Name _____

acceleration = a vector measuring the change in velocity of an object over time

$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_0}{t} \qquad \Rightarrow \qquad v_f = v_0 + at$

Note: We will always treat acceleration to be constant, or ignore parts of the motion of an object where it is not.

Signs of vectors $\Delta x,\ v,\ a$

Δx is same as v, which both point in the direction of motion of the object.

Sign of acceleration points in direction of change in velocity of the object (Same direction as v if object is speeding up, opposite if slowing down):

- a = + if v is + and object is speeding up
- a = - if v is + and object is slowing down
- a = - if v is - and object is speeding up
- a = + if v is - and object is slowing down

1. If an object has a negative acceleration, does that mean it is decelerating, i,e. slowing down? Why or why not? **A**:Yes, **B**: No

2. For the following situations, determine the sign (positive or negative) of the displacement, velocity, and acceleration, or indicate if they are zero. Let's define right to be positive (+) and left to be negative (-), up to be positive (+) and down to be negative (-).
   For voting purposes: **A** = + **B** = − **C** = 0

   (a) A car moving right slows down to a stop sign.
   $\vec{\Delta x}$: $\vec{v}$: $\vec{a}$:

   (b) Roxie moves at a constant velocity to the left.
   $\vec{\Delta x}$: $\vec{v}$: $\vec{a}$:

   (c) A plane takes off on a runway pointing towards the left.
   $\vec{\Delta x}$: $\vec{v}$: $\vec{a}$:

   (d) A sprinter running to the left slows down at the end of the race.
   $\vec{\Delta x}$: $\vec{v}$: $\vec{a}$:

   (e) A ball is thrown upward, slows down, stops in mid-air, and then accelerates downward.
   $\vec{\Delta x}$: $\vec{v}$: $\vec{a}$:

3. The fastest production car can accelerate from rest to $97 km/hr$ (0 to 60(mph)) in $1.98s$ What is the acceleration of the car in $(km/hr)/s$ and in m/s^2?

   If the car continued for another second at this acceleration, how fast would it be moving, in km/hr?

4. The maximum acceleration a human can withstand is about 5g's, where g= $9.8 m/s^2$. If a roller coaster accelerates for $3s$, what is the maximum speed that can be attained, if it starts from rest?

5. If an object has an acceleration of $-1m/s^2$ and it is initially moving with a velocity of $+2m/s$.

   A. $+2m/s$

   B. $+1m/s$

   C. $0m/s$

   D. $-1m/s$

   E. $-2m/s$

   (a) What will its velocity be after $1s$?

   (b) What will its velocity be after $2s$?

   (c) What will its velocity be after $3s$?

   (d) What will its velocity be after $4s$?

   Sketch acceleration vs time and velocity vs time plots for this object. Then try to sketch a position vs time plot for this object.

6. A car moves at a constant speed of $20m/s$. After a distance of $200m$ the driver steps on the brakes until coming to a stop. This entire motion (constant speed + braking) takes a total time of $25s$. What was the acceleration of the car?