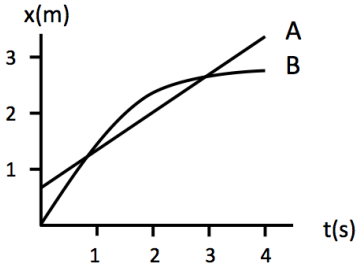
Name: _____

Worksheet 2: Kinematics

1 Confronting misconceptions in motion



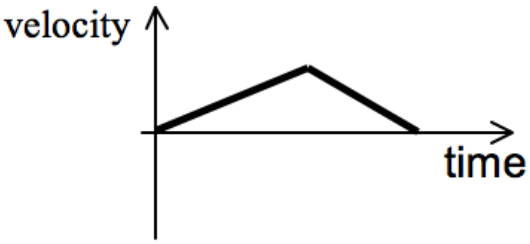


Figure 1:

Left Figure

a) Do objects A and B ever have the same position? _____

b) Do objects A and B ever have the same velocity? _____

Right Figure

c) Does the object reverse direction?_____

* **The positions of two blocks at successive 0.20 second time intervals are represented by the numbered squares in the diagram below. The blocks are moving toward the right.**

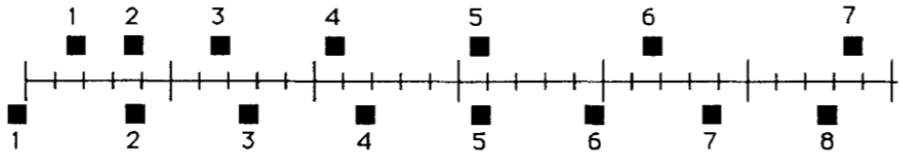


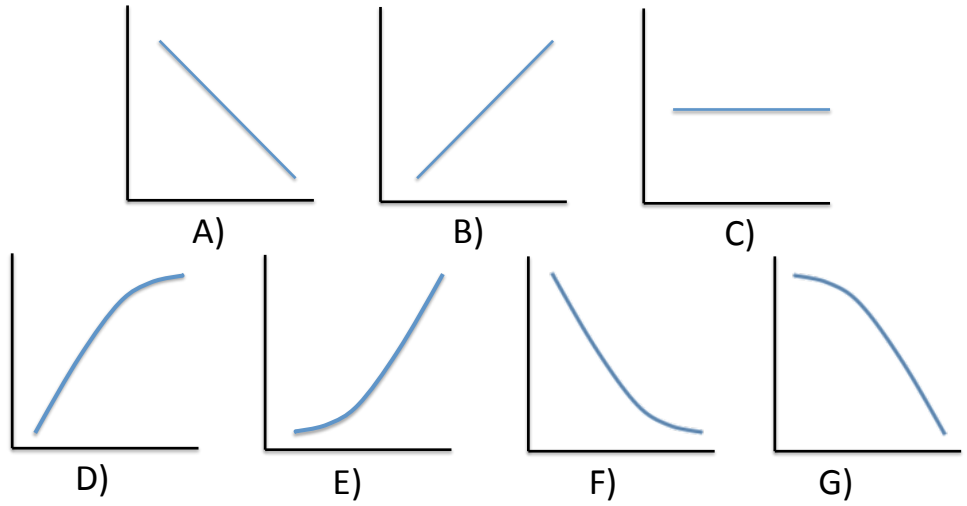
Figure 2:

a) Do the blocks ever have the same position? _____

b) Do the blocks ever have the same velocity? _____

c) Do the blocks ever have the same acceleration? _____

2 Match the Graph



List all the graphs that match the following criteria:

Assume that UP is the positive y direction, DOWN is the negative y direction.

a) If the displacement graph looks like this, the velocity is negative. _____

b) If the displacement graph looks like this, the acceleration is negative. _____

c) If the acceleration is zero, the velocity graph could look like this. _____

e) If the velocity is zero, the displacement graph could look like this. _____

f) This graph illustrates a displacement graph of slow down._____

g) A ball is thrown up in the air. Part of the velocity graph looks like this. _____

h) A ball rolls up a ramp. The displacement graph looks like this. _____

i) A ball rolls down a ramp. The acceleration graph looks like this. _____

3 Representations of motion

The following are some descriptions of motion. Make a drawing of the motion along with plots of the position, velocity, and acceleration on the following pages. These get increasingly more difficult. Pick any 4 to do, and make sure you label which one you are doing. (Hint: During any interval the plots need to look like one of the pictures in Problem 2)

3.1) A ball is thrown straight up into the air. It reaches a height h and then falls back down to the ground.

3.2) A student walks along side a 2-meter measuring stick. The student moves with decreasing speed toward the 2 meter mark. After coming momentarily to rest near the 2 meter mark, the student immediately begins moving toward the 0 meter mark with increasing speed.

3.3) From t = 0 to t = 5 s, a car is cruising down a street at steady speed, when suddenly a cuddly puppy runs into the road. So, at t = 5 s, the driver slams the brakes, and the car slows down at a steady rate until stopping 3 seconds later.

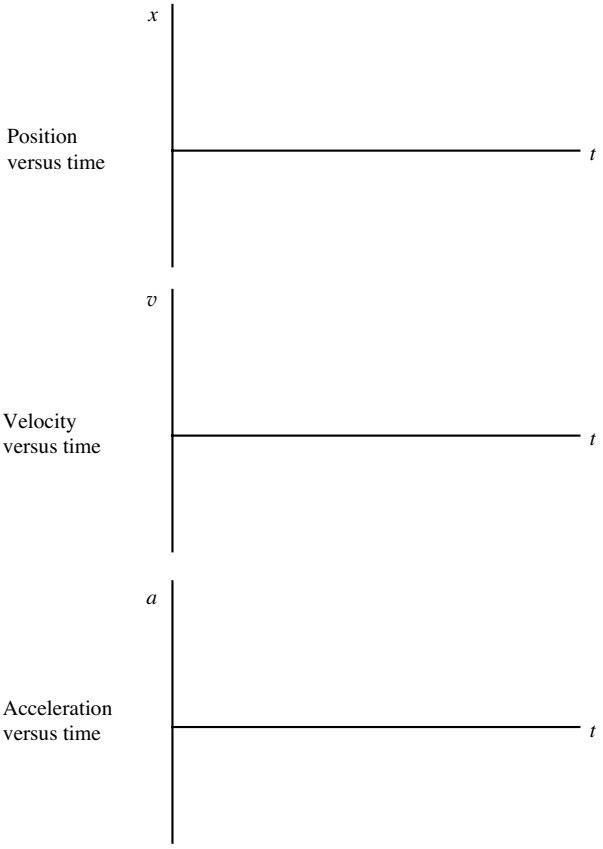
3.4) A ball, released from rest, rolls down ramp A, then along the floor, then up ramp B, as drawn here. Rounded segments at the bottoms of the ramps allow the ball to roll smoothly from a ramp to the floor and vice versa. Air resistance is negligible. (Sketch the motion in the y direction. Hint: velocity in the x direction will be constant)

3.5) A hard rubber ball is dropped from rest. It falls to the concrete floor and bounces back up almost to its initial height.

3.6) A model rocket is launched straight up with constant acceleration a. It runs out of fuel at time t_1. It reaches a maximum height at t_2 and then begins to fall. (Hint: gravity is always acting on the rocket!)

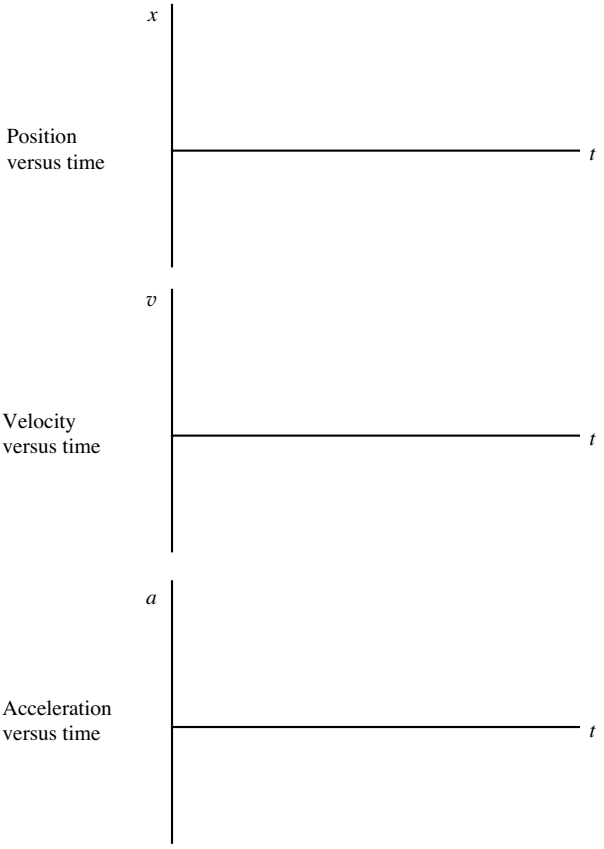
Draw a motion diagram (show coordinate system)

Sketch graphs of the motion below.



Draw a motion diagram (show coordinate system)

Sketch graphs of the motion below.



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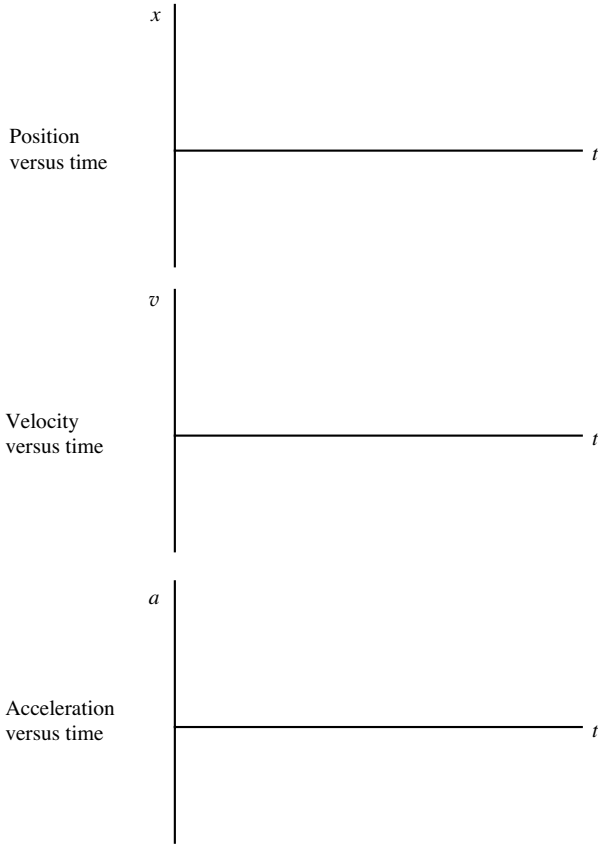
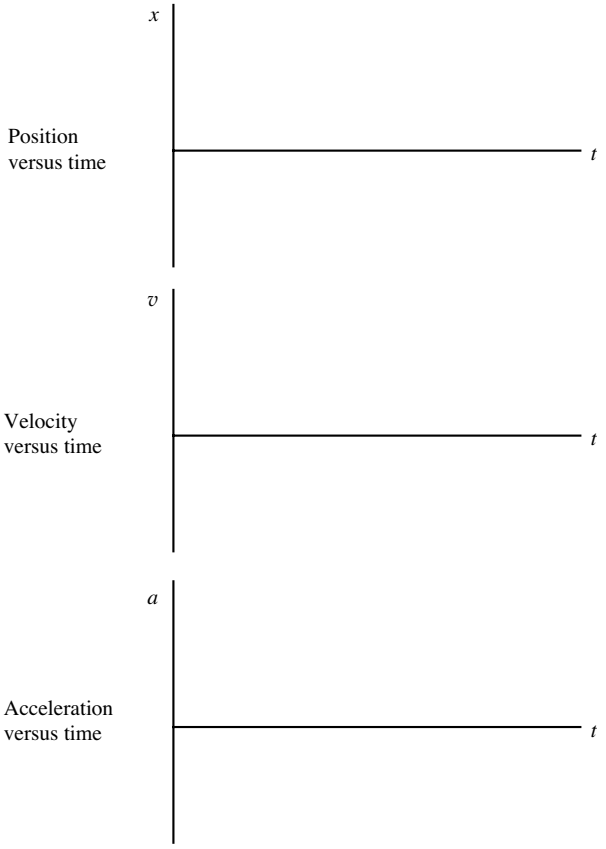
Draw a motion diagram (show coordinate system)

Sketch graphs of the motion below.



Draw a motion diagram (show coordinate system)

Sketch graphs of the motion below.



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4 Pick the kinematics equation

$x_f = x_0 + v_0 t + \frac{1}{2} a t^2$	x_f x_0 v_0 t a
$v_f = v_0 + at$	v_0 v_f t a
$x_f = x_0 + \frac{1}{2}(v_f + v_0)t$	x_f x_0 v_0 v_f t
$v_f^2 = v_0^2 + 2a(x_f - x_0)$	v_f v_0 a x_f x_0

Figure 3: The four kinematics equations with their variables.

Pick the appropriate equation or set of equations to use.
(You can solve the word problems if you wish. Use g=10 m/s^2) :

a)v$_f$, v_0, a, and x_0 are known. x_f is desired _____

b) x_f, x_0, a, and t are known. v_0 is desired _____

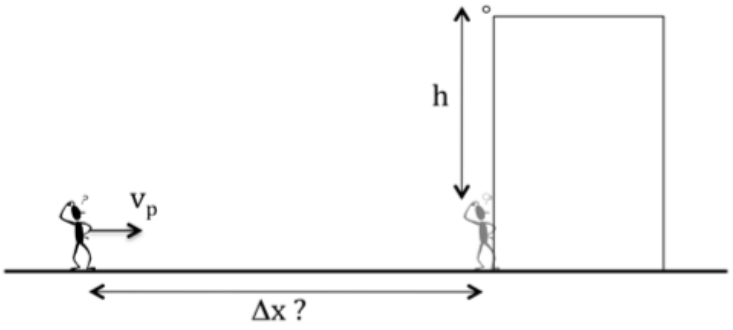
c) A car is moving to the right with an initial speed of 60 mph. When it passes the point $x = 0$ the driver hits the break pedal. How long does it take the car to come to a stop?_____

d)A ball is dropped from rest at a height of 10 m. What is the velocity of impact when it hits the ground? _____

e) A ball is tossed up in the air. It takes 5 s for it to reach its final height. What was its speed when it was launched?_____

5 Egg drop problem

You have an egg and are standing atop a building with height h. Your oblivious professor is walking at ground level below you, at a constant speed of v_p toward the building. You wish to drop the egg, starting at rest, at the perfect time so that it lands atop the professor's head. How far away from the building should your professor be when you drop the egg? Assume that h is the vertical distance between the initial height of the egg and the top of the professor's head.



a) List all the knowns and the desired variable:

b) Which kinematics equations should you use?

c) Solve for the desired variable algebraically in terms of all the knowns:

d) Plug in the following variables and solve for the desired variable:
$v_P = 0.05m/s$, $h = 40m$.

6 A note about the quiz

Remember that this homework will only be graded for completion. It is in your interest to attempt as much of it as you can because it is an excellent way to prepare for the quiz. Quiz 1 can cover anything that we go over in class, anything from the reading assignments, reading quizes, or homework.