20-P-KM-AF-004

Rectilinear Continous Motion: Beginner

Q:

You hang out with your friend and their dog. The dog is older and has a harder time seeing the ball so you have to roll the ball. Due to the grass, the acceleration acts as $a = (A - Bt)\ m/s^2$. The initial velocity is $v = D\ m/s$. Where does the ball stop and how long does it take the dog to get there if they move at $C\ m/s$.

A:

use $v = v_0 + a_c t$, $s = s_0 + v_0 t + \frac{1}{2} a_c t^2$, note $A = D \cdot B - 1$

$v_0 = D\ m/s$

$v = 0$

$a_c = A - Bt$

$v = v_0 + a_c t$

$0 = D + (A - Bt)t$

$0 = D + At - Bt^2$

$-Bt^2 + At + D$

$t = D\ s$

$s = 0 + Dt + \frac{1}{2}[A - Bt]t^2$

$s = D^2 + \frac{1}{2}[A - B \cdot D]D^2$

$s = D^2\left[1 + \frac{[A - B \cdot D]}{2}\right]$

$v = s/t = D\left[1 + \frac{[A - BD]}{2}\right]$