ABRHS Physics (CP) Name: KEY

Acceleration Problems with Graphs

1. A bicyclist has an initial velocity of 2 m/s. Over 12 seconds, it speeds up to 8 m/s.
   a. What was the accleration of the bicylclist?

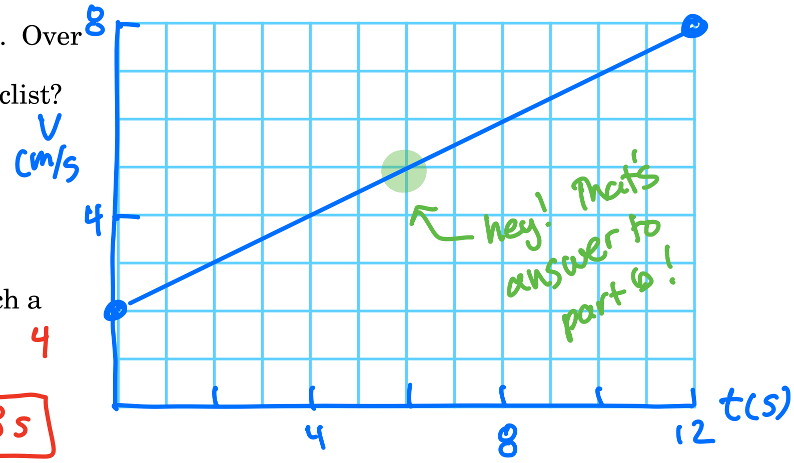
$v_i = 2$ m/s, $t = 12$ s, $v_f = 8$ m/s

$a = \frac{v_f - v_i}{t} = \frac{8-2}{12} = \frac{1}{2}$ m/s²

   b. How many seconds did it take to reach a velocity of 6 m/s?

Now $v_f = 6$ m/s

$a = \frac{v_f - v_i}{t}$, $0.5 = \frac{6-2}{t}$, $(0.5)t = 4$, $t = 8$ s



   c. Make a correct velcocity vs time graph for this motion.

   d. From the graph, how could you determine the acceleration?

The slope of the velocity graph is the acceleration

2. Another bicylclist has an initial velocity of 16 m/s. They slow down to 4 m/s, in a time of 6 seconds.
   a. What was the acceleration of the bicylclist?

$v_i = 16$ m/s, $v_f = 4$ m/s, $t = 6$ s

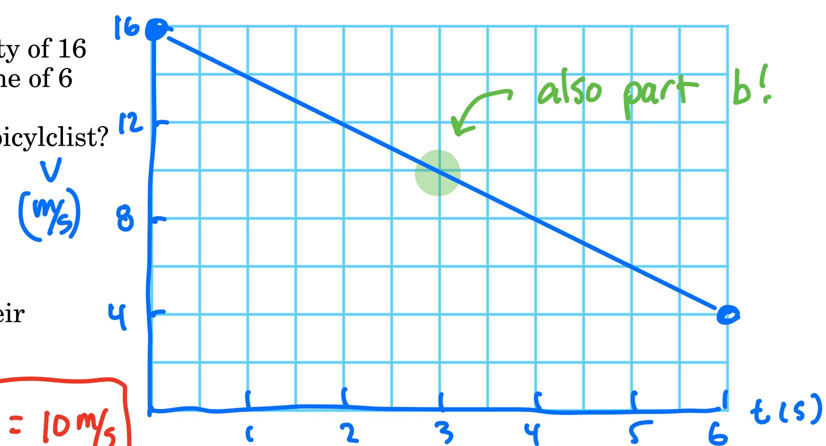
$a = \frac{v_f - v_i}{t} = \frac{4-16}{6} = -2$ m/s²

   b. After only 3 seconds, what was their velocity?

Now, $t = 3$

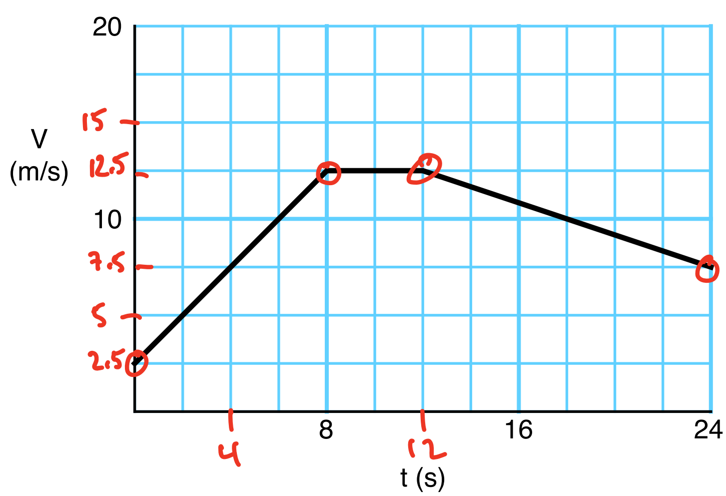
$a = \frac{v_f - v_i}{t}$, $-2 = \frac{v_f - 16}{3}$, $-6 = v_f - 16$, $v_f = 10$ m/s

   c. Make a correct ~~position~~ velocity vs time graph for this motion.



3. The velocity vs time graph of something is shown to the right.
   a. Describe the motion. (No calculations needed.)

Speeds up from 2.5 m/s to 12.5 m/s in 8 seconds. Then it has a constant velocity for 4 seconds. Then it slows down to 7.5 m/s in 12 seconds.



   b. What is the acceleration during the first 8 seconds?

It is the slope of the line!

$v_f = 12.5$ m/s, $v_i = 2.5$ m/s, $t = 8$ s

$a = \frac{v_f - v_i}{t} = \frac{12.5 - 2.5}{8} = \frac{10}{8} = 1.25$ m/s²

Acceleration Problems with Graphs

c. What is the acceleration between 8 and 12 seconds?

Slope is 0 so $0\ m/s^2$

d. What is the acceleration for the last 12 seconds?

it's just the slope of the last ½ of the graph!

$v_f = 7.5$ s $t = 12$ s
$v_i = 12.5$ s

$a = \frac{v_f - v_i}{t} = \frac{7.5 - 12.5}{12} = \frac{-5}{12} = -0.42\ m/s^2$

e. What was the maximum speed of the object?

12.5 m/s

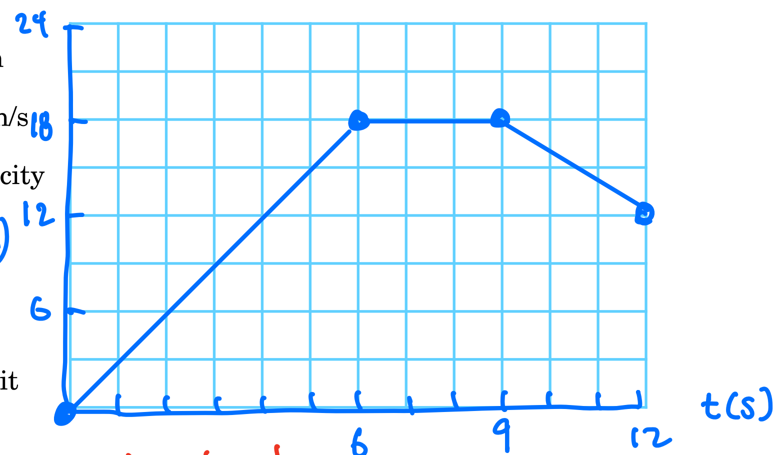
f. When did the object have a velocity of 0? (*Be careful!*)

Never! (The slowest was 2.5 m/s @ t = 0.)

6. When is the object the farthest away from its original position? (You don't know how to calculate this, but just think about what the graph means.)

At the very end! It was always moving with a positive velocity.

4. Starting from rest, a car has a constant acceleration of 3 mph/s for 6 seconds. It then has a constant speed for the next 3 seconds. Then it has a constant acceleration of –2 mph/s for the next 3 seconds.



a. After the first 6 seconds, what is the velocity of the car?

$v_i = 0\ m/s$
$a = 3\ \frac{mph}{s}$
$t = 6$ s

$a = \frac{v_f - v_i}{t}$ $3 = \frac{v_f - 0}{6}$ $v_f = 18$ mph

b. What is the acceleration of the car while it has a constant speed?

0! It is not speeding up or slowing down!

c. What was the velocity of the car after the last 3 seconds?

$v_i = 18$ mph
$a = -2$ mph/s
$t = 3$ s

$a = \frac{v_f - v_i}{t}$ $-2 = \frac{v_f - 18}{3}$ $-6 = v_f - 18$ $v_f = 12$ mph

d. Make an appropriate ~~position~~ velocity vs time graph for this motion.

Answers:

1. a) 0.5 m/s² b) 8 s d) the slope of the velocity line is the acceleration

2. a) –2 m/s² b) 10 m/s 3. b) 1.25 m/s² c) 0 m/s² d) –0.417 m/s² e) 12.5 m/s

f) never g) t = 24 s 4. a) 18 mph b) 0 mph/s c) 12 mph