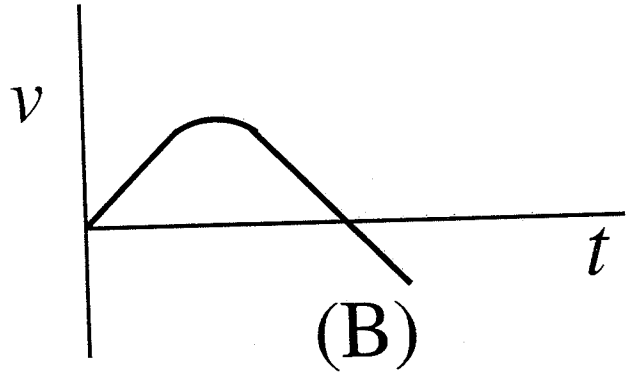
Interactive Question

Consider the graph to the right. Which graph below represents the same motion?

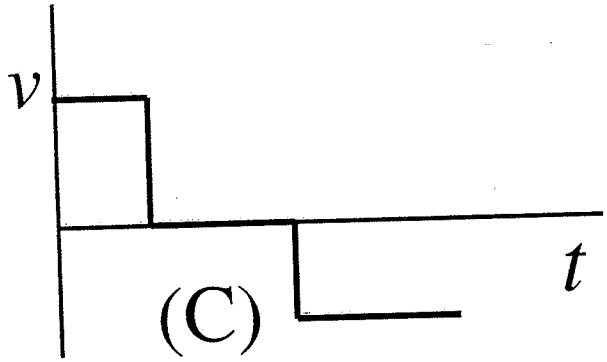




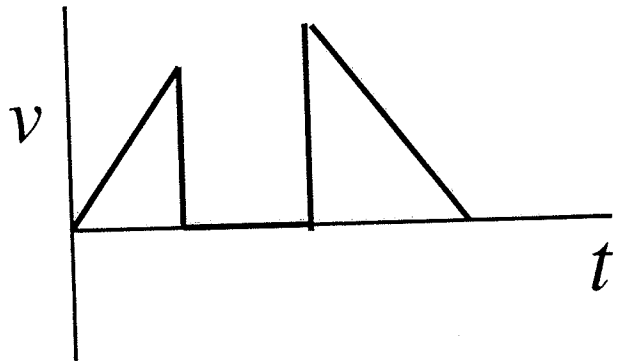
(A)



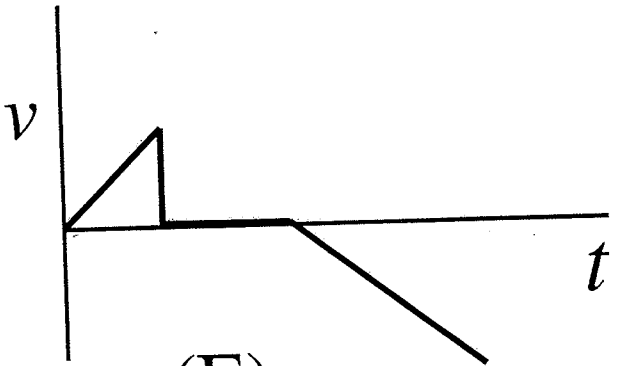
(B)



(C)



(D)



(E)