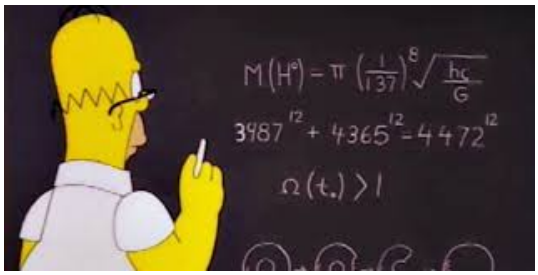
Equation of Motion



We want to describe the location of an object as a function of time.

d = distance of the object from the origin.

Assume the object starts at the origin at time=0 (if t=0 then d=0)

$d = v_{av}\, t$

$a = (v_f - v_i)/t \quad \Rightarrow v_f = v_i + at$

$v_{av} = (v_f + v_i)/2$

Note $\overline{v} = v_{av}$

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What is the plan? How do I do this?

Rather than doing each step with numbers, let us substitute equations into each other and get one grand equation which has everything included.

d equals vit plus half a t squared.
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  and don't leave out units, you'll incur the wrath!
Time is the only scalar here. A, V, and D are vectors.
Solo:
Distance and time, your secrets we've shared.
D equals vit plus half a t squared.
Yes, d is vit plus half a t squared,
  and I never make the left-out-units gaffe!
Time is the only scalar here. A,V, and d are vectors.
All:
d equals vt plus half a t squared,
and please don't forget to check the math!

How far will a freely falling object move in 4.2 seconds? (Take the acceleration of gravity to be 9.81 m/s^2

An astronaut drops a feather from 1.2 m above the surface of the moon. If the acceleration due to gravty on the moon is 1.62 m/s^2 downward, how long does it take the feather to hit the moon's surface?

A police motorcycle at rest is passed by a driver moving at a constant 88 ft/s (which is 60 mi/hr). At the instant the car passes the motorcycle, the officer begins to accelerate at 10 ft/s^2. How long will it take for the motorcycle to overtake the car?