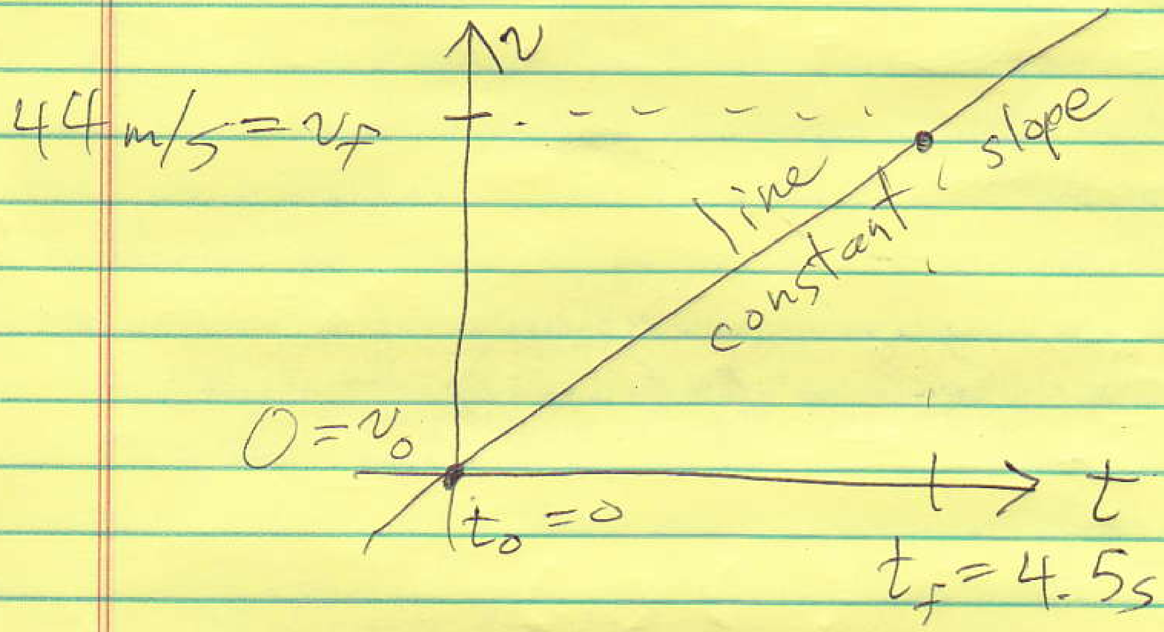
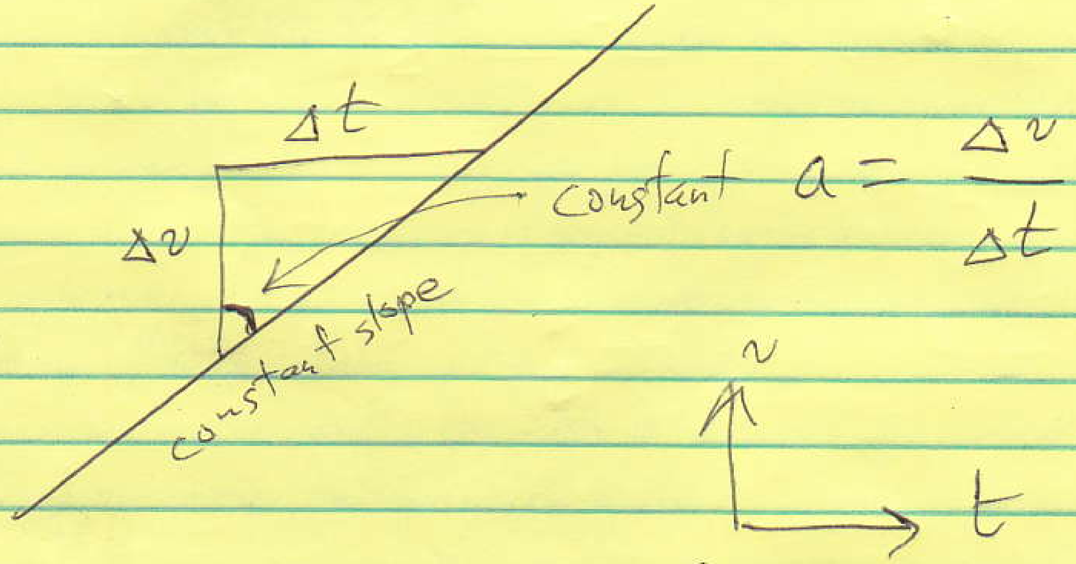
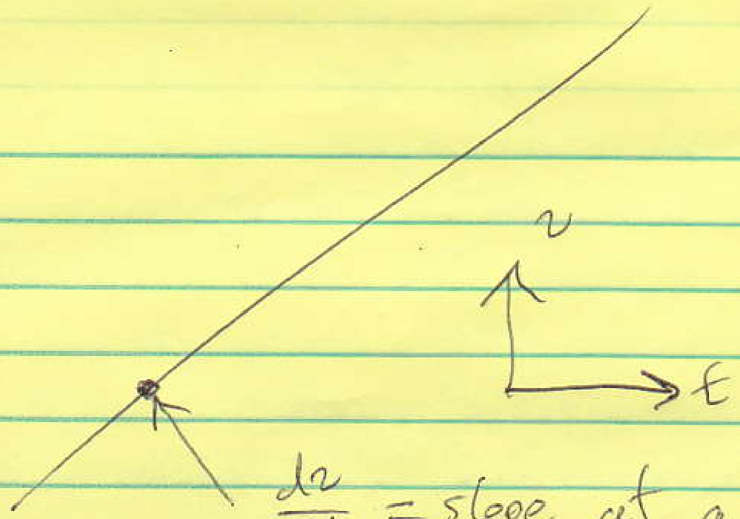
constant acceleration:



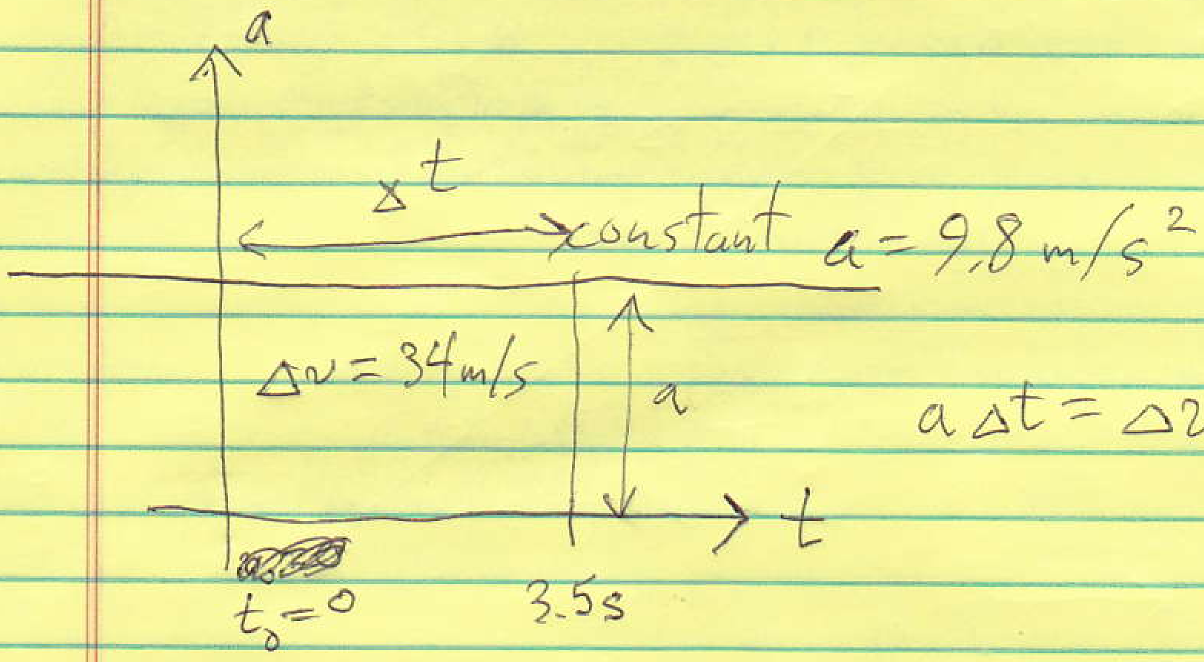


Calculus: $\frac{dv}{dt}$ (dv also small)
dt is an extremely small Δt

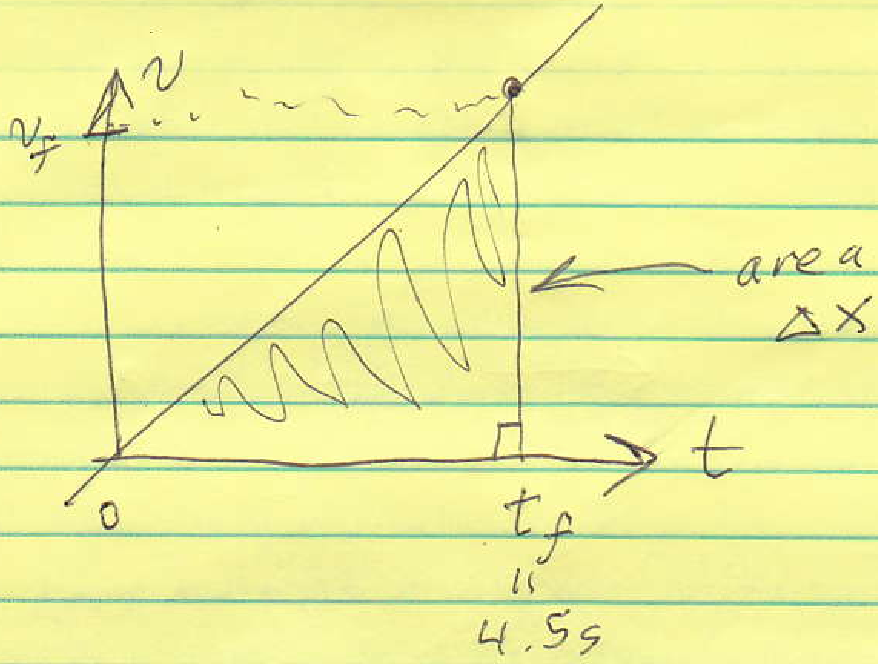


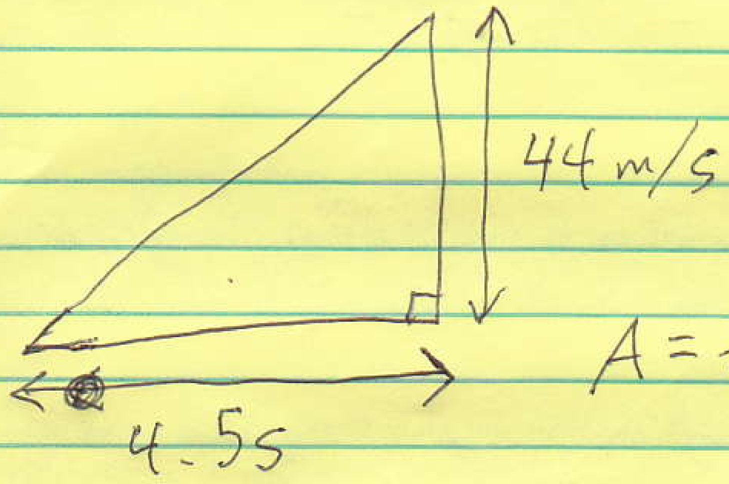
$\frac{dv}{dt}$ = slope at a point

= instantaneous rate of change



$a \Delta t = \Delta v$





$A = \frac{1}{2} b h$

$\Delta x = \frac{1}{2}(4.5\,s)(44\,m/s)$

$= 99\,m$

$$t_0 = 0$$

$$\frac{dv}{dt} = a \qquad v_0 = 0$$

$$\Downarrow$$

$$dv = a\,dt$$

$$\int_{v_0}^{v_f} dv = \int_{t_0}^{t_f} a\,dt$$

$$v \Big|_{v_0}^{v_f} = at \Big|_{t_0}^{t_f}$$

$$v_f - v_0 = at_f - at_0$$

$$v_f = at_f$$

$$\int_{v_0}^{v} dv = \int_{t_0}^{t} a\,dt$$

$$v \Big|_{v_0}^{v} = at \Big|_{t_0}^{t}$$

$$v - v_0 = at - at_0$$

$$\boxed{v = at}$$

$v = at$ $x_0 = 0$

$\frac{dx}{dt} = v$ $t_0 = 0$

$dx = v\,dt = at\,dt$

$\int_{x_0}^{x_f} dx = \int_{t_0}^{t_f} at\,dt$

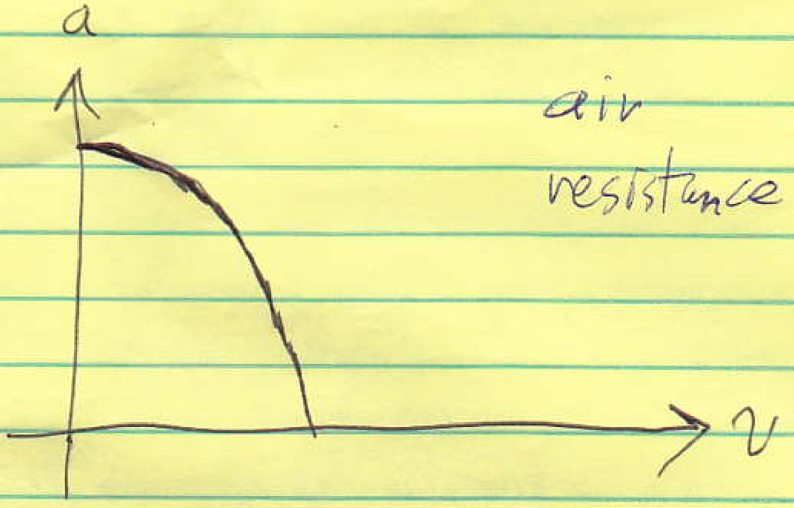
$x\Big|_{x_0}^{x_f} = \frac{1}{2}at^2\Big|_{t_0}^{t_f}$

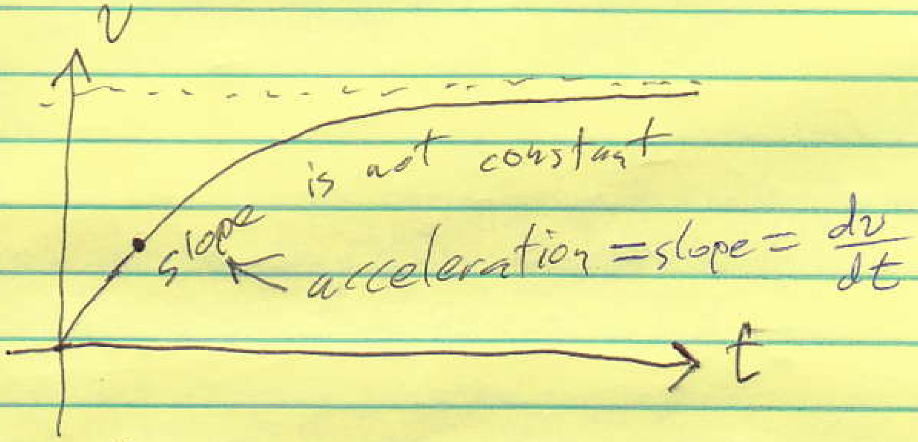
$x_f - x_0 = \frac{1}{2}at_f^2 - \frac{1}{2}at_0^2$

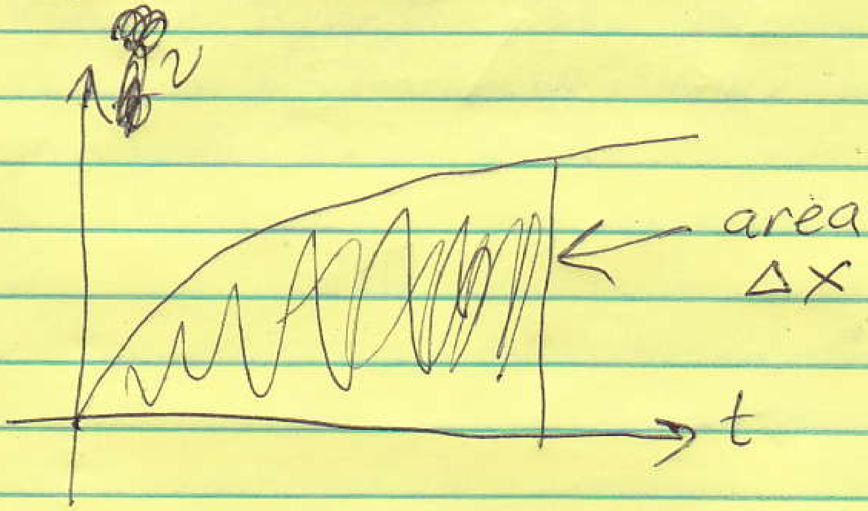
$x_f = \frac{1}{2}at_f^2$

$= \frac{1}{2}(9.8 m/s^2)(4.5 s)^2$

$= 99 m$? Yes


a
air resistance
v


v
is not constant
slope
acceleration = slope = $\frac{dv}{dt}$
t


v
area
Δx
t