TEST 2 Q 1 some HONORS review questions to try

Define: displacement, velocity, average velocity, average speed, acceleration.
Displacement: change in distance from start (with direction)
Velocity: change in displacement over change in time, (indicates direction)
Average velocity: total change in displacement over change in time, the average displacement for each time interval
Average speed: the average distance traveled for each time interval, total distance traveled over change in time.
Acceleration: the increase in velocity over each time interval, change in velocity over change in time.

Describe the motion of an object that starts with:

Positive velocity, positive acceleration ***it speeds up going forwards, displacement always increasing.*** →. . . . . .→

Positive velocity, negative acceleration ***it starts going forwards, getting slower, but still going forwards, eventually stopping for a split second then reversing direction and going backwards.*** →. . . . . .→
←. . . . . .←↩

Negative velocity, positive acceleration ***it starts off going backwards fast, then gets slower while still going backwards, eventually stopping for a split second then reversing direction and going forwards.*** ←. . . . . .←
↘→. . . . . .→

Negative velocity, negative acceleration ***It speeds up going backwards, displacement from start is always decreasing (getting farther away in the reverse direction)*** ←. . . . . .←

When does an object have an average velocity of zero?***When the displacement is zero (it returns to its starting point)… note that its speed could be anything!***

** How do you calculate total distance for an object that has a starting velocity of zero, accelerates, then stays the same speed, then slows down to zero again, if:

all three parts of the journey are the same time.

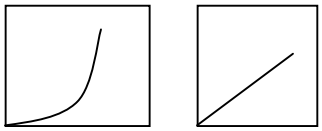
Then the total distance is the distance for each part added… or the average velocity times the total time… In this case the average velocity for the first and last part is ½ the final speed, if each time is equal, you can add up each average velocity and divide by 3…. Vavg is 2/3 V final (1/3 (1/2V)+1/3(V)+1/3(1/2V))

D=2/3V*T

All three parts of the journey are the same distance.

This is harder to do, each distance is the same, yet each time is different, so need to add the three distances….. D1=D2=D3 $D1=V^2/2A=D3$

A ball is rolled down a ramp.
Sketch the D-T and V-T graph.
If down is positive



Explain how to get the acceleration, using only a stopwatch and ruler. (T & D)
If you know the initial velocity is zero, then the average velocity is D/T. the final velocity is twice the average (middle) velocity. Acceleration is change in velocity over time.

Or using equation #4: $A = 2D/T^2$ if Vi=0

If the a is 1 m/s^2, what is the ball's velocity after 5 seconds? ***Vi=0, A=1, T=5, Vf=???***

Vf=Vi+AT = 0+AT = AT = 1(5) = 5 m/s… the ball increases velocity by 1 m/s every second for 5 seconds…

What is its average velocity? ***If the ball has a final velocity of 5 m/s, and an initial velocity of 0 m/s, its average velocity is Vavg= (Vi+Vf)/2=(0+5)/2=5/2= 2.5 m/s***

How much distance has it covered in that time? ***Dis is Vavg*T = 2.5 (5)=12.5 meters***

Or $D=ViT+ ½*AT^2 = 0+ ½(1)(5^2)=1/2*25= 12.5$ m

What was the distance traveled in the 5^{th} second? (from 4 to 5)

The distance traveled in the 5^{th} second is the distance at 5 sec minus distance at 4 sec….
Distance at 4 sec = $D=ViT+ ½*AT^2 = 0+ ½(1)(4^2)=1/2*16= 8$ m, so distance in the 5^{th} second is D(5)-D(4)= 12.5-8= 4.5 m
Or…. The average velocity from T=4 to T=5 is (Vf(4)+Vf(5))/2= 4.5 m/s in one second… D=Vavg*T=4.5*1=4.5 m

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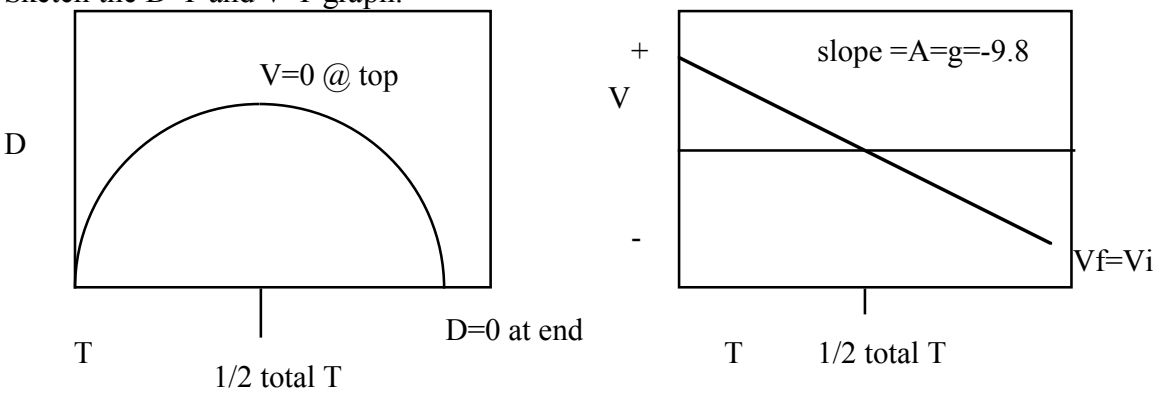
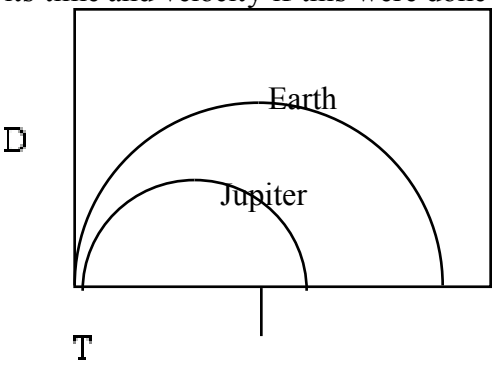
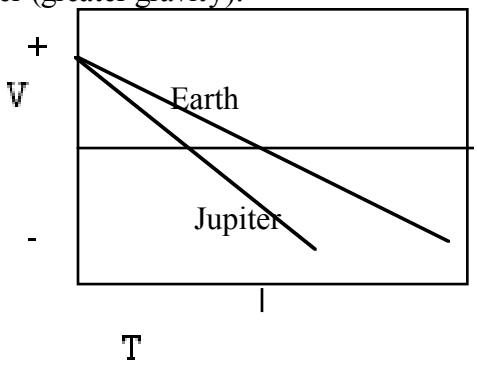
A ball is thrown up in the air and caught at the point of release.
Sketch the D-T and V-T graph.



Explain what two pieces of information would help calculate the maximum height. ***You know that at the maximum height the object has a Vf of 0, and the time is half the total time of the trip.***

Explain what would be different about the ball's path, its maximum height, its graphs, and its time and velocity if this were done on Jupiter (greater gravity).





The gravity is more on Jupiter, thus the ball would not go as high, and hit the ground sooner, the acceleration due to gravity would be different, but the final velocity at which it hits the ground would still be the same as the start….

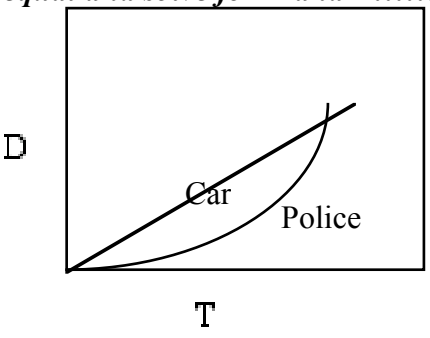
A speeder going at a constant speed passes a police car, who starts accelerating from 0 some time later. Explain how to calculate when and where the cops catch the speeder, and sketch a strobe motion dot image, D-T, and V-T graph for each.

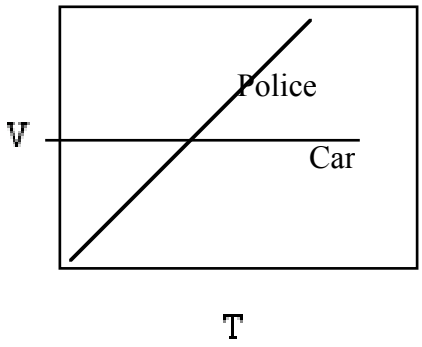
If the speeder is going at a constant speed, then his distance is rate times time… or D=VT . . . . . .

If the police car is starting at Vi=0, then his distance is average velocity (1/2 final velocity=1/2AT) times time or D= 1/2AT^2

. . . . . .

They meet at the same place (D) at the same time (T) D=D, T=T, so set the two equations equal and solve for D and T…… VT=1/2AT^2





WORD PROBLEMS TO TRY (HONORS):

A tennis ball is released at the top of a 5-m ramp and rolls down .
The ball reaches the end of the ramp in 5.0 s and rolls onto the floor. If the ball experiences an
average deacceleration of -0.25 m/s ^{2} as it rolls along the floor, how far from the end of the ramp will the ball stop?

Two parts, one on the ramp, one after…….

On the ramp: Vi=0, D=5, T=5, Vf=?, A=?

D=(Vi+Vf)/2 *T D=Vf/2*Tor Vf=2Vavg=2*D/T=2*1=2 m/s

This Vf for part one is Vi for part two:

Vi=2 m/s, A=-0.25, Vf=0 (when stops), D=????

For D, eq #5 $Vf^2=Vi^2+2AD$ $0^2=2^2+2*-.25*D$ D= (0-4)/-.5=8 meters =D

I start traveling at 3 m/s and accelerate at the rate of 2 m/s^2, to a max of 25 m/s. I can only last 5 seconds at this top speed though….

A tiger is 50 meters behind me traveling a constant 20 m/s.

When I reach my maximum speed of 25 m/s, will I be in front of, or behind the tiger?

Me: Vi=3 m/s, A = 2, Vf=25 m/s Dme=??? Tme=????

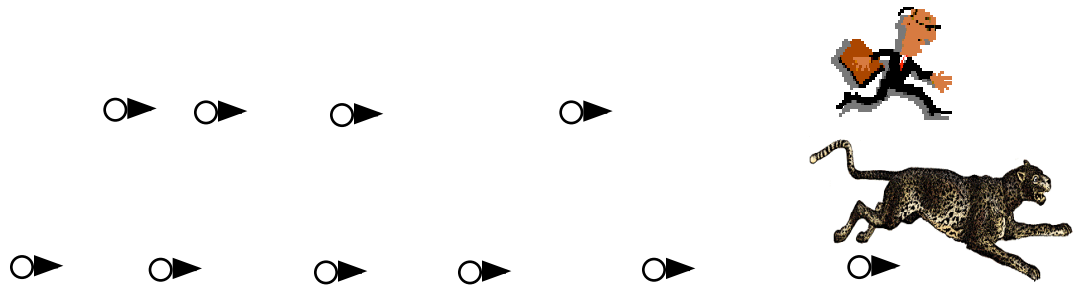
For D, eq #5 $Vf^2=Vi^2+2AD$ $25^2=3^2+2*2*D$ D= (625-9)/4=154 meters =Dme

For T, eq #3 Vf=Vi+AT 25=3+2(T) T=(25-3)/2=11 seconds

In that time…… Tiger Di =-50, Vi=Vf=Vavg=20m/s, A=0

D=20T-50 Dtiger=20(11)-50=220-50=170m

The tiger is still ahead of me!!!



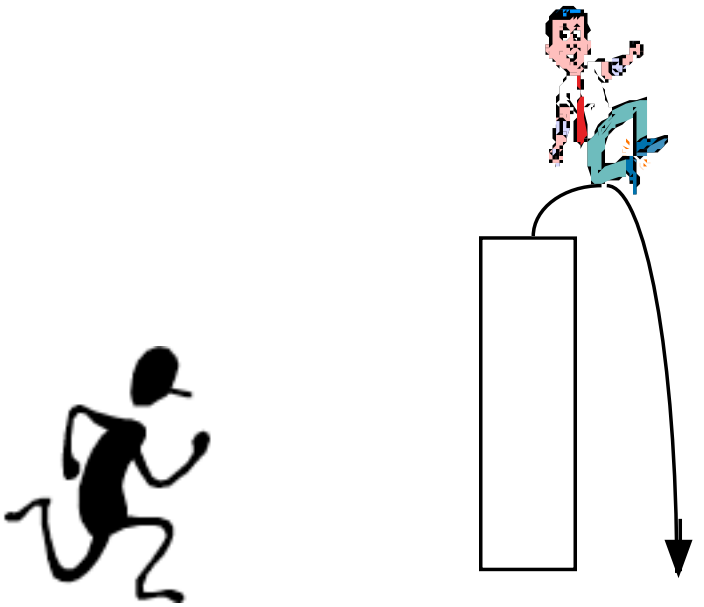
Will I eventually ever be ahead of him?

Since I can only keep up this pace for another 5 seconds

Dme=154+VT=154+25(5)=279m

Dtiger=170+20(5)=270m so eventually I will be ahead of him…. Of course, then I will stop and he will pounce on me and that's it for me ☹.

I stand on a cliff and jump up at 39.2 m/s. If I hit the valley below after 10 seconds, how fast am I going? How high is the cliff? How high did I jump?



Vi=39.2 m/s, A=-9.8 m/s^2, T=10sec

Vf=??, D=???

Vf= Vi +AT = 39.2 + -9.8 * (10) = -58.8 m/s downward

D=ViT+1/2AT^2 = 39.2 (10) + ½*-9.8*100 = -98 meters below start is cliff

How high? At the apex Vf = 0 m/s so:

Vi=39.2 m/s, Vf=0m/s, A=-9.8 m/s^2, Dheight=????

For D,

eq #5 Vf^2=Vi^2+2AD 0^2=39.2^2+2*-9.8*D D= (-1536.64)/-19.6=78.4 meters =Dheight

If my friend saw me and started running to catch me, with an acceleration of 3 m/s^2, how close would he have to be to the cliff to catch me?

If my time was 10 seconds, his vi=0, and A=3,he would need to be

D=ViT+1/2AT^2 = 0 (10) + ½*3*100 = 150 meters away from the cliff to catch me.