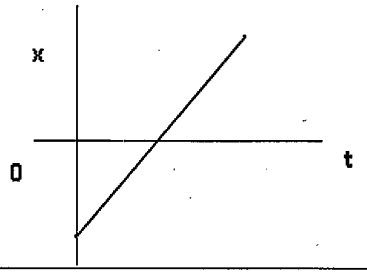
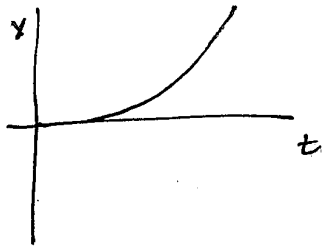
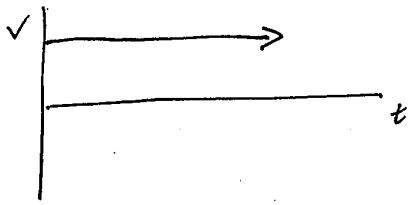
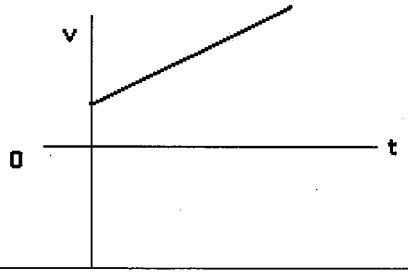
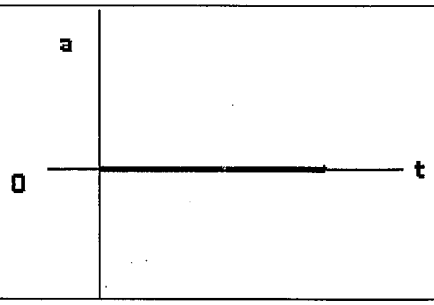
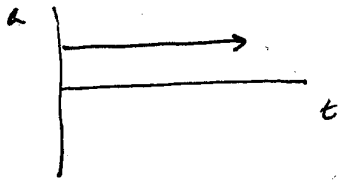
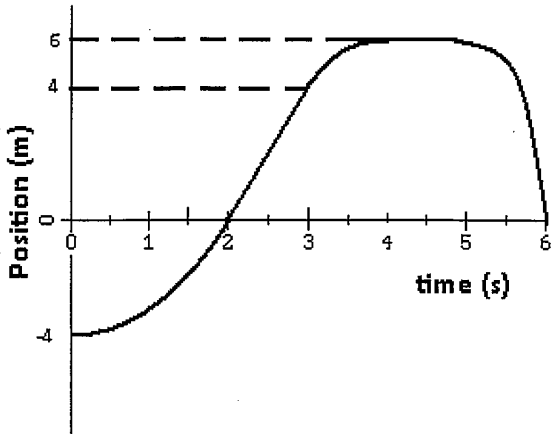
KEY

Motion graphing practice packet **Name:**_____

Summary of Motion (So Far…)

Describe the motion	Motion with constant velocity	Motion with constant acceleration
In words, provide an example	Objects velocity stays constant as a ball rolls along a table	The object's velocity is increasing by the same amount every second- for example a ball rolling down a smooth track tilted at an angle.
Draw a x-t graph		
Mathematical equation of x(t)	$\Delta x = At$ $x = v_0 t + x_0$	$\Delta x = At^2$ $x = \frac{1}{2}at^2 + v_0 t + x_0$

Describe the motion	Motion with constant velocity	Motion with constant acceleration
With a v-t graph		
Mathematical equation of v(t)	*v=const*	$V = At$
Draw an a-t graph		
Mathematical equation of a(t)	$a = 0$	*a=const*



1. Find the average velocity between 3 and 4 seconds.

$\bar{v} = \frac{x_f - x_0}{t} = \frac{6-4}{2} = \frac{2}{2} = 1$

2. Show how you would find the instantaneous velocity at 2 seconds.

Slope at $t=2$

3. List the region(s) where the velocity is positive.

@ ~~posi~~ times 0 to 4 and 5 to 6

4. List the region(s) where the velocity is negative.

t 5 to 6

5. List the region(s) where the object is speeding up.

t from $0_s - 3_s$ and 5 to 6

6. List the region(s) where the object is slowing down.

t $3_s - 4$

7. List the region(s) where the object is not moving.

$4_s - 5_s$

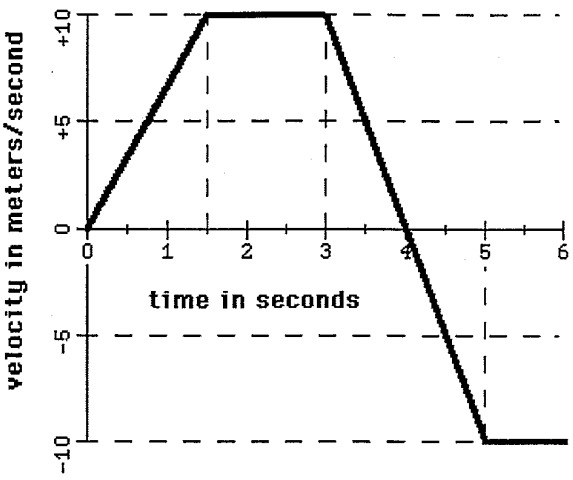
8. List the region(s) where the acceleration is positive.

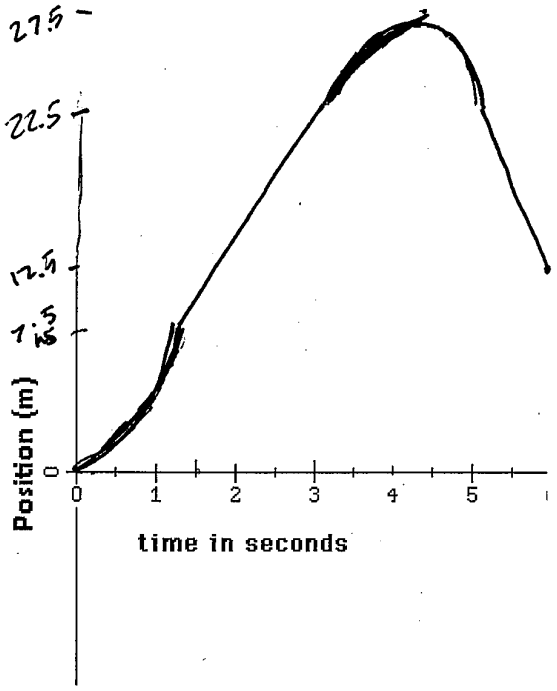
0 to 3

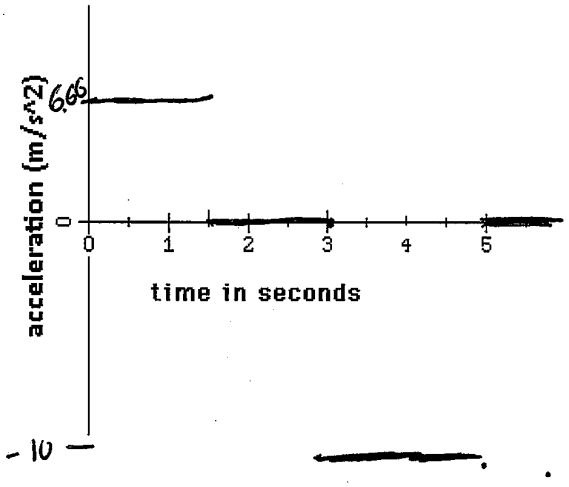
9. List the region(s) where the acceleration is negative.

3 to 6

Additional Problems: Motion Graphs







1. Above, draw the x-t graph.
2. Right, draw the a-t graph.
3. List all the region(s) where the object is speeding up. 0 - 1.5s
4. List all the region(s) where the object is slowing down. 4s - 5s
5. At the beginning which way is the object moving?

   Positive

6. List the region(s) where the acceleration is in the positive direction.

   0 - 1.5s

7. List the region(s) where the acceleration is in the negative direction.

   3 - 4s

8. List the region(s) where the object has no acceleration.

   1.5 - 3s, 5 - 6s

9. What time(s) is the object at rest? 0s, 4s
10. What is the displacement of the object over the first 4 seconds? Over the entire 6 seconds?

4s: $\frac{10 \cdot 1.5}{2} = 7.5$, $10 \cdot 1.5 = 15$, $\frac{10 \cdot 1}{2} = 5$ → 27.5m

6s: $\frac{-10 \cdot 1}{2} = -5$, $-10 \cdot 1 = -10$ → -15

+27.5m

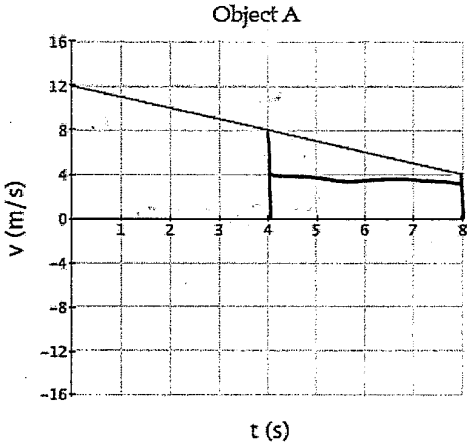
27.5 - 15 = 12.5m

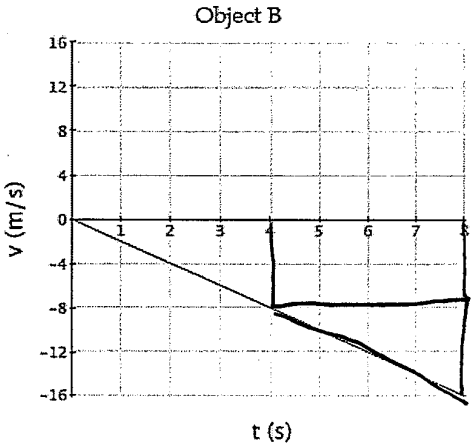
A: Object is moving @ 12 m/s in the positive direction and ~~begins~~ slows to 4 m/s over 8 s

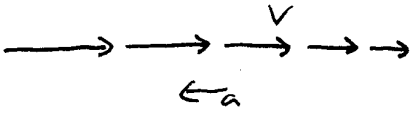
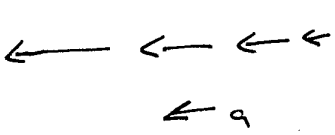
B: Object is at rest and begins moving in the negative direction until it reaches -16 m/s over 8 s

Graphs of Motion with Changing Velocity

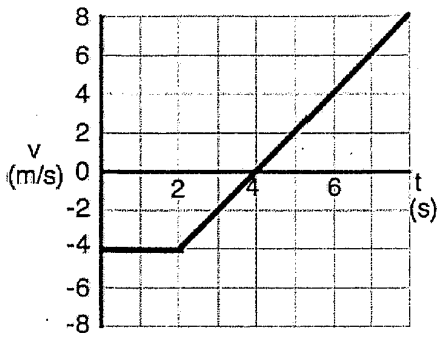
1. Consider the velocity-vs-time graphs and describe the motion of the objects.





	Object A	Object B
Determine the displacement between 4 and 8 seconds. Show work!	$(8-4)4 = 16$ $\frac{(8-4)4}{2} = 8 +$ $\boxed{24\text{ m}}$	$(8-4)\cdot 8 = -32\text{ m}$ $\frac{(8-4)\cdot -8}{2} = -16\text{ m}$ $(8-4)\cdot -8 =$ -48 m
Determine the average acceleration during the first 3 seconds. Show work!	$\frac{-12\text{ m/s}}{8\text{ s}} = -\frac{3}{2}\text{ m/s}^2$	$\frac{-16\text{ m/s}}{8\text{ s}} = -2\text{ m/s}^2$
Describe the motion in words.	object slows from 12 m/s to 4 m/s over 8 seconds	object speeds up from 0 m/s to -16 m/s over 8 seconds
Sketch a motion map. Be sure to include both velocity and acceleration vectors.		

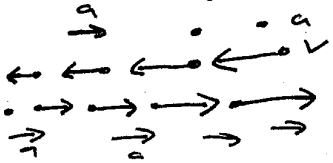
2. Use the velocity-vs-time graph to analyze the motion of the object.



a. Give a written description of the motion.

- Moves @ 4 m/s away from O for 2 secs
- Slows to a stop for 2 secs
- Speeds up from a stop going back away from O for 4 sec

b. Sketch a motion map. Be sure to include both velocity and acceleration vectors.



c. Determine the displacement of the object from $t = 0$ s to $t = 4$ s.

$-4 \cdot 2s = -8m$ = displacement

$+ \frac{-4 \cdot 2s}{2} \quad -4m$

d. Determine the displacement of the object from $t = 4$ s to $t = 8$ s.

$\frac{-2 \cdot 4}{2} = -4m \quad -2m$

$\frac{8 \cdot 4}{2} = 16m$

displacement: $-2m + 16m = 14m$

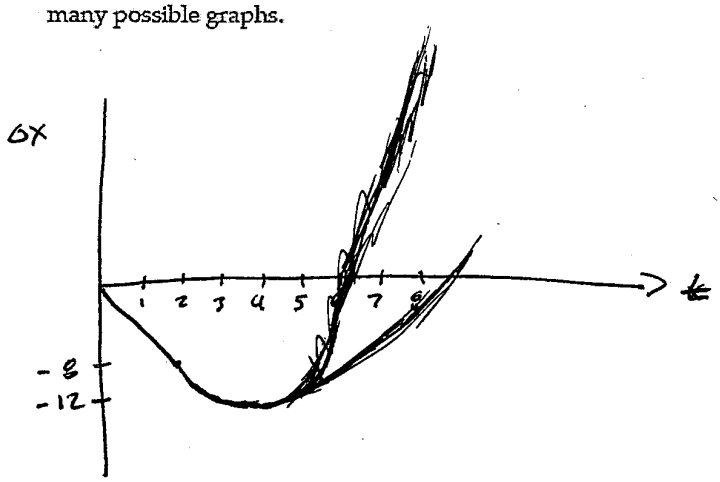
e. Determine the displacement of the object from $t = 2$ s to $t = 6$ s.

O areas cancel

f. Determine the object's acceleration at $t = 4$ s.

$\frac{\text{Rise}}{\text{Run}} = \frac{2\ m/s}{1s} = 2\ m/s/s$

g. Sketch a possible position-vs-time graph for the motion of the object. Explain why your graph is only one of many possible graphs.



Crosses x axis when displacement = 0