Theme 2
Mechanics

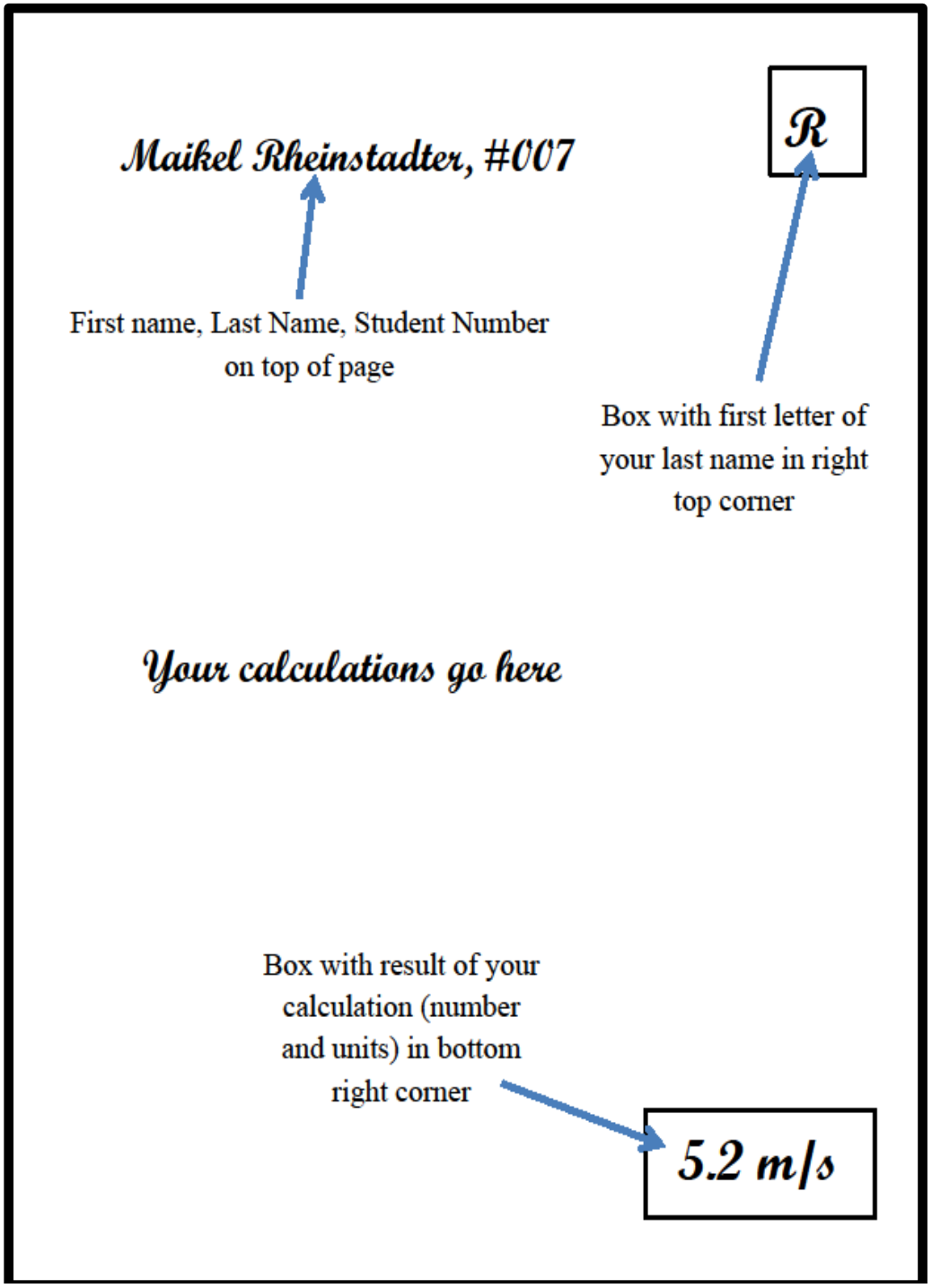
Module T2M1:
Kinematics

- New CAPA is up, homework quiz in a week (just like today)
  - One of the first 4 questions
- Today:
  - 1) homework quiz (total of 9 quizzes in semester based on 9 CAPA's). The CAPA's are for practice, the quiz is worth 5% of your grade.
  - 2) Module Clicker quiz as we have done the last weeks.
  - This will happen every week
- Next week on Friday is the MT everything up to and including Kinematics (i.e. lectures 1A/B…4A/B)

HOMEWORK!

LONCAPA Quiz 1

On your Desk, only a Pen or Pencil, Paper and Calculator



LONCAPA Quiz 1

Bicyclists in the Tour de France reach speeds of 28.7 miles per hour (mi/h) on flat sections of the road.

a) What is the speed in kilometers per hour (km/h)?

b) What is the speed in meters per second (m/s)?

NOTE: 1 Mile = 1609 m

Module Clicker Quiz!

Now that you have had a chance to review module T2M1, here is your

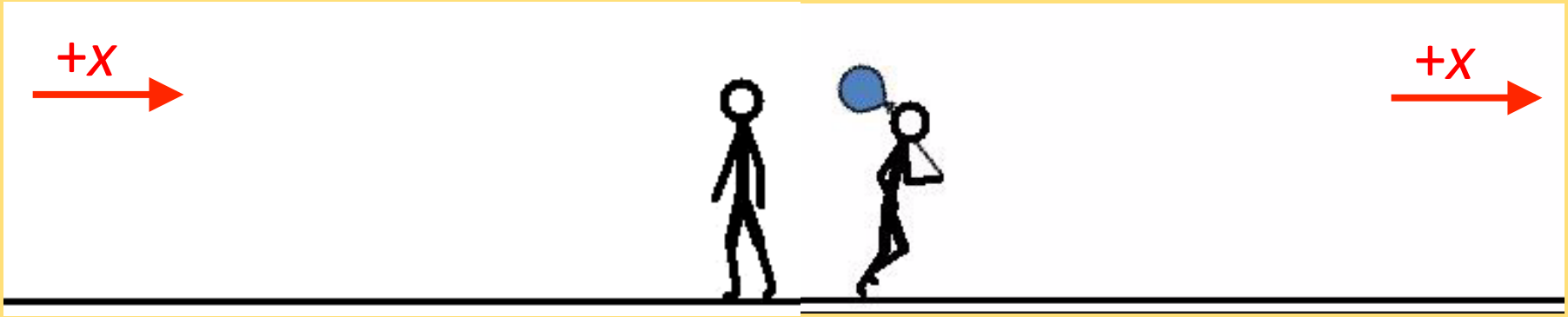
module quiz!

Module Clicker Quiz!

Direction of acceleration (120 seconds)

Person X
At rest then starts running

Person Y
Running, but comes to rest



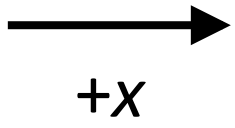
A. $a_X > 0$, $a_Y > 0$

B. $a_X < 0$, $a_Y > 0$

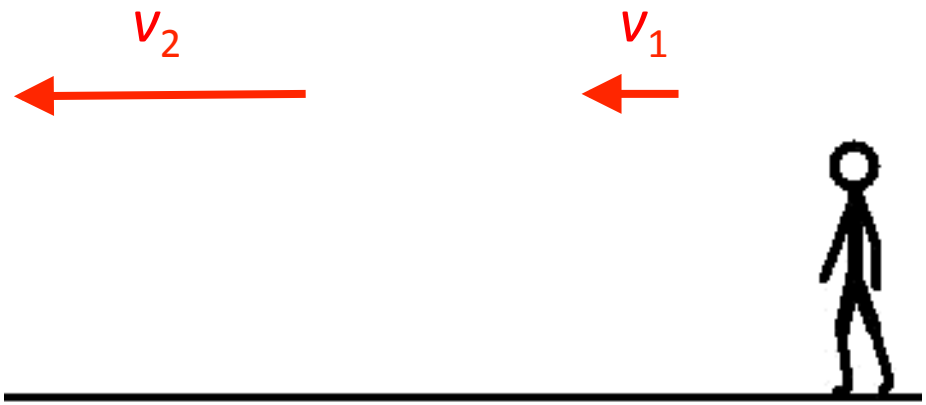
C. $a_X > 0$, $a_Y < 0$

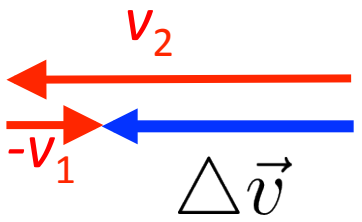
D. $a_X < 0$, $a_Y < 0$

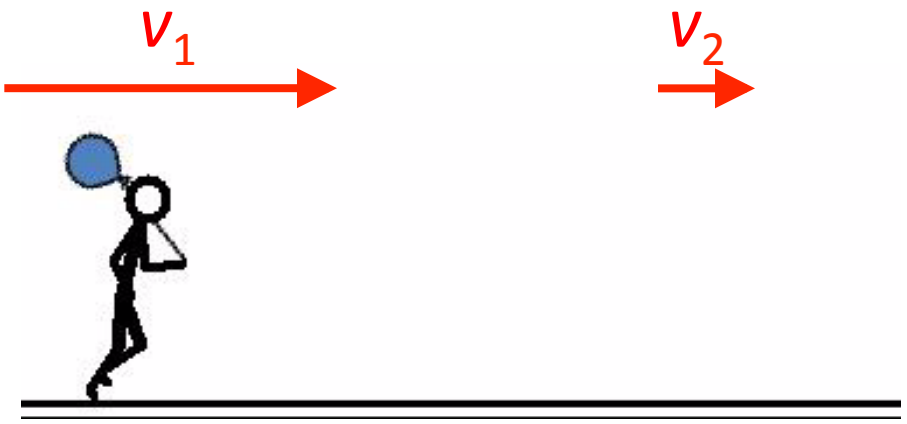
E. I don't know

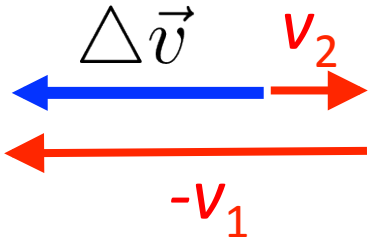


$$\vec{a}_{avg} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1}$$





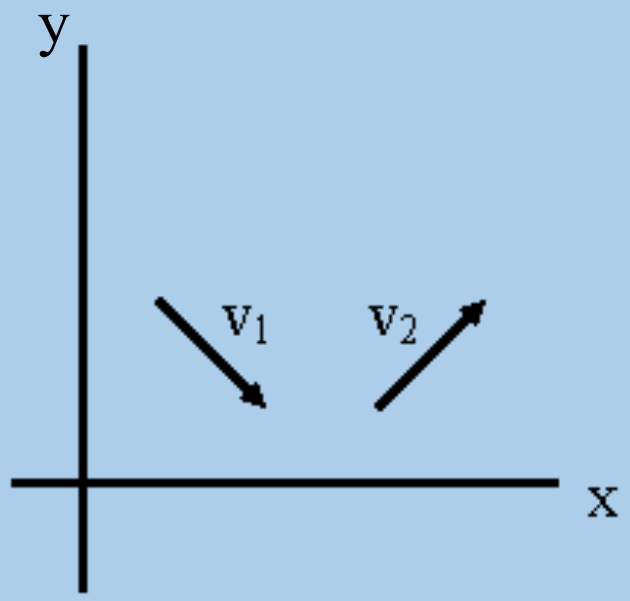




For both change in vel. is –ve
And acceleration is -ve

Clicker Quiz: 2D velocity

A particle is moving with constant acceleration. Its velocity vector at two different times is shown below. What is the direction of the acceleration?



A)

D) B)

C)

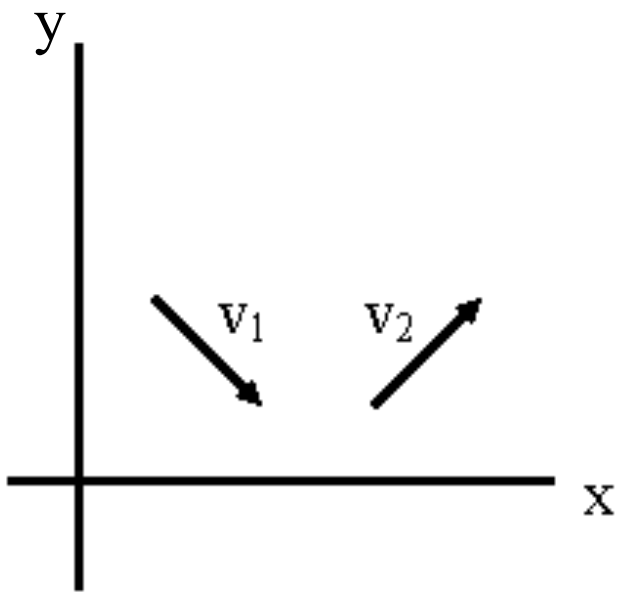
E) Some other direction

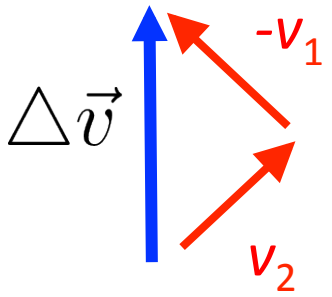
HINT: $$\vec{a}_{avg} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1}$$

Clicker Quiz: 2D velocity

A particle is moving with constant acceleration. Its velocity vector at two different times is shown below. What is the direction of the acceleration?

$$\vec{a}_{avg} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1}$$





Answer: A

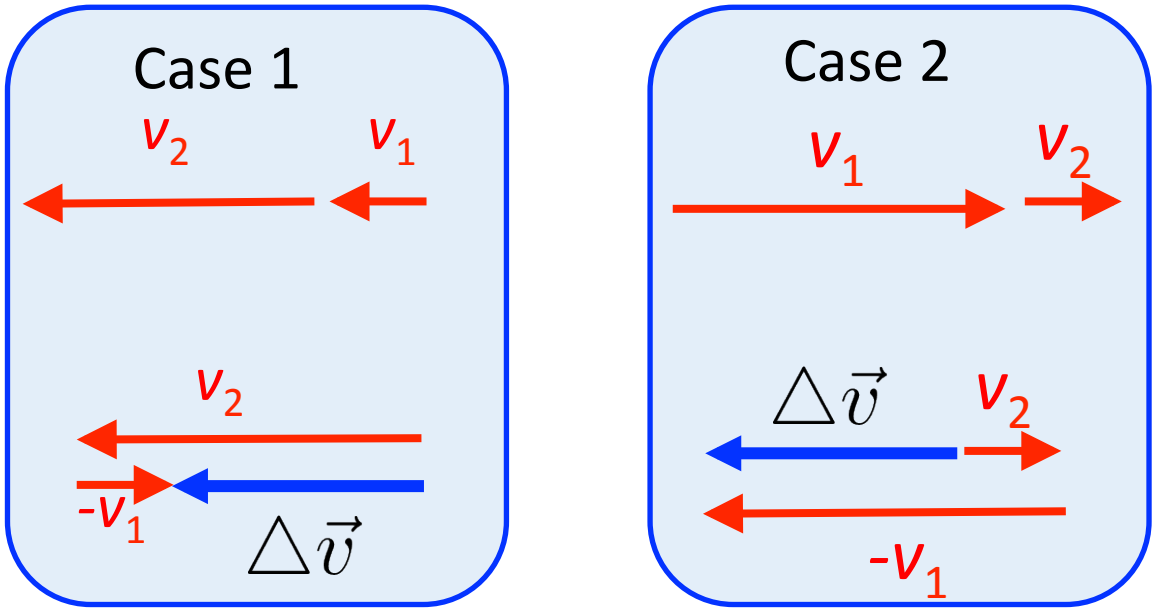
Misconceptions

1. velocity is constant then acceleration is also constant.

2. If an object moves with a high speed then its acceleration is high and if an object moves with a low velocity then the acceleration is low.

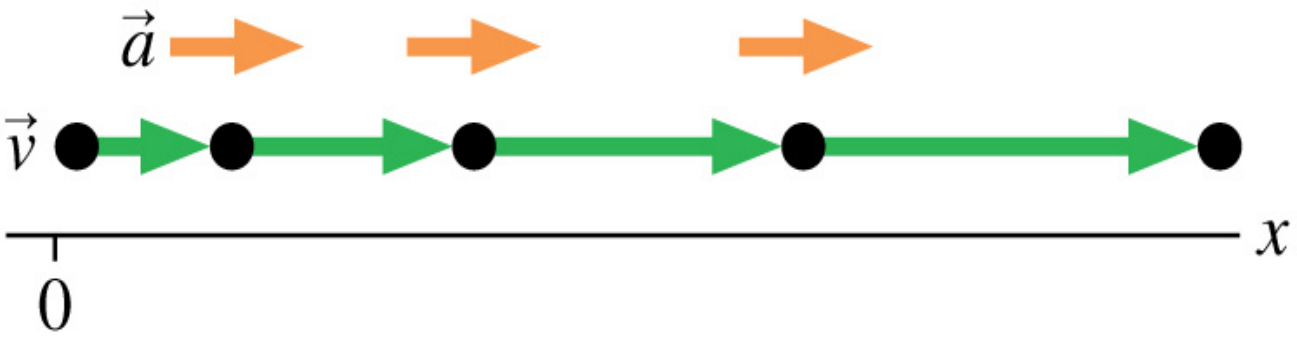
3. If the acceleration is positive than the object speeds up, and if the acceleration is negative then the object is slowing down.

4. What is negative acceleration?



Signs of position, velocity, acceleration

(a) Speeding to the right



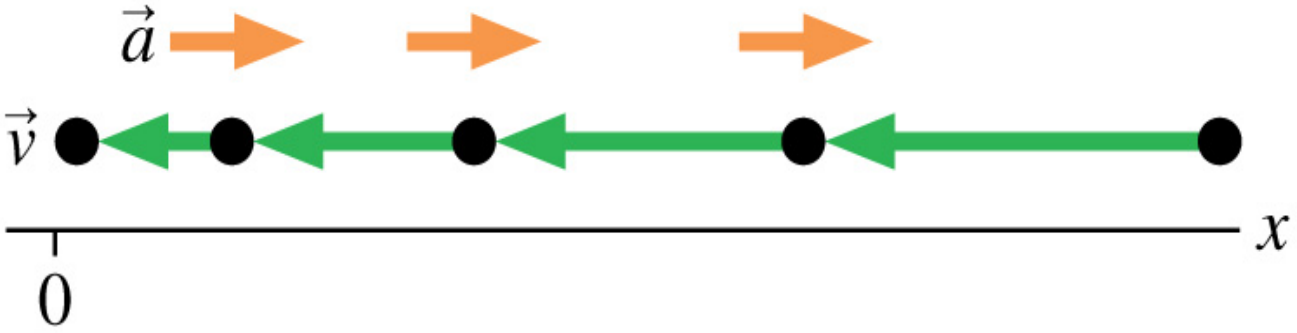
$x > 0$

$v > 0$

$\Delta v > 0$

$a > 0$

(b) Slowing down to the left



$x > 0$

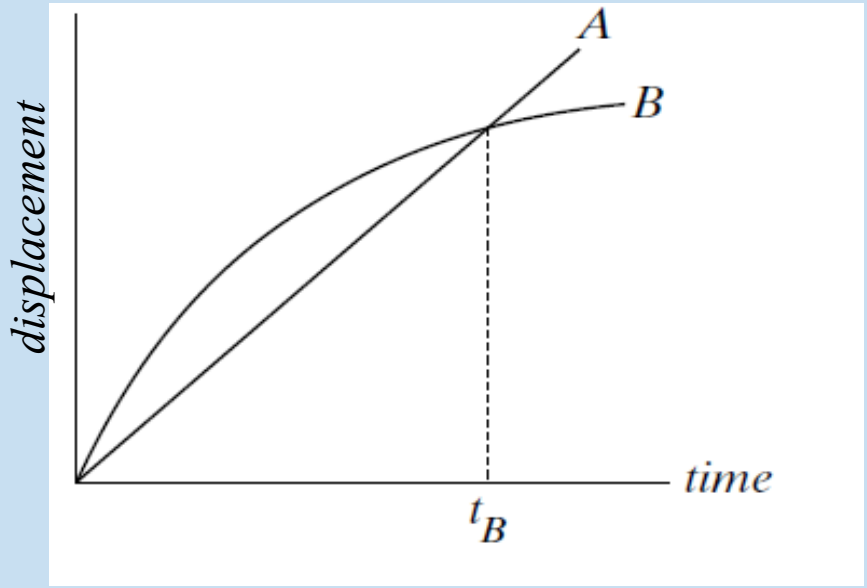
$v < 0$

$\Delta v > 0$

$a > 0$

Clicker Quiz: Recap x-t graphs

The graph shows displacement as a function of time for two trains running on parallel tracks. Which of the following is true?



a) At time t_B, both trains have the same velocity.

b) Both trains speed up all the time.

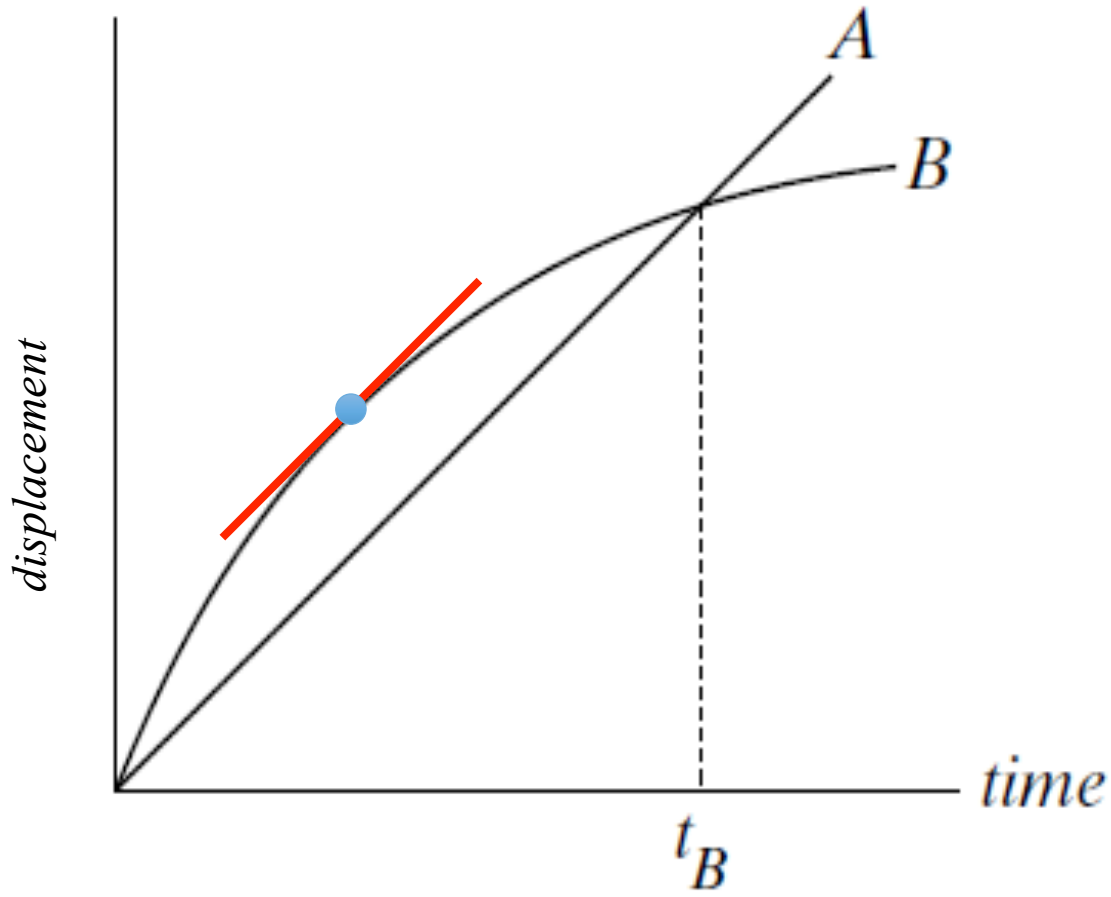
c) Both trains have the same velocity at some time before t_B.

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

e) None of the above statements is true.

Clicker Quiz: Recap x-t graphs

The graph shows displacement as a function of time for two trains running on parallel tracks. Which of the following is true?

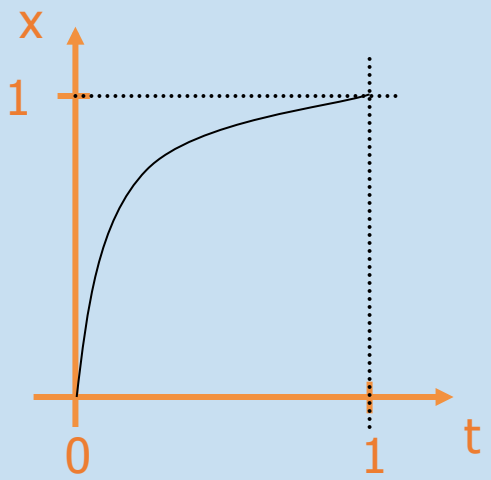


Answer: C Both trains have the same velocity at some time before t_B.

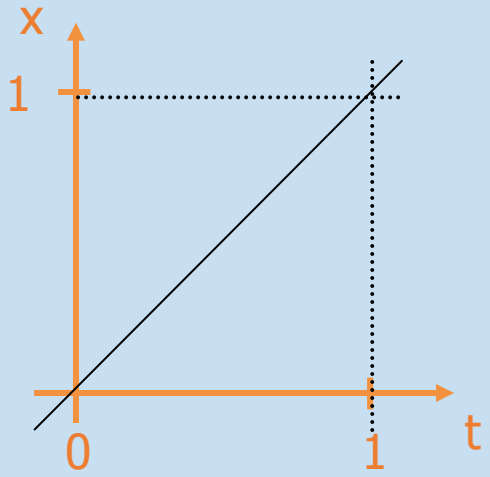
Clicker Quiz: Recap x-t graphs

Which of the motions described has the larger **average** velocity in the interval 0 s < *t* < 1 s?

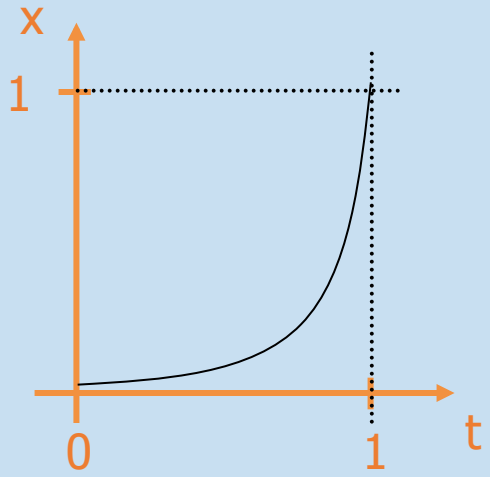
a)



b)



c)



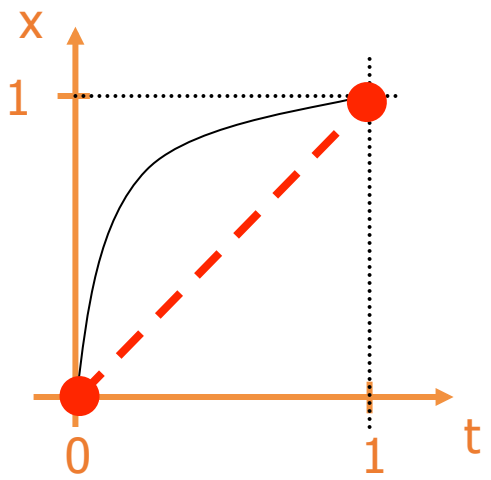
A) $v_a > v_b > v_c$.
B) $v_c > v_b > v_a$.
C) $v_b > v_a > v_c$.
D) $v_b > v_c > v_a$.
E) $v_a = v_b = v_c$.

Hint: $v_{ave} = \frac{x_2 - x_1}{t_2 - t_1}$

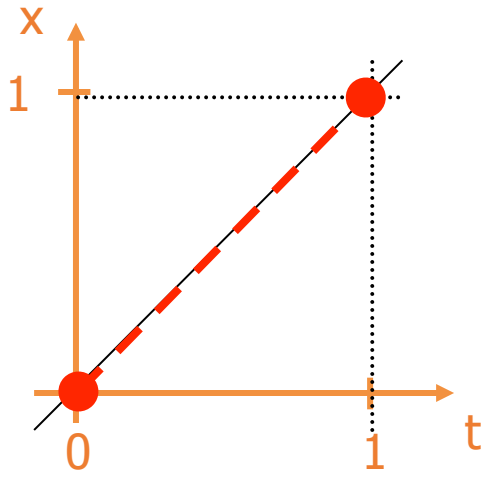
Clicker Quiz: Recap x-t graphs

Which of the motions described has the larger **average** velocity in the interval 0 s < *t* < 1 s?

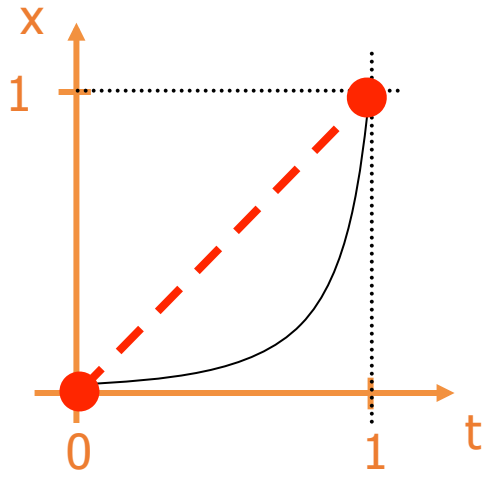
a)



b)



c)



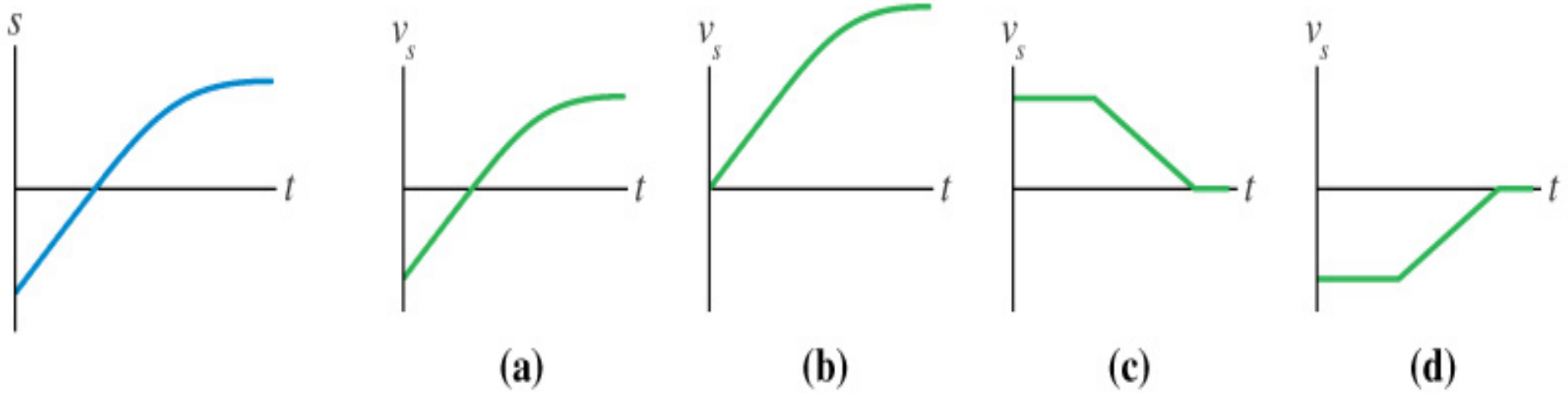
stop start

$$v_{ave} = \frac{x_2 - x_1}{t_2 - t_1}$$

Answer: E) $v_a = v_b = v_c$.

Clicker Quiz: Recap x-t graphs

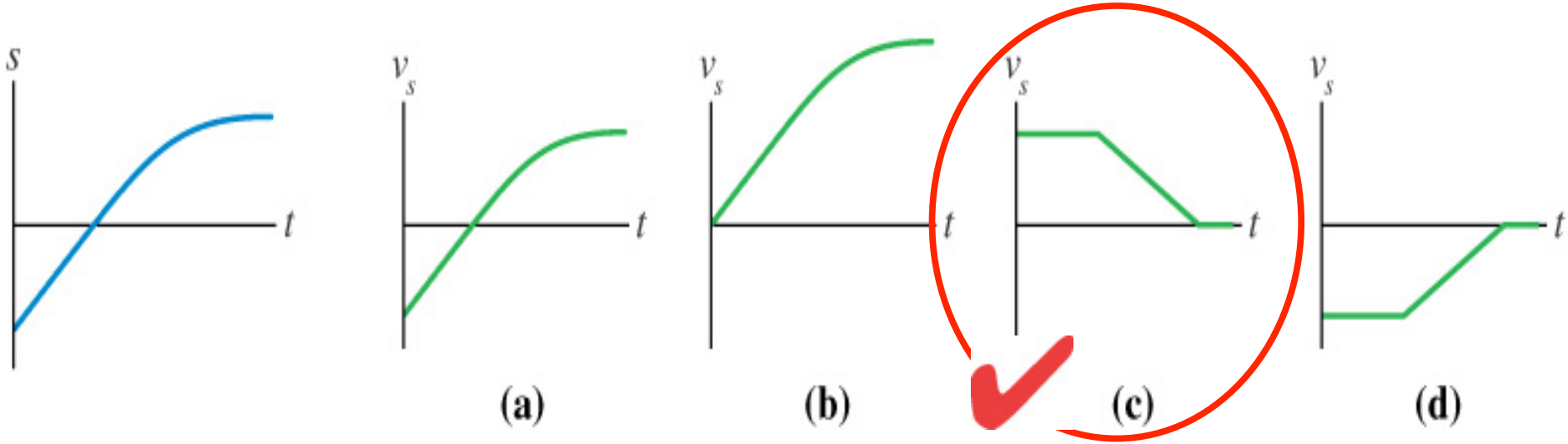
Which velocity-versus-time graph goes with this position-versus-time graph on the left?



Hint: do the pen test!

Clicker Quiz: Recap x-t graphs

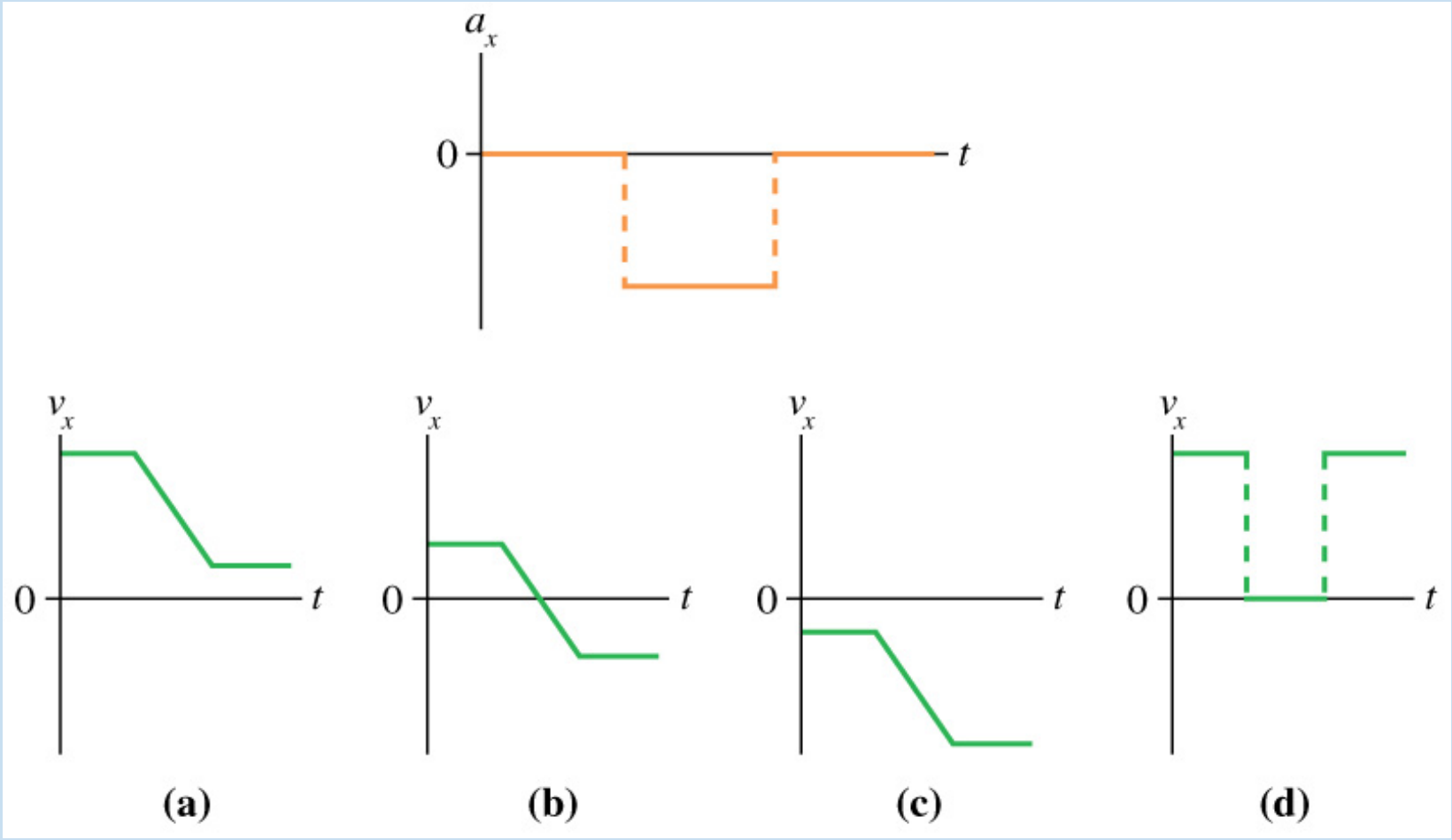
Which velocity-versus-time graph goes with this position-versus-time graph on the left?



Hint: do the pen test!

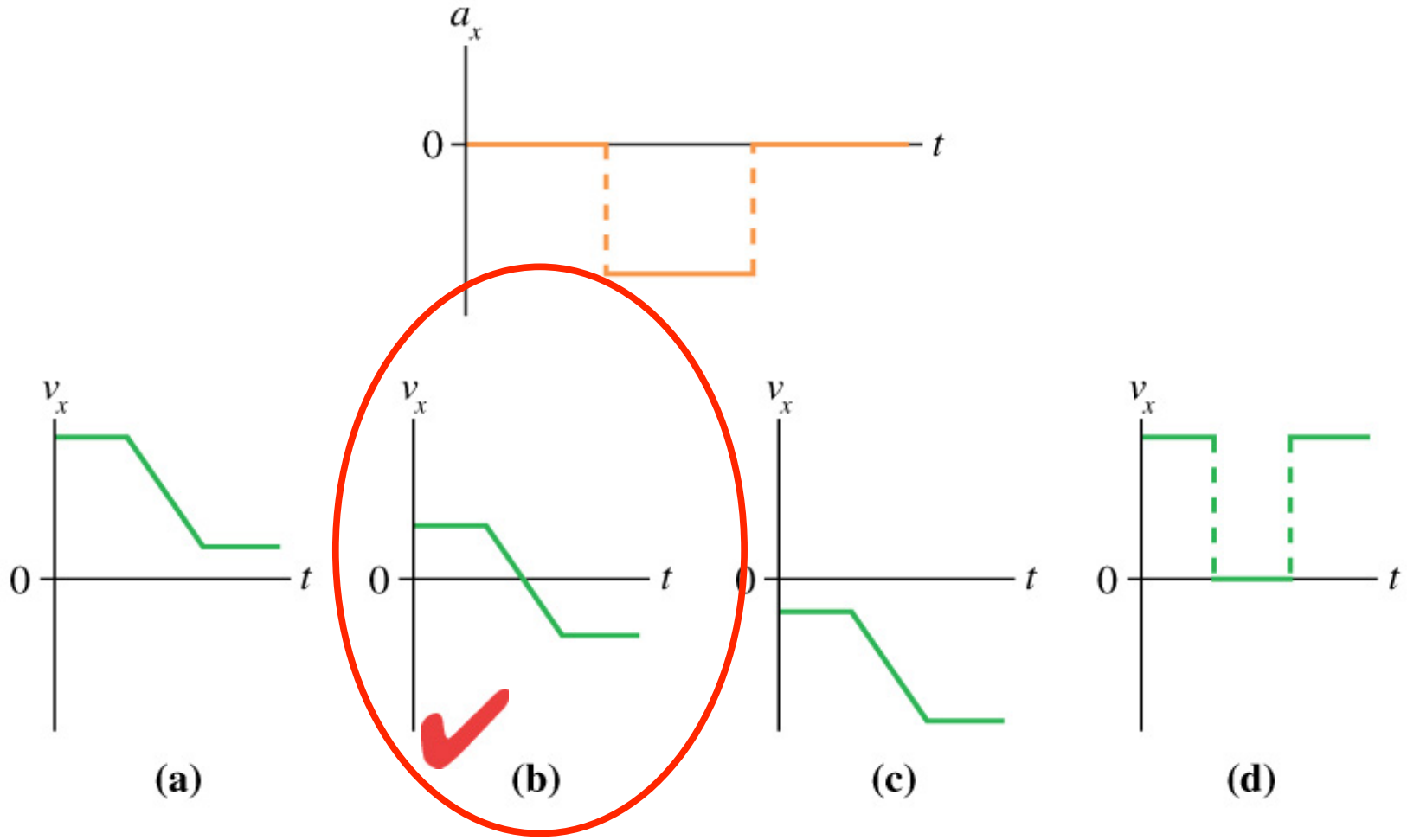
Clicker Quiz: a-t and v-t graphs

Which velocity-versus-time graph or graphs goes with this acceleration-versus-time graph? The particle is initially moving to the right and eventually to the left.



Clicker Quiz: a-t and v-t graphs

Which velocity-versus-time graph or graphs goes with this acceleration-versus-time graph? The particle is initially moving to the right and eventually to the left.



Kinematic equations of motion

constant *a*

$$v_f = v_i + a\Delta t$$

$$x_f = x_i + v_i\Delta t + \frac{1}{2}a\Delta t^2$$

$$v_f^2 = v_i^2 + 2a \cdot (x_f - x_i)$$

$$(x_f - x_i) = \frac{v_i + v_f}{2} \cdot \Delta t$$

$$\Delta x = x_f - x_i$$

a = 0

$$v_i = v_f$$

$$x_f = x_i + v\Delta t$$

What you need for every kinematics problem

$a =$

$v_i =$

$v_f =$

$\triangle x =$

$\triangle t =$