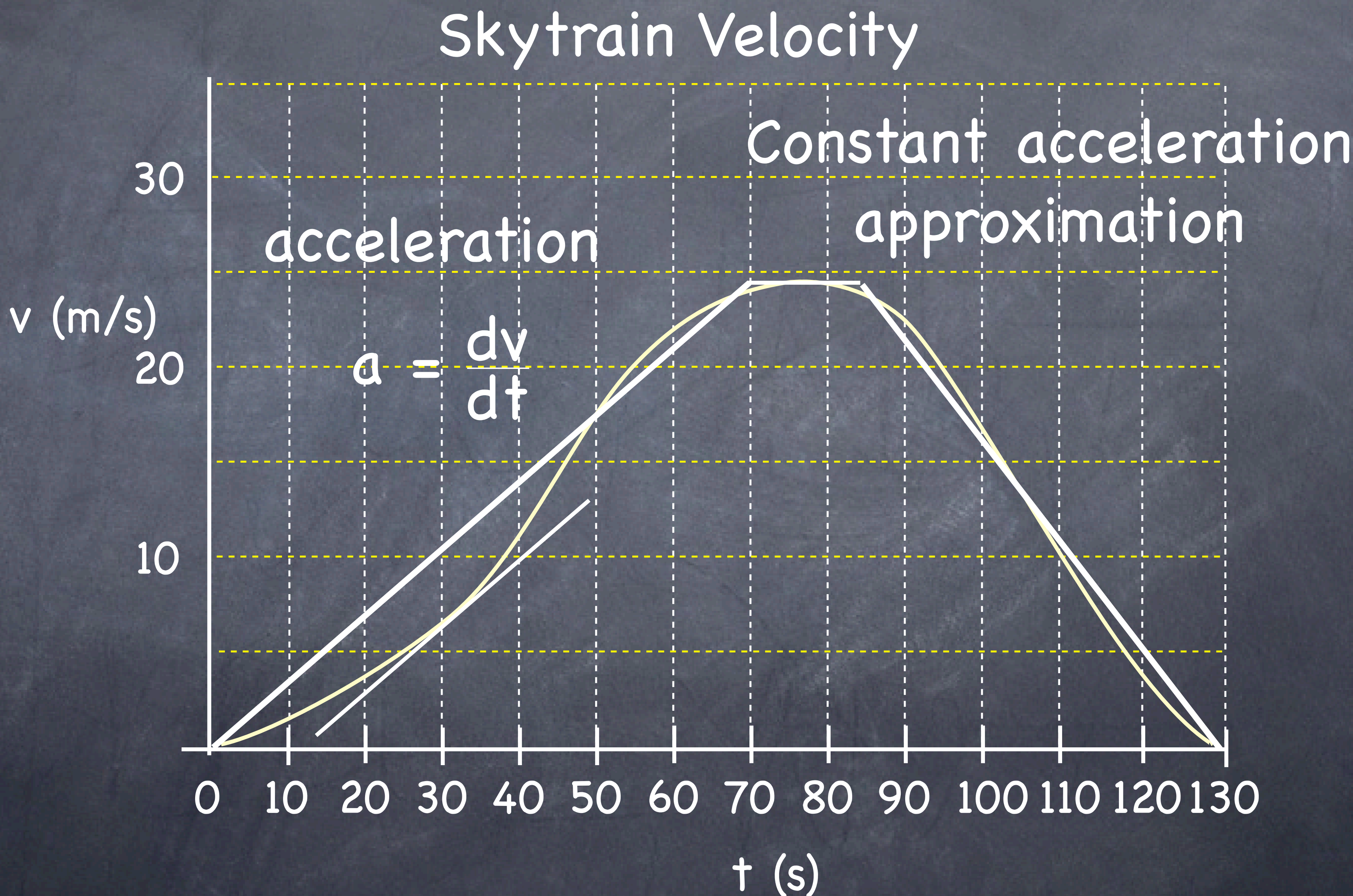
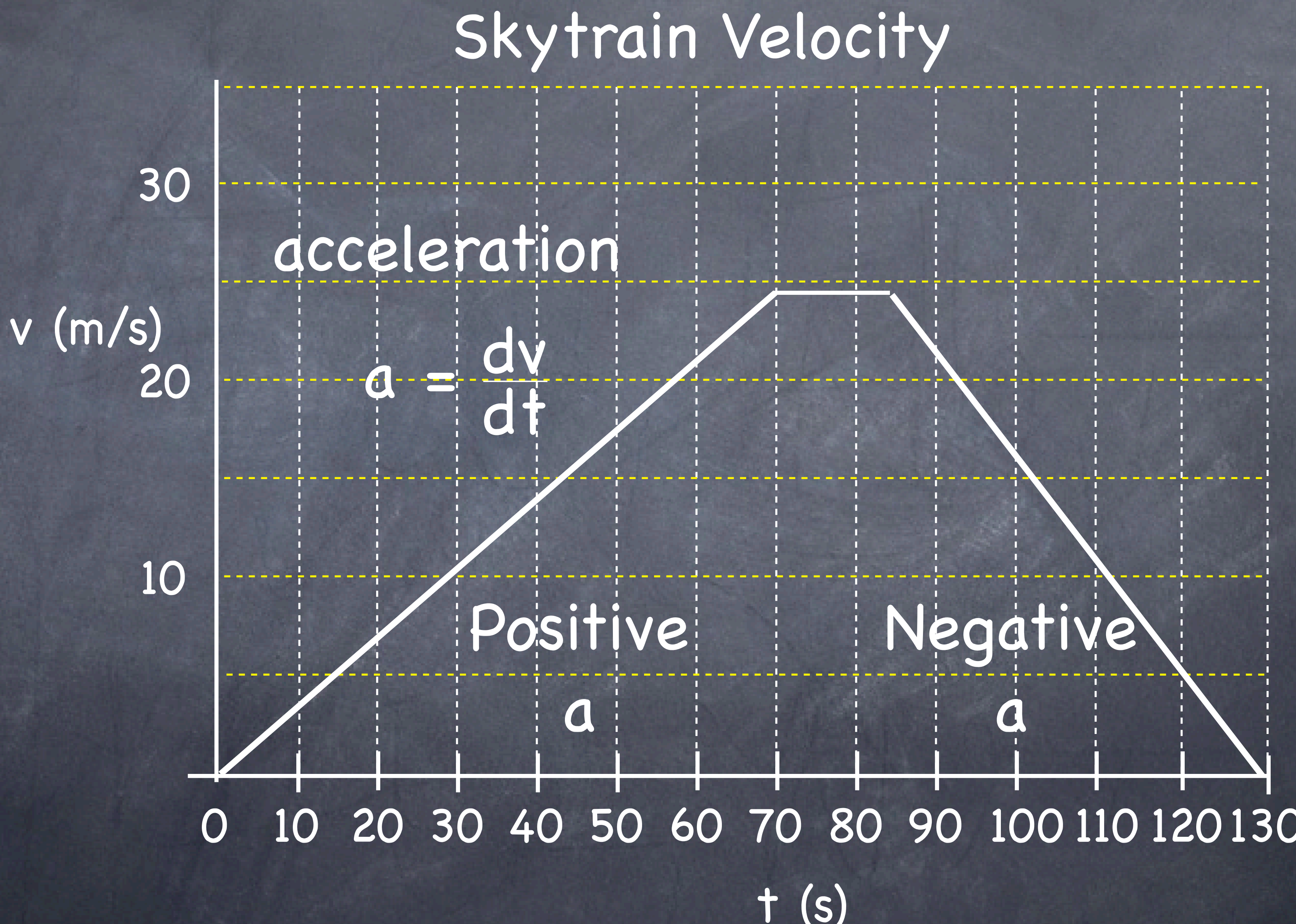
Constant Acceleration

kinematic equations

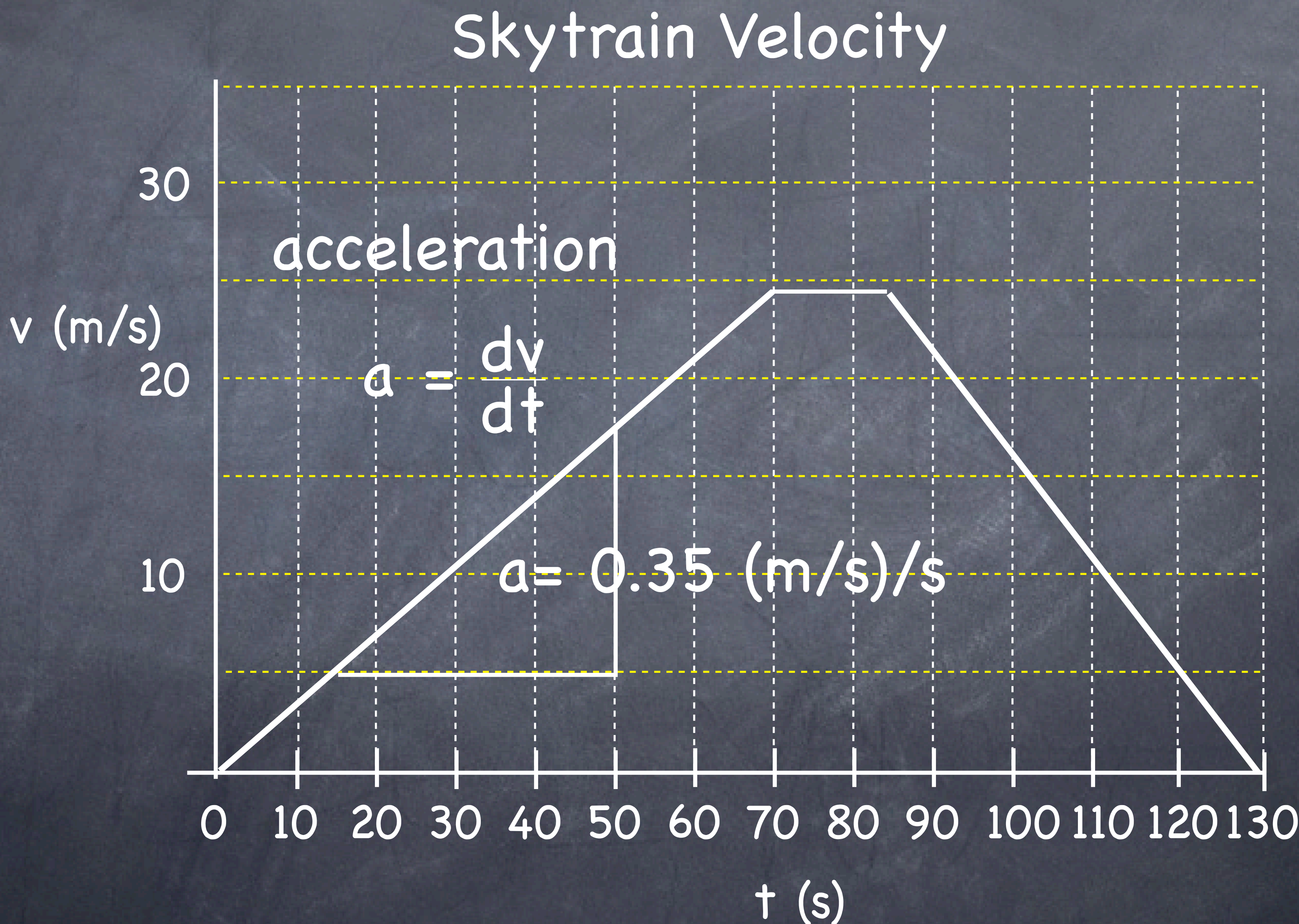
Skytrain revisited



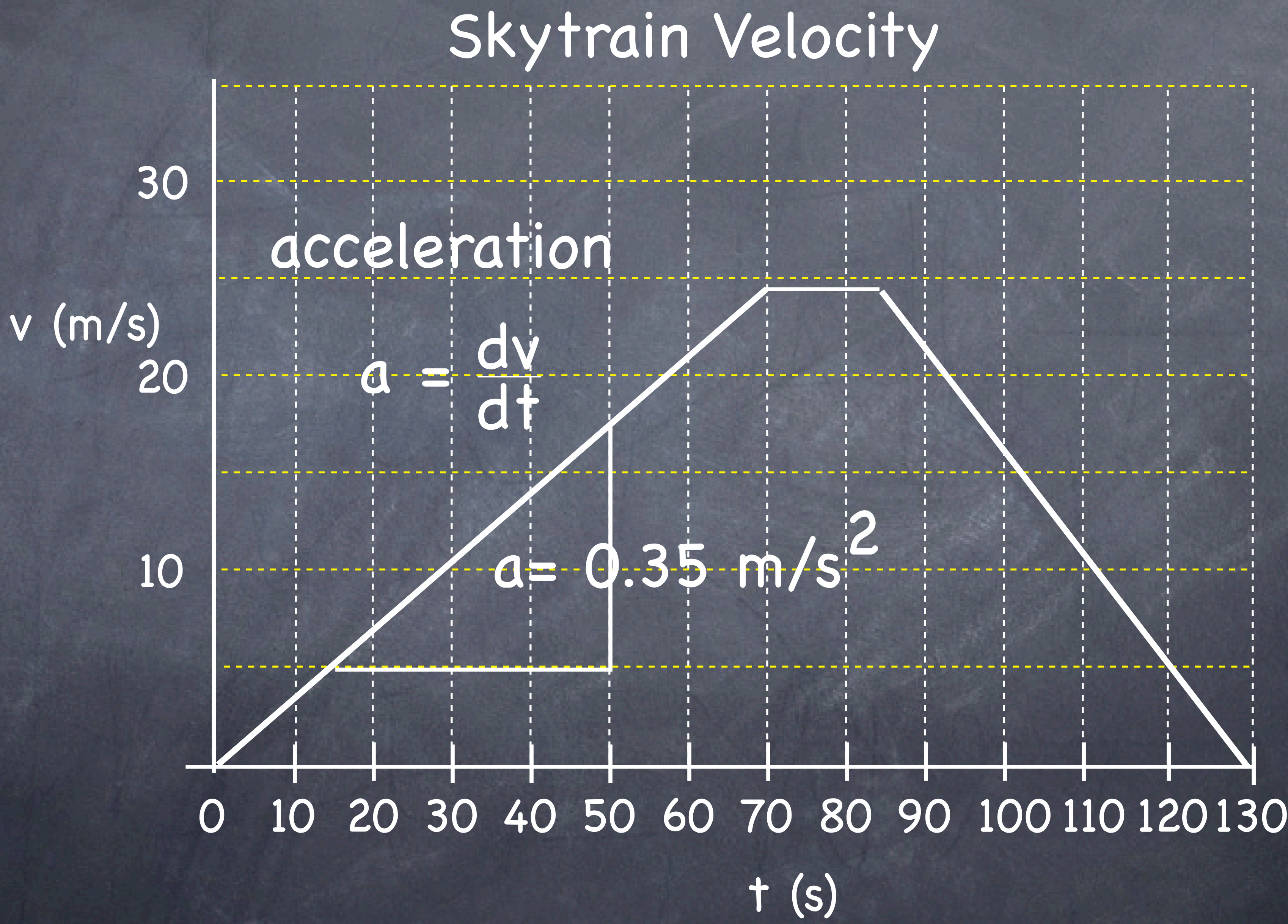
Skytrain revisited



Skytrain revisited

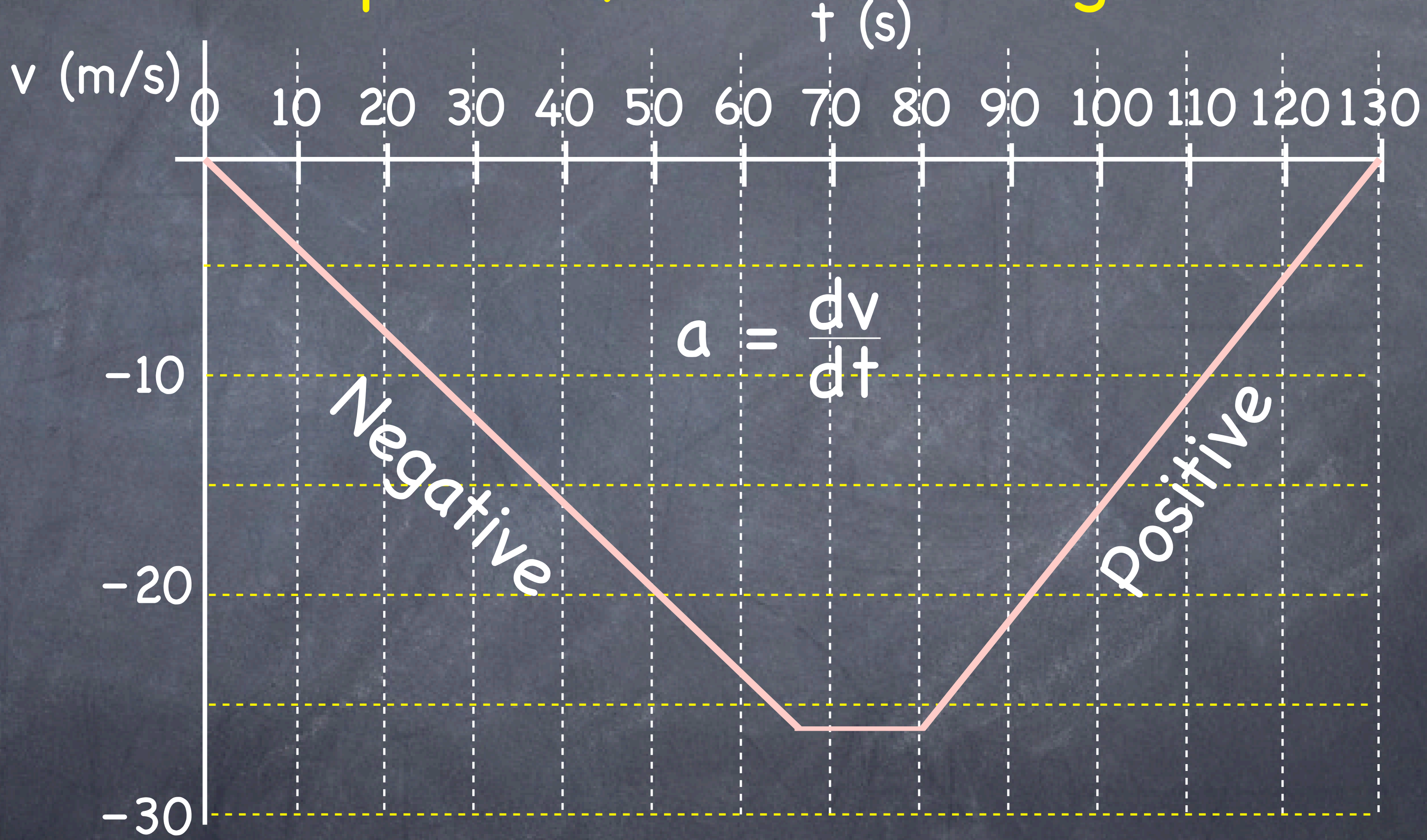


Skytrain revisited



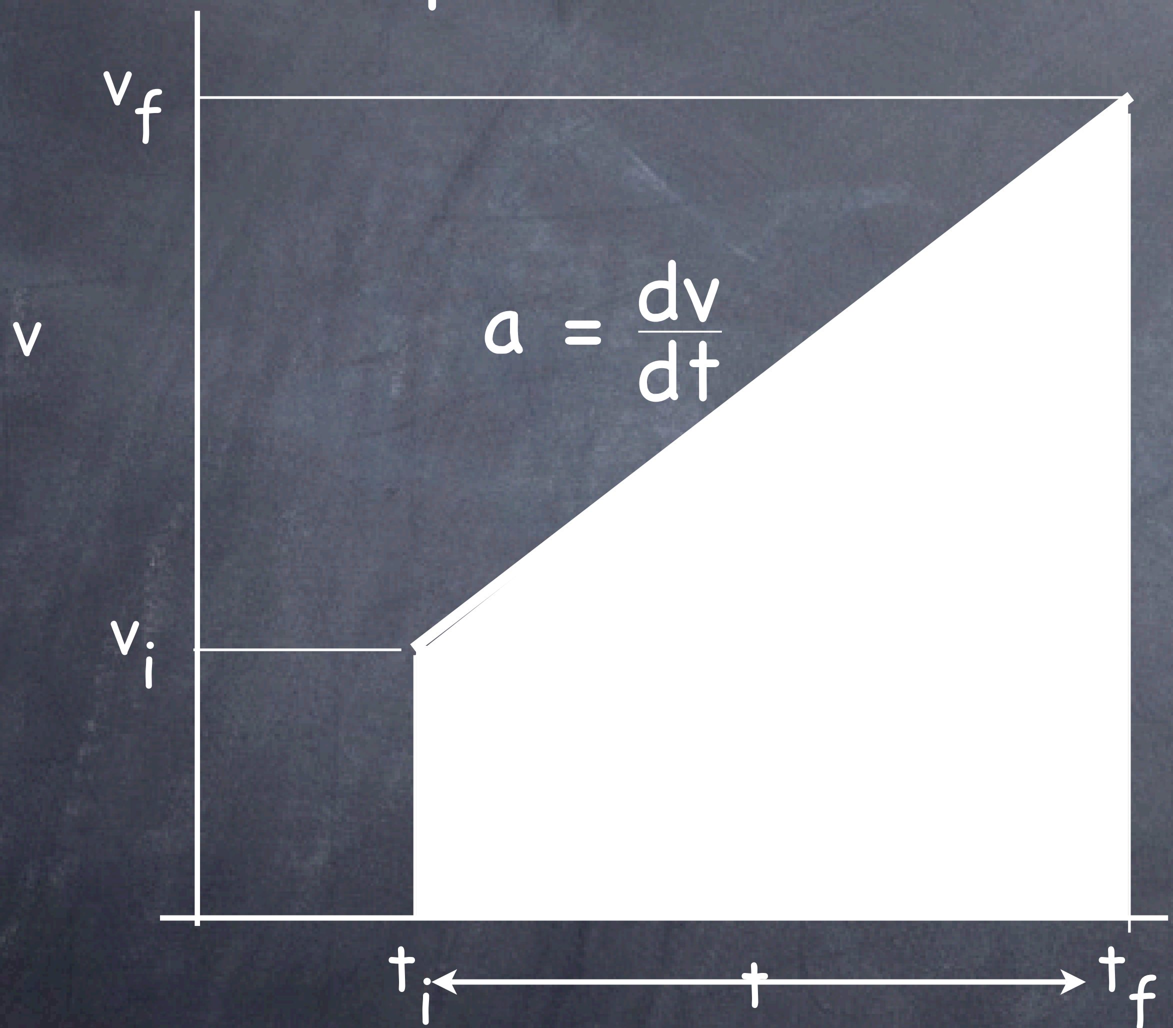
Going the Other Way

When is a positive, when is a negative?



The Kinematic Equations

$$v_f = v_i + at$$

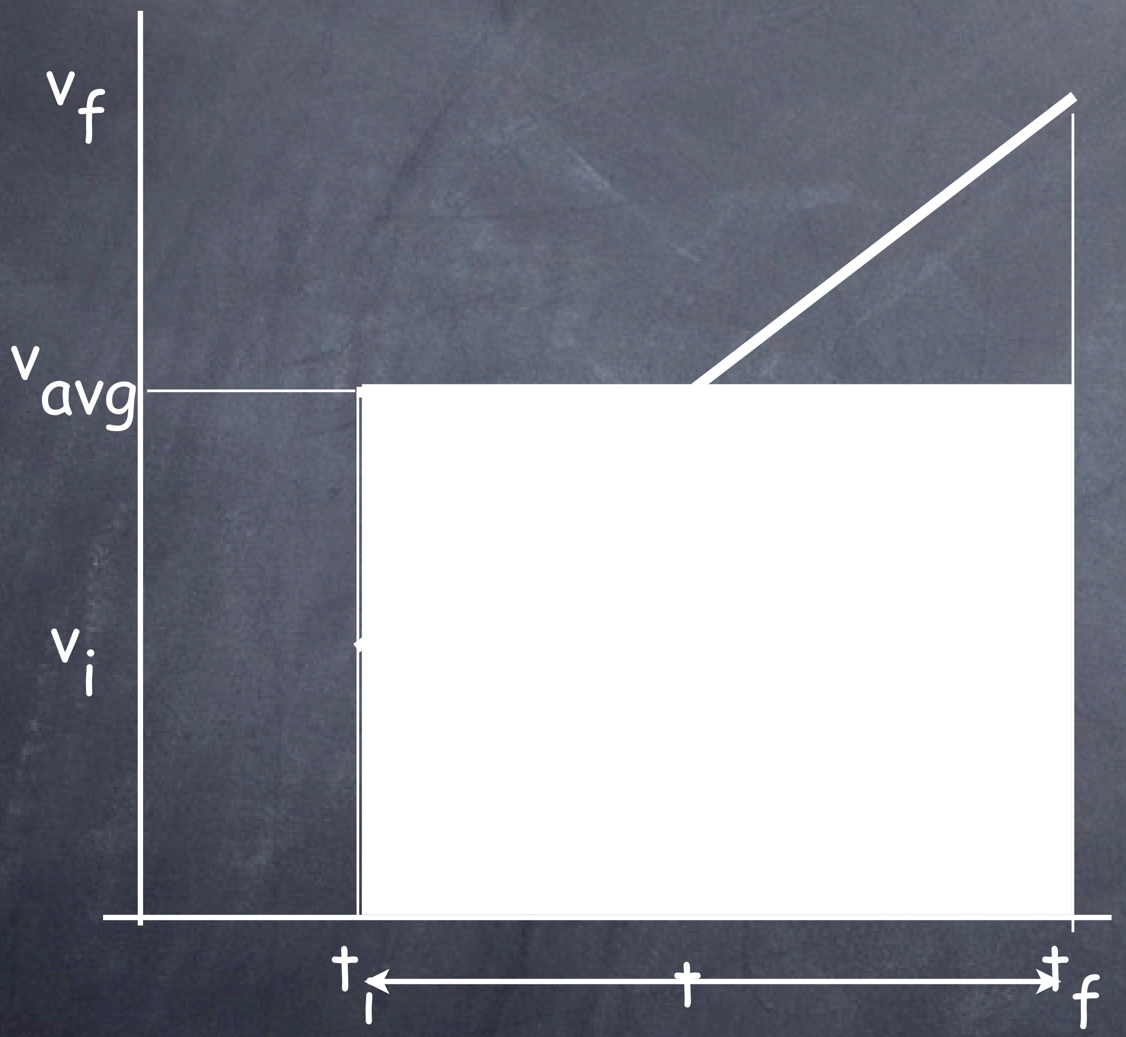


$$\Delta x = v_i t + \tfrac{1}{2}(v_f - v_i)t$$

$$\Delta x = \tfrac{1}{2}v_i t + \tfrac{1}{2}v_f t$$

$$\Delta x = \frac{v_i + v_f}{2}\, t$$

$$v_f = v_i + at$$

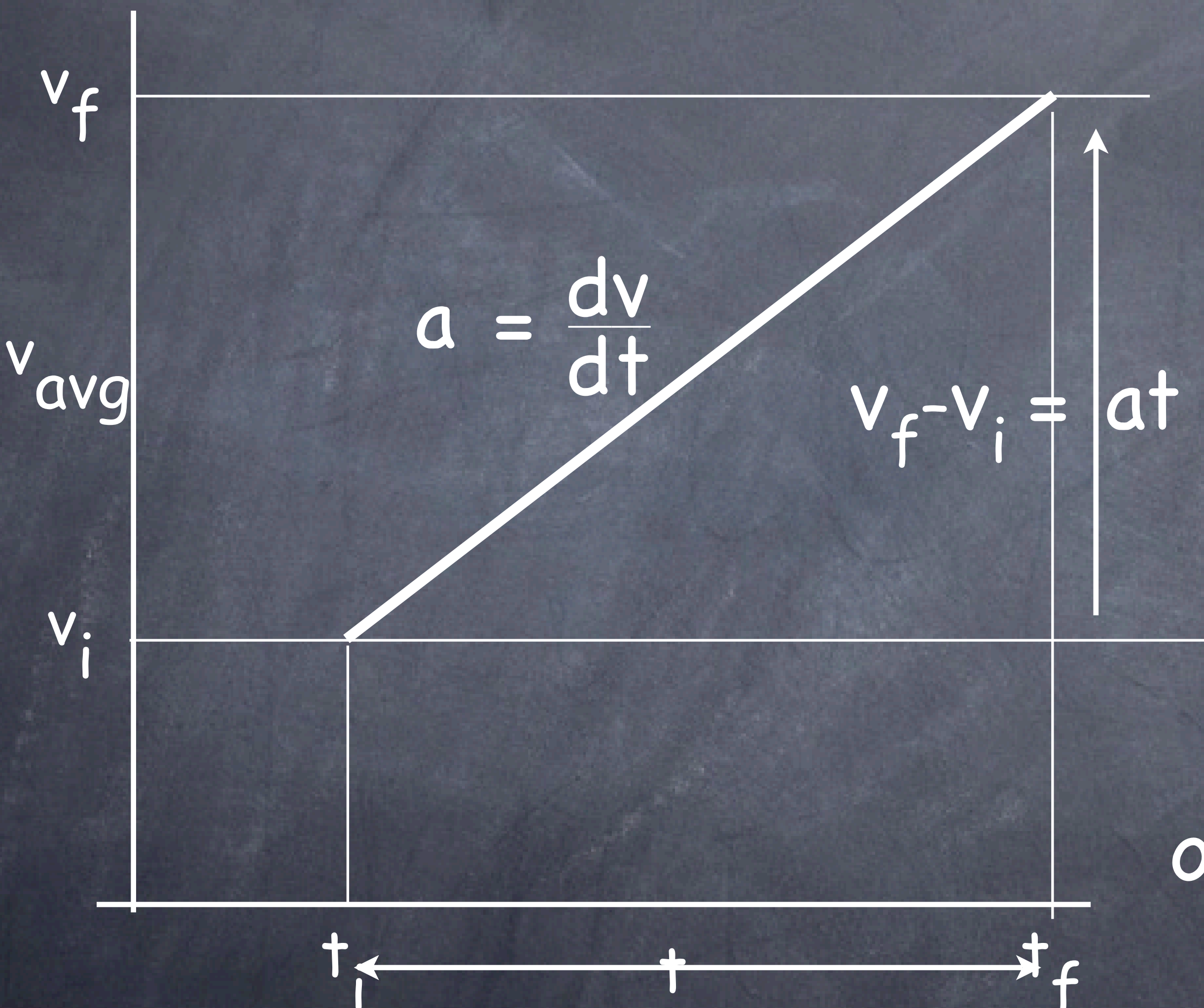


$$\Delta x = \frac{v_i + v_f}{2} t$$

$$v_{avg} = \frac{v_i + v_f}{2}$$

$$v_f = v_i + at$$

$$\Delta x = \frac{v_i + v_f}{2}\, t$$



$$\Delta x = v_i t + \tfrac{1}{2}(v_f - v_i)t$$

$$\Delta x = v_i t + \tfrac{1}{2}(at)t$$

$$\Delta x = v_i t + \tfrac{1}{2}at^2$$

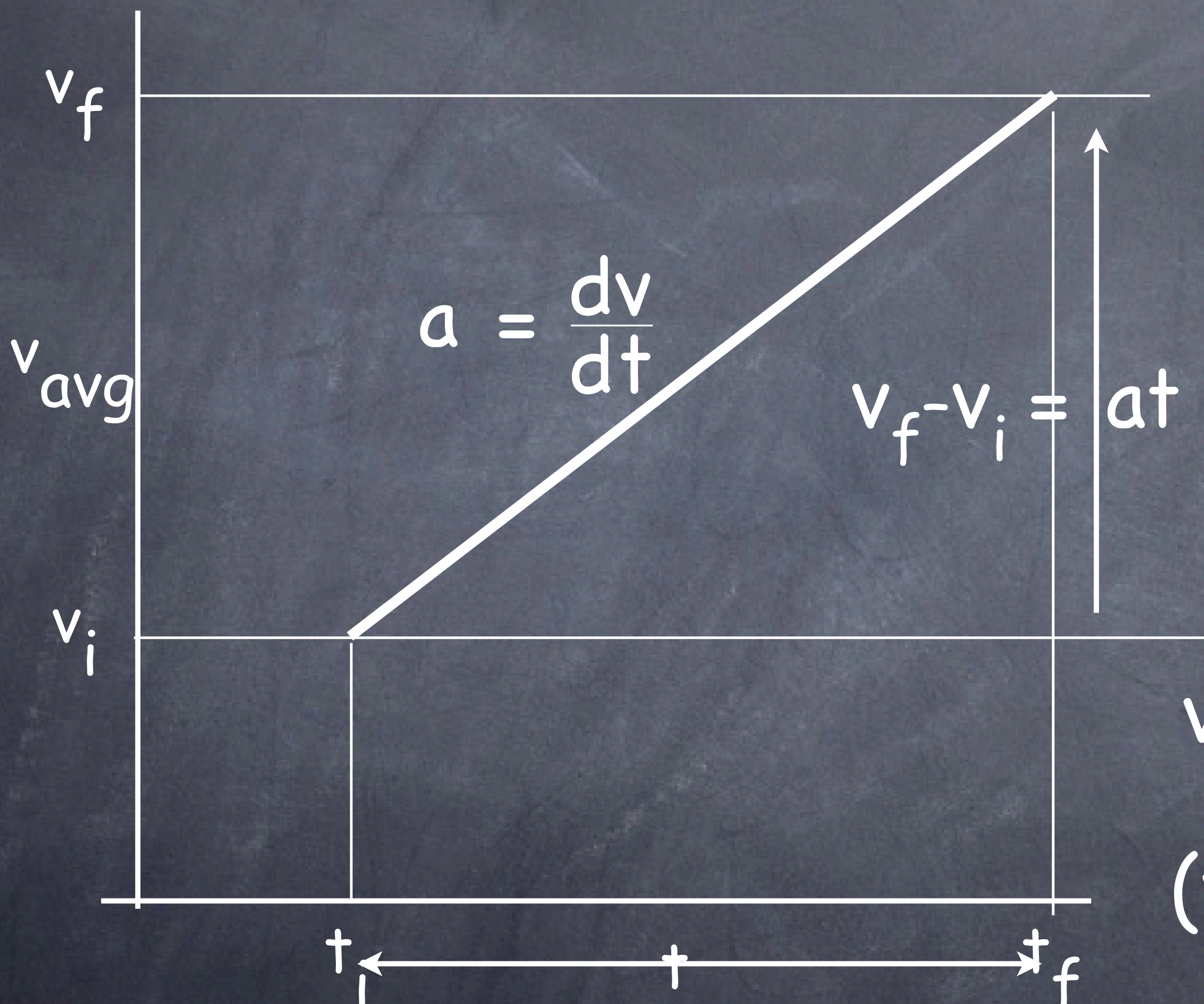
or

$$x = x_i + v_i t + \tfrac{1}{2}at^2$$

$$\Delta x = v_i t + \frac{1}{2} a t^2$$

$$v_f = v_i + at$$

$$\Delta x = \frac{v_i + v_f}{2} t$$



$$t = \frac{2}{v_i + v_f} \Delta x$$

$$v_f - v_i = at$$

$$v_f - v_i = a \frac{2}{v_i + v_f} \Delta x$$

$$(v_f - v_i)(v_f + v_i) = 2a\Delta x$$

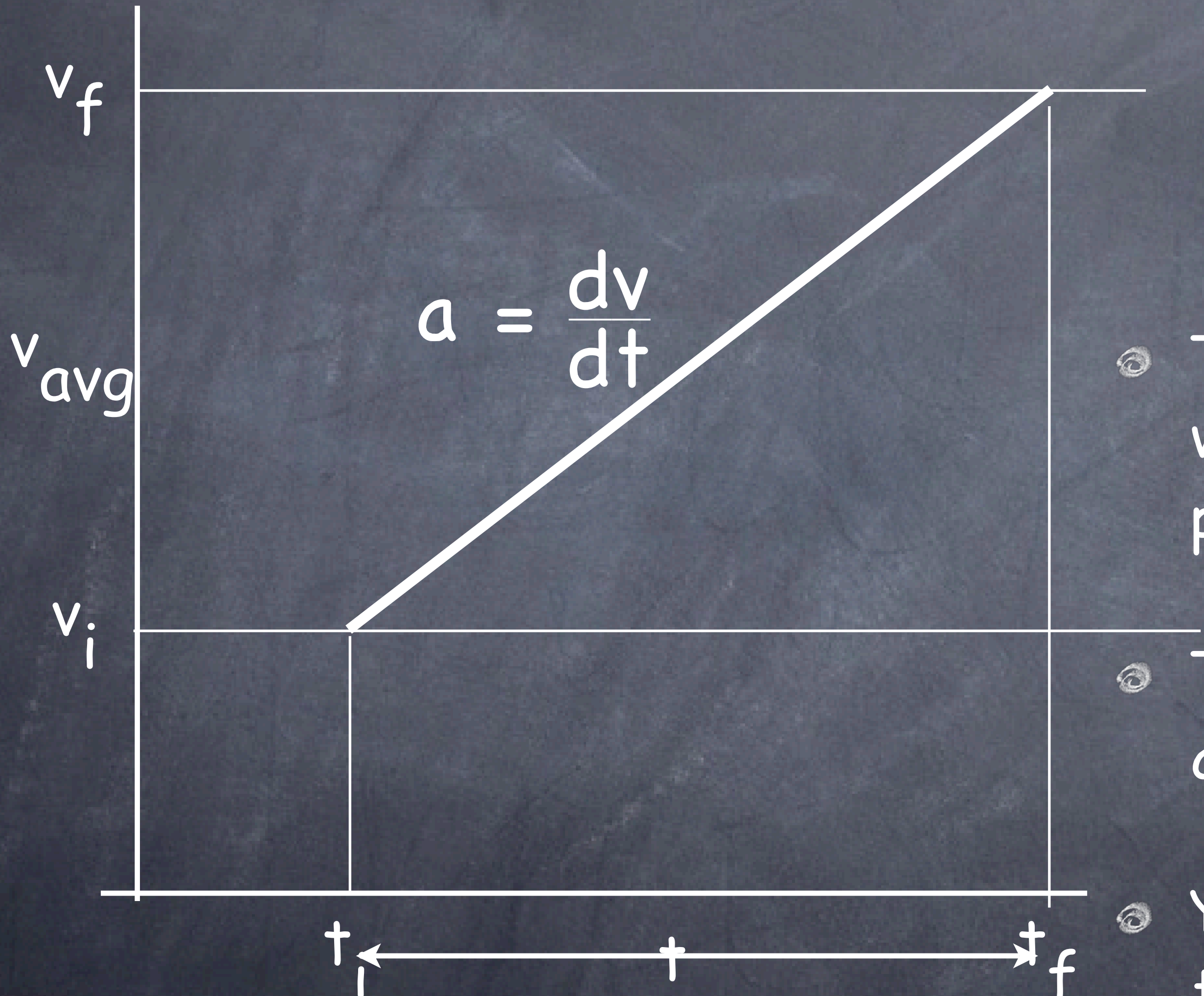
$$v_f^2 - v_i^2 = 2a\Delta x$$

$$\Delta x = v_i t + \tfrac{1}{2} a t^2$$

$$v_f = v_i + at$$

$$\Delta x = \frac{v_i + v_f}{2} t$$

$$v_f^2 - v_i^2 = 2a\Delta x$$



- This is your arsenal of weapons for kinematics problems
- They work for constant acceleration **only**.
- You only need to remember the basic definitions — use algebra to go from one to another.

and ALWAYS

draw a graphical representation of the motion before using the equations.