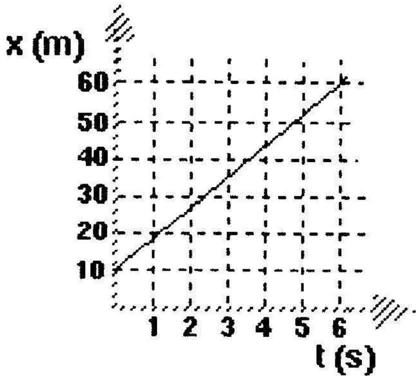
Name______________________________

Date__________ Pd____

Constant Velocity Particle Model:
Review Sheet

1. Consider the following position vs. time graph.



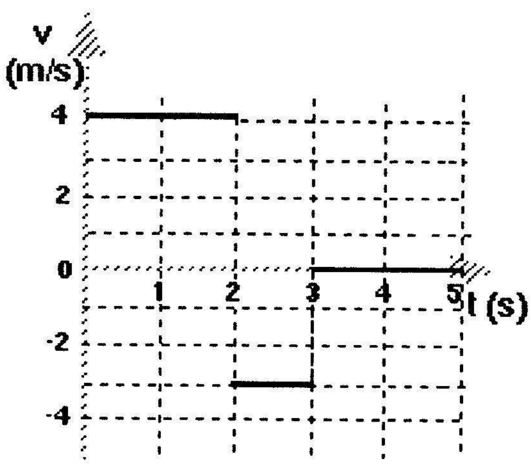
a. Determine the average velocity of the object.

8.33 m/s

b. Write a mathematical model to describe the motion of the object.

$S = 8.33 \frac{m}{s}(t) + 10\ m$

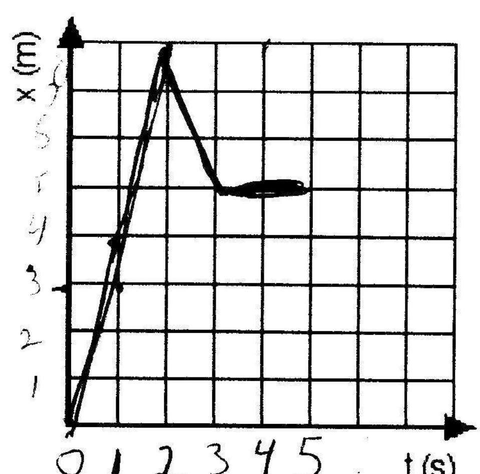
2. Shown below is a velocity vs. time graph for an object.



a. Describe the motion of the object.

0-2 sec → Forward @ 4 m/s
2-3 sec → Reverse @ 3 "
3-5 s → stopped

b. Draw a corresponding position vs. time graph. Number the axes. You may assume the object starts from the origin.



c. How far did the object travel in the interval t =1s to t =2s?

~~5~~ 4 m

d. Find the displacement from t = 0s to t = 5 s. Explain how you got your answer.

+5 m

Read S @ 5 s
S @ 0 s
start
$S_5 - S_0$

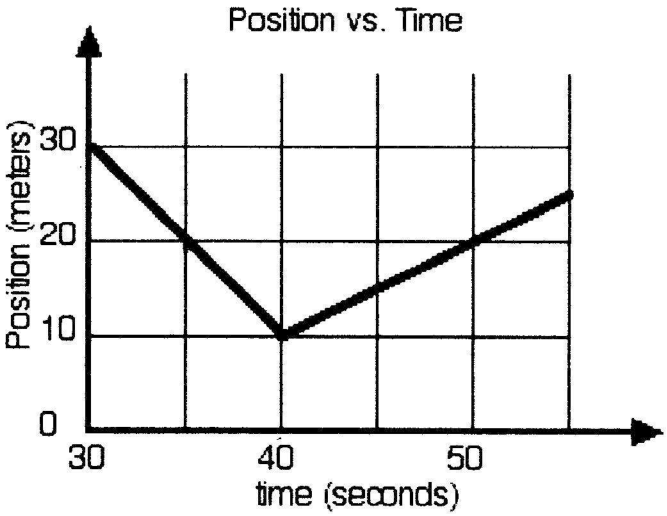
e. Find the average velocity from t = 0s to t = 5 s. Explain how you got your answer.

$\vec{V} = \frac{\Delta S}{t} = \frac{5 m}{5 s} = 1 m/s$

f. Find the average speed from t = 0s to t = 5 s. Explain how you got your answer.

Odometer reading = 8 m + 3 m to = $\frac{11 m}{5 s}$ = 2.2 m/s

3. A bird travels toward the origin, then suddenly reverses direction.



a. Find the average velocity from t = 30s to t = 40s.

10 m − 30 m = $\frac{-20 m}{10 s}$ = −2 m/s

b. Find the average velocity from t = 40s to t = 50s.

$\frac{20 m - 10 m}{10 s}$ = 1 m/s

c. Determine the average speed from t = 30s to t = 50s.

20 m + 10 m = $\frac{30 m}{20 s}$ = 1.5 m/s

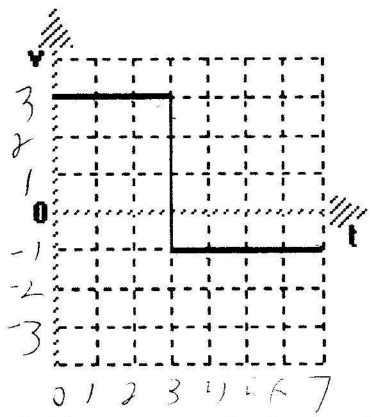
d. Determine the average velocity from t = 30s to t = 50s.

20 m − 30 m = −10 m $\frac{-10 m}{20 s}$ = −0.5 m/s

e. Find the velocity at t = 35 seconds.

−2 m/s

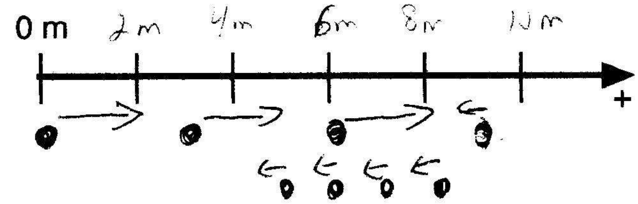
4. A basketball initially travels at 3 meters per second for 3 seconds:



a. Describe the motion of the ball after t = 3 seconds.

It travels in the opposite direction at a speed of 1m/s for 4 s (velocity = -1 m/s)

b. Draw a quantitative motion map that models the motion of the object.



c. How far did the ball travel from t = 3s to t = 7s?

4m

5. A racecar reaches a speed of 95 m/s after it is 450 meters past the starting line. If the car travels at a constant speed of 95 m/s for the next 12.5 s, how far will the car be from the starting line? Use the appropriate mathematical model and show how units cancel.

Givens: $s_0 = 450m$ Unknown = s

$\bar{v} = 95\ m/s$

$t = 12.5\ s$

Equation: $\Delta s = \bar{v}t$ → or $s = s_0 + v_0 t + \frac{1}{2}at^2$

$s - s_0 = \bar{v}t$

$s = s_0 + \bar{v}t$

Substitute with units: $= 450m + (95\ m/s)(12.5\ s)$

Solve: You don't need me for this part

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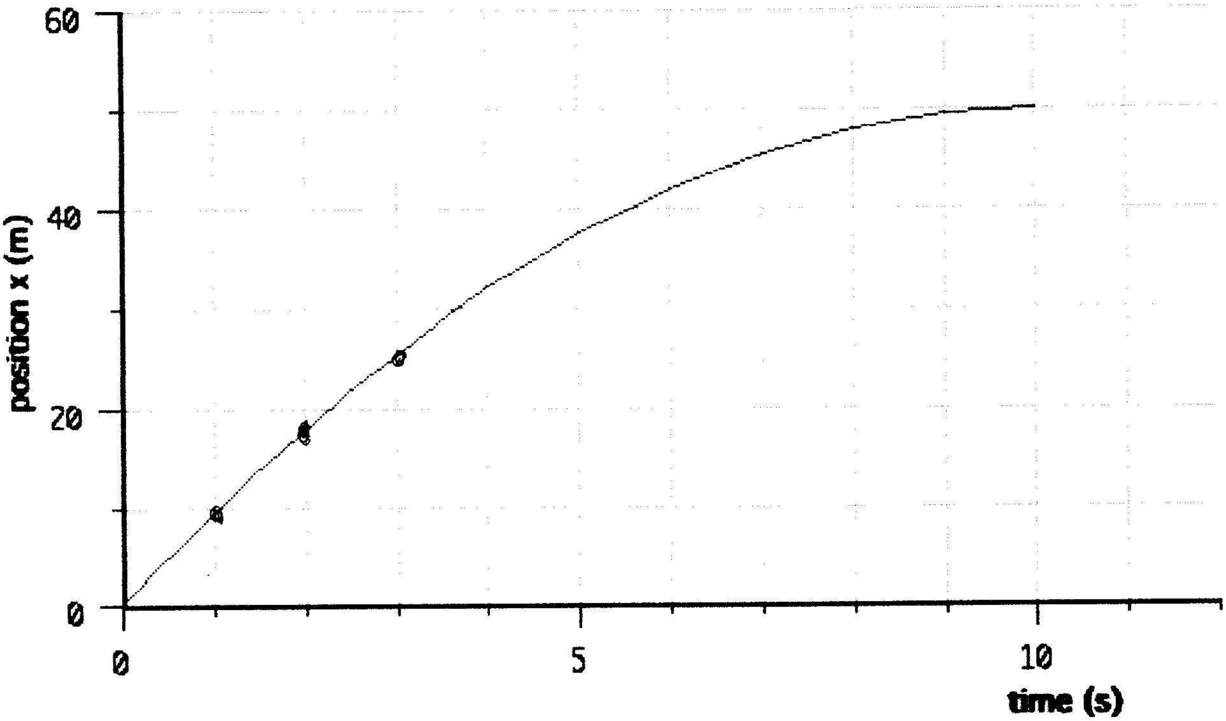
Uniformly Accelerated Particle Model: Review Sheet

Position vs. Time for Object A

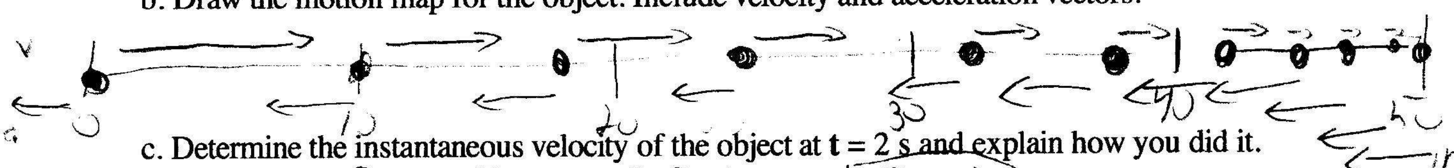


1. Use the graph above to answer the following questions:

a. Give a written description to describe the motion of this object.

Moving in the forward direction and slowing to a stop @ 10 s.

b. Draw the motion map for the object. Include velocity and acceleration vectors.



c. Determine the instantaneous velocity of the object at **t** = 2 s and explain how you did it.

S @ 3s = 26 m V_{1-3s} $\frac{26m - 10m}{2s}$ = 8 m/s

S @ 1s = 10 m   Instantaneous @ midpoint = V. (or find slope of tangent)

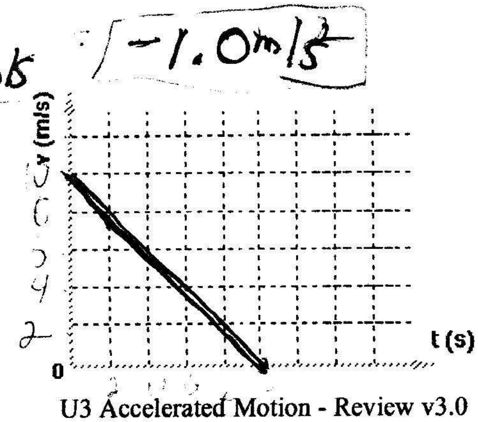
d. Assume the initial velocity was 10 m/s; determine the acceleration of the object.

V_0 = 10m/s   V = V_0 + at

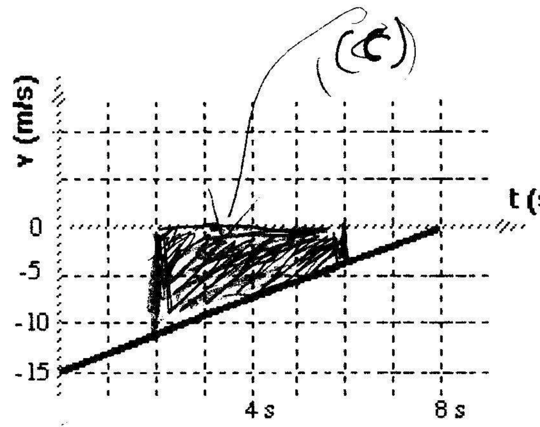
$V_{@2s}$ = 7.5 m/s   a = $\frac{V - V_0}{t}$ = $\frac{8m/s - 10m/s}{2s}$ = −1.0 m/s²

t = 2s

e. Sketch a corresponding velocity time graph for the graph above.



2. Use the graph to answer the following questions.



a. Describe the motion of the object.

Object has initial speed of 15m/s in reverse direction & travels in reverse, slowing down until it comes to a stop @ 8 seconds.

b. Determine the acceleration of the object from the graph.

$a = \frac{\Delta v}{t}$ (slope) $= \frac{0\ m/s - (-15\ m/s)}{8s} = \frac{+15\ m/s}{8s} = +1.875\ \frac{m}{s^2}$

c. Shade the portion of the graph that represents the displacement of the object from 2 to 6 seconds.

d. Use an appropriate mathematical model to calculate the velocity of the object at 2 seconds and at 6 seconds.

$V = V_0 + at$ @ 2s $V = -15\ m/s + 1.875\ m/s^2\ (2s) = -11.25\ m/s$

@ 6s $V = -15\ m/s + 1.875\ \frac{m}{s^2}\ (6s) = -3.75\ m/s$

e. Use an appropriate mathematical model to calculate the object's displacement from 2 to 6 seconds.

$\Delta s = \frac{1}{2}(V_0 + V)(t) = \frac{1}{2}(-11.25\ m/s - 3.75\ m/s)(4s) = -30\ m$

(OR)

$\Delta s = V_0 t + \frac{1}{2}at^2 = (-11.25\ m/s)(4s) + \frac{1}{2}(1.875\ \frac{m}{s^2})(4s)^2$

$= -45\ m + 15\ m = -30\ m$

3. A car, initially at rest, accelerates at a constant rate of 4.0 m/s² for 6 s. How fast will the car be traveling at **t** = 6 s?

G) $a = 4.0\ m/s^2$, $t = 6s$, $V_0 = 0$

U) $V = ?$

E) $V = V_0 + at$

S) $V = 0 + (4.0\ \frac{m}{s^2})(6s)$

S) $V = 24\ \frac{m}{s}$

4. A tailback initially running at a velocity of 5.0 m/s becomes very tired and slows down at a uniform rate of 0.25 m/s². How fast will he be running after going an additional 10 meters?

G) $V_0 = 5\ m/s$, $\Delta s = 10\ m$, $a = -0.25\ m/s^2$

U) $V = ?$

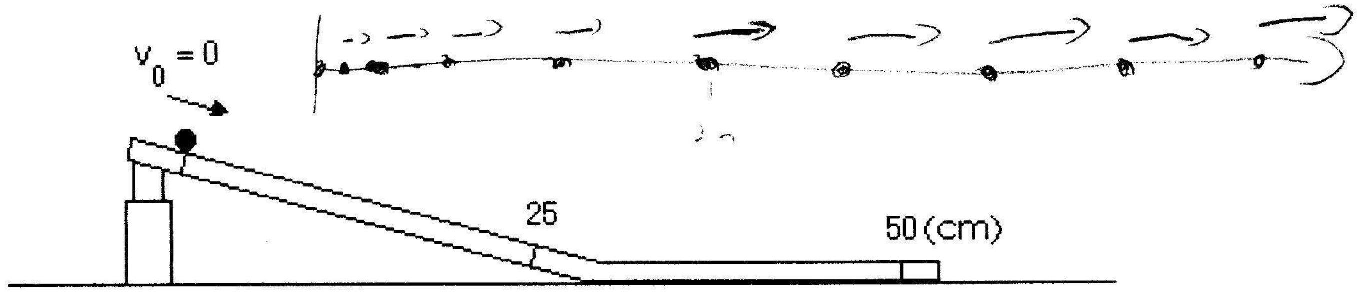
E) $V^2 = V_0^2 + 2a\Delta s$

S) $V^2 = (5\ m/s)^2 + 2(-0.25\ \frac{m}{s^2})(10\ m)$

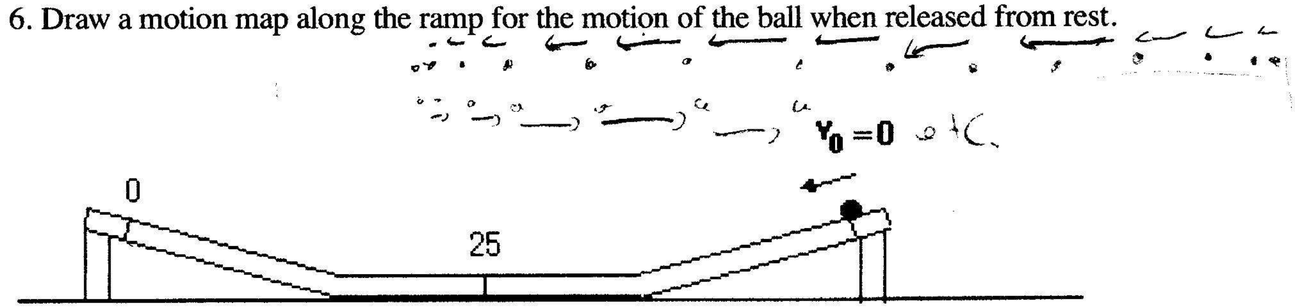
S) $V = 4.47\ \frac{m}{s}$

↑ Note: Sign of a & v are opposite because runner is slowing down

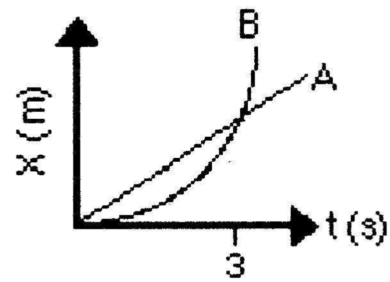
5. Draw a motion map along the ramp for the motion of the ball when released from rest.



6. Draw a motion map along the ramp for the motion of the ball when released from rest.



7. Using the graph compare the following quantities for objects A and B. **Is A > B, A < B, or A = B.**



a. **Displacement** from 0 to 3 s A = B How do you know? Both at same point on Y axis

b. **Displacement** from 0 to 1.5 s A > B How do you know? Posit of A vs B on Y

c. **Displacement** from 1.5 to 3 s B > A How do you know?

d. **Average** velocity from 0 to 3 s A = B How do you know? Same Δs in same Δt

e. **Average** velocity from 0 to 1.5 s A > B How do you know? Greater Disp. for A

f. **Average** velocity from 1.5 to 3 s B > A How do you know? Greater [illegible] for B

g. **Instantaneous** velocity at 3 s B > A How do you know? Tan of B > slope of A at 3

h. **Instantaneous** velocity at 0 s A > B How do you know? Slope of A > tan of B @ 0

i. If the motion of B is uniformly accelerated, at what time will both graphs have exactly the same slope? Explain. at 1.5 s → Both have same ave velocity from 0 - 3 seconds Inst V = ave V at midpoint

8. For each of the position vs time graphs shown below, draw the corresponding **v** vs **t**, **a** vs **t** , and motion map.