ABRHS PHYSICS (CP) NAME: KEY

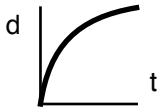
Velocity & Acceleration

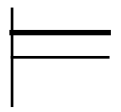
1. Velocity tells you how quickly position changes and is the slope of a position vs time graph.
   ← could say distance also
2. Acceleration tells you how quickly velocity changes and is the slope of a velocity vs time graph.
3. From the list of units below, circle all that are velocity and underline all that are acceleration.

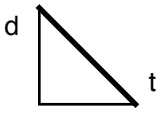
   m m/s kg/m cm/s km/h/s m/s² mph s/m m/s/s m²/s s kg

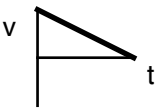
   kg/s kg•m/s² s²/m mile/min km/yr kph mph/s

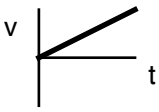
4. Which of the following graphs could show something that has a constant velocity?

   a. 

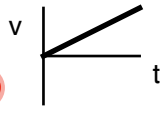
   b. 

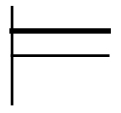
   c. 

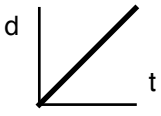
   d. 

   e. 

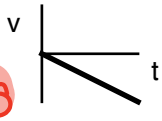
5. Which of the following graphs could show something that has a constant acceleration?

   a. 

   b. 

   c. 

   d. 

   e. 

   b is a constant acceleration of zero

6. There are three terms that often get confused: *constant speed*, *constant velocity* and *constant acceleration*. Explain what each means so that one of your confused friends could understand.

7. What is your speed for each of the following situations?
   a. You travel 100 miles in 2 hours.

   $v = \frac{d}{t} = \frac{100}{2} =$ 50 mph

   b. You move 3 meters every second for 5 seconds.

   3 m/s ← That is the velocity! The "5 seconds" is just a distraction!

   c. You stand still 10 meters away from your friend for 20 seconds.

   $v = \frac{d}{t} = \frac{0}{20} =$ 0 m/s

   d. Starting 5 meters away from a friend, you end up 20 meters away from them after 3 seconds.

   $d = 20 - 5 = 15$ m $\quad v = \frac{d}{t} = \frac{15}{3} =$ 5 m/s

Velocity & Acceleration

8. What is your acceleration for each of the following situations?
   a. You are speeding up at a constant rate of 3 m/s/s.

$3\ m/s^2$ ← that is acceleration!

   b. You have a constant speed of 30 mph for 5 seconds.

$0\ m/s^2$ ↑ a distraction!

   c. You slow down 15 mph in 3 seconds.

$a = \frac{\Delta v}{t} = \frac{-15}{3} = -5\ \frac{mph}{s}$

   d. You speed up from 5 m/s to 25 m/s in 8 seconds.

$v_i = 5\ m/s \quad t = 8s$
$v_f = 25\ m/s$

$a = \frac{v_f - v_i}{t} = \frac{25-5}{8} = 2.5\ m/s^2$

   e. You have a constant velocity of 12 m/s for 4 seconds.

$0\ m/s^2$

   f. You speed up 8 m/s every second for 2 seconds.

$8\ m/s^2$

9. Kahwi speeds up from 10 mph to 25 mph in 3 seconds. Kevin speeds up from 20 mph to 35 mph in 4 seconds.
   a. Who had the bigger final velocity? Show your work.

Since 35 mph > 25 mph, Kevin has biggest v_f

   b. Who had the bigger change in velocity? Show your work.

Kahwi: 10 → 25 $\quad \Delta v = +15$ mph
Kevin: 20 → 35 $\quad \Delta v = +15$ mph
the same! both +15 mph

   c. Who had the bigger acceleration? Show your work.

Kahwi $a = \frac{\Delta v}{t} = \frac{15}{3} = 5\ \frac{mph}{s}$ Kevin: $a = \frac{15}{4} = 3.75\ \frac{mph}{s}$

10. Starting at 10 mph, Jayson has a change in velocity of 30 mph that took 4 seconds. Starting from 15 mph, Jaylan has a change in velocity of 20 mph in 2 seconds.
   a. Who had the bigger final velocity? Show your work.

Jayson: 10 mph + 30 mph = 40 mph
Jaylan: 15 mph + 20 mph = 35 mph

   b. Who had the bigger change in velocity? Show your work.

30 > 20 so Jayson

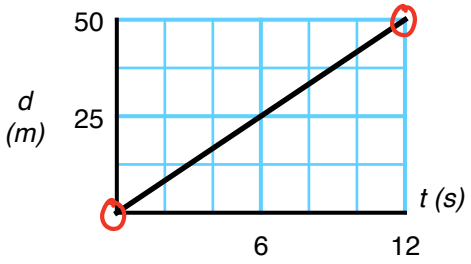
Velocity & Acceleration

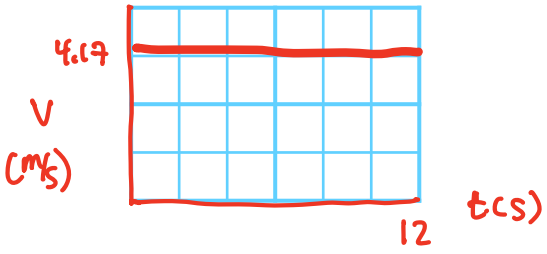
c. Who had the bigger acceleration? Show your work.

Jayson $a = \frac{\Delta v}{t} = \frac{30}{4} = 7.5 \frac{mph}{s}$

Jaylan: $a = \frac{20}{2} = 10 \frac{mph}{s}$

11.





a. Is this a constant velocity or a constant acceleration?

constant velocity

b. Where is the object at t = 6?

d = 25 m

Note: constant velocity motion, so the "t = 8" doesn't matter.

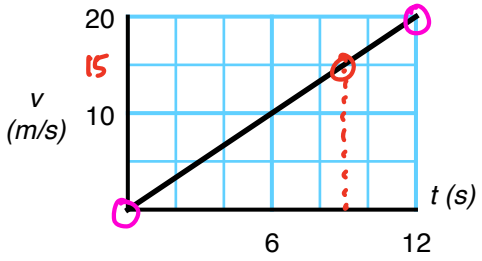
c. How fast is the object going at t = 8?

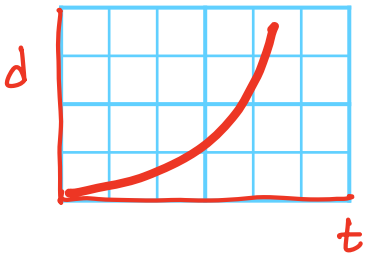
The slope is the velocity, so $\frac{50-0}{12-0} = 4.17$ m/s

d. Make the velocity vs time graph that goes with this motion.

(see above)

12.





a. Is this a constant velocity or a constant acceleration?

constant acceleration

b. What time is the object moving at 15 m/s?

t = 9 sec. ($\frac{1}{2}$ way between 6 & 12)

c. What is its acceleration at t = 4?

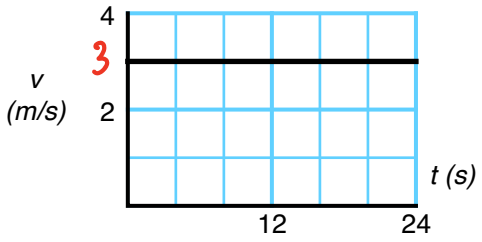
just the slope of the line. (t=4 doesn't matter b/c its constant acceleration)

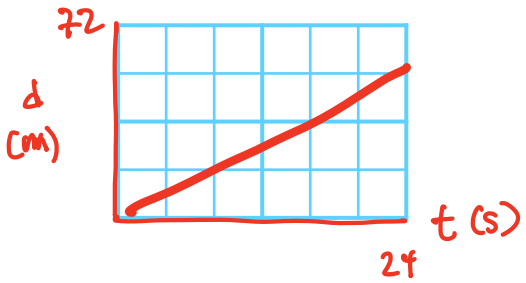
a = slope = $\frac{20-0}{12-0} = 1.67$ m/s^2

Velocity & Acceleration

d. Sketch the *shape* of the position vs time graph that would go with this motion. (You don't know how to calculate the numbers at this point.)

13.





a. Is this a constant velocity or a constant acceleration?

b. What is the initial velocity of the object?

3 m/s (from graph

$d = vt = (3)(24)$

$d = 72$ m

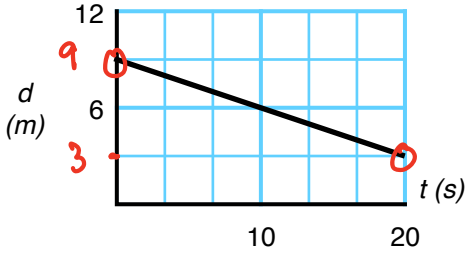
(Need to figure out how far it went.)

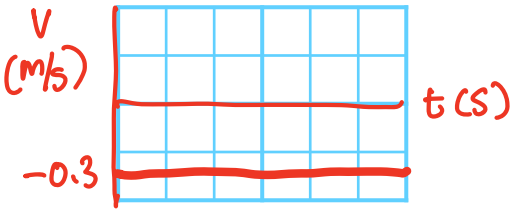
c. What is its acceleration at t = 15 seconds?

a = slope of velocity = 0 m/s^2

d. Make the position vs time graph that goes with this motion. (Call the initial position 0.)

14.





a. Is this a constant velocity or a constant acceleration?

b. What is the final position of the object?

3 m

c. What is the velocity of the object going at t = 8?

v = slope of position = $\frac{3-9}{20-0} = \frac{-6}{20} =$ -0.3 m/s

d. Make the velocity vs time graph that goes with this motion.