Solve with: formulas, D-T and V-T graphs, or Interactive Physics!

D= Vavg T   Vavg = (Vi + Vf) / 2 (if A is constant)   A = (Vf-Vi) /T

D-T graph, slope is velocity   V-T graph area is displacement, slope is accel

1) While driving his sports car at 20 m/s Eddie comes up behind a slow moving dump truck and decides to pass it. If he can accelerate at a rate of 5 m/s/s, how long will it take him to reach a speed of 30 m/s ?
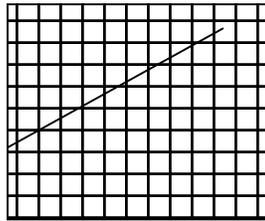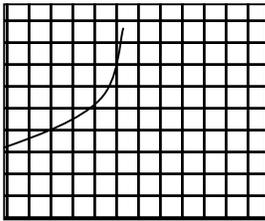*Vi= 20 m/s,   A= 5 m/s^2,   Vf= 30 m/s,   T = ??*

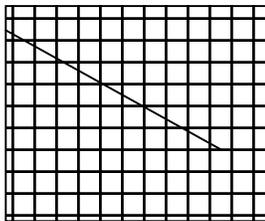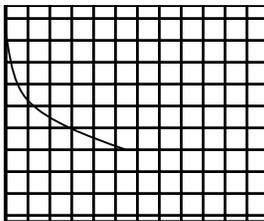*A = (Vf-Vi)/T   5 = (30-20)/T   5T = 10   T = 2 sec*

2) A jet taxing down a runway receives word that it must return to the hangar for an important message. The jet is traveling at 45 m/s . What is the acceleration of the plane if it takes 5 sec to bring it to a halt?
Vi = 45 m/s,   Vf= 0,   T = 5 sec,   A= ??

A= (Vf-Vi)/T   A= (45-0)/5   A= 9 m/s^2

3) Hans stands at the rim of the Grand Canyon and yodels. He hears his yodel 5 sec later. (2.5 sec to go down, 2.5 sec to come back) Assume that the speed of sound is 340 m/s . How deep is the canyon?
T= 5/2 = 2.5 sec,   Vavg= 340 m/s   D=??

*D=VavgT   D= 340*2.5 = 840 m*

4) Monica is walking to the hairdresser at 1.3 m/s, then realizes she is going to be late. She quickens her pace at the rate of .09 m/s/s . What is her speed after 10 s? How far has she traveled in this time?
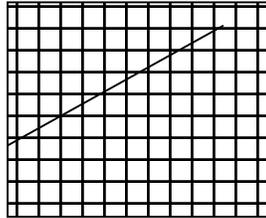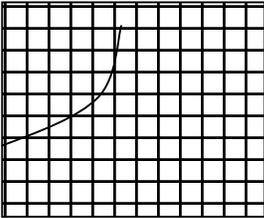
Vi = 1.3 m/s, A = .09 m/s^2, T= 10 sec, Vf=??, D=??

A= (Vf-Vi)/T   .09 = (Vf-1.3)/10   10*.09 = Vf-1.3

Vf=1.3+.9 = 2.2 m/s=Vf

D=VavgT   Vavg=(Vi+Vf)/2 Vavg=(1.3+2.2)/2 = 1.75 m/s=Vavg

D = (1.75 m/s) * 10 sec = 17.5 m=D

5) Bobby wants to catch up with his friend in the hallway. His friend is 10 m ahead of him, walking at 3 m/s. If Bobby constantly accelerates at a rate of 2 m/s/s from rest, how long till he catches up to his friend? How far? What is his speed at that time?

Friend: *Vavg= 3m/s*   *D=10+VavgT*   *D= 10 +3T*
Bobby: *Vi=0   Vavg=(Vi+Vf)/2=Vf/2*   *A= 2 m/s^2*

      A=(Vf-Vi)/T   *2 = Vf/T*   *Vf=2T*
    D= Vavg T   *D= (Vf/2)T*   *D= (2T/2)T*   *D=T^2*

    Friend   *D=10+3T*   *Bobby*   *D=T^2*
           10+3T   =   *T^2*
           0 = T^2-3T-10
           Solve….. T=+5 or -2, so obviously T=+5 seconds!
      D=10+3T=10+3(5)= 25 m or D =T^2=5^2=25m
      Bobby Vf=0+2(T)=2(5)=10 m/s

Better to solve this one on a graph!!!!
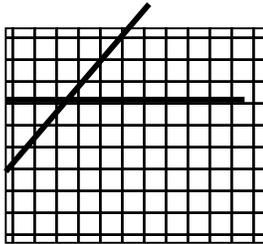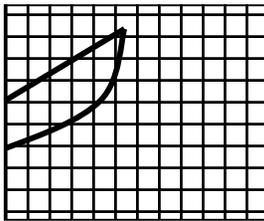
On a V-T graph, look to where the areas under the graph are the same…. Not where the velocities are equal!

See car passing van interactive physics for an example of this!

** HONORS

6) Frank is going 4 m/s for 5 seconds. If I start 2 m ahead of him going 9 m/s, at what rate will I have to deaccelerate so I will be in the same spot as him after 5 sec?

Frank: Vavg= 4m/s, T= 5 sec, D= VavgT D=4(5)=20 m

me: Di=2, Vi=9m/s, T=5sec, Vf=?, A=?, Df=20 m
   D= 20-2=18m = Vavg T=Vavg (5)
     Vavg = D/T = 18/5 = 3.6 m/s
   Vavg =(Vi+Vf)/2 3.6 = (9+Vf)/2
          7.2 =9 + Vf Vf= -1.8 m/s
   A= (Vf-Vi)/T   A= (-1.8-9)/5 = -10.8/5 = -2.16 m/s^2 =A

7) A bird is flying along at 60 m/s and reaches a constantly increasing force of wind which causes the bird to deaccelerate at the rate of 12 m/s/s. How far will the bird have gone after 15 seconds? What will its velocity be at that time?

Vi = 60 m/s, A = -12 m/s^2, T= 15 s, D =??, Vf =??

A= (Vf-Vi)/T   -12 = (Vf-60)/15 Vf= 60 + -12(15) = -120 m/s= Vf
D=VavgT D = (Vi+Vf)/2 T D= (60+-120)/2 (15) = -30*15 = -450 m = D

8) What speed do I have to start at if I want to go 200 meters accelerating at the rate of 4 m/s/s for 10 seconds?

Vi = ??, D= 200m, A = 4 m/s^2, T = 10 s

D= (Vavg)T 200=Vavg(10)   Vavg = 200/10=20 m/s

A= (Vf-Vi)/T   4 = (Vf-Vi)/10   40 = Vf-Vi Vf=40+Vi
Vavg = (Vi+Vf)/2 20 = (Vi+Vf)2   40=Vi+Vf 40=Vi+40+Vi
                      0=2Vi, Vi=0!!