KINEMATICS EQUATIONS

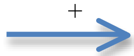
EQUATIONS

POSITION	VELOCITY	ACCELERATION	TIME
Δx = Displacement (Change in position)	v_o = initial velocity v = final velocity	a = acceleration	t = time

Equation 1: $v = at + v_0$

Equation 2: $\Delta x = \frac{1}{2} at^2$

STORY PROBLEM STEPS

1. Draw a picture. 0  +

(Identify origin and positive direction.)

2. Alphabet Soup

(Set up a list of variables)

Δx =

v_0 =

v =

a =

t =

3. Pick an equation.

4. Eliminate zeros

(Erase all zeros & anything they touch.)

5. Isolate the desired variable. (want variable.)

(Keep it purely symbolic)

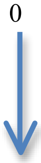
6. Plug it in.

(Finally, use numbers)

EXAMPLES

A. Bob drops a quarter off of the Empire State building. How fast (in m/s) will it be moving 5 seconds? (This could be dangerous!)

0

 +

Δx = DC (don't care)

$v_0 = 0$

v = want

$a = 10\ m/s^2$

$t = 5\ s$

$v = at + v_0$

$v = at$

$v = (10)(5) = 50\ m/s$

B. Susy slams on her brakes because she sees a little old granny crossing the street. After 2.5 seconds her car barely manages to stop in time. How fast was Susy driving (in m/s) if she accelerated $-5 m/s^2$?

\+

0 

Δx = DC (don't care)

v_0 = want

$v = 0$

$a = -5\ m/s^2$

$t = 2.5\ s$

$v = at + v_0$

$0 = at + v_0$

$-at = v_0$

$-(-5)(2.5) = v_0$

$v_0 = 12.5\ m/s$

EXAMPLES (Cont.)

C. Betty goes skydiving. After 25 seconds of free fall, how far has she fallen?

$\Delta x = 3125$ m

D. Bob drops a water balloon onto Betty's head from a balcony that is 10 m high. How much time will it take the balloon to reach Betty's head?

$t = 1.41$s

E. Bob starts from rest and accelerates to 15 m/s in 4 seconds. How far did his car move?

+

0 

Δx = want	$v = at + v_0$
$v_0 = 0$	$v = at$
v = 15 m/s	$a = v/t$
a = need	$a = (15)/(4) = 3.75$ m/s^2
t = 4 s	
	$\Delta x = ½ at^2 = ½ (3.75)(4)^2 = 30$ m

<u>TITLE</u>: Kinematics Car Lab

<u>OBJECTIVE:</u> To determine the acceleration and final velocity of a toy car going down a ramp.

<u>DESIGN:</u>
1. Measure the length of the ramp in meters.
2. Set the toy car at the top of the ramp.
3. Record the time (in seconds) it takes for the car to go down the ramp.

<u>DATA COLLECTION</u>: Record the length of the ramp and the time.
Remember the distance needs to be meters and the time in seconds.

<u>DATA ANALYSIS</u>: Use the kinematics equations to determine the acceleration of the car and its final velocity at the end of the ramp. (Hint: you should use alphabet soup and both equations to figure this out.)

<u>CONCLUSION</u>: What was the acceleration of the toy car?
What was the final velocity of the toy car at the end of the ramp?

<u>EVALUATION:</u> Do you trust your results? Any problems I should be aware of?