The Kinematic Equations

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1 First Equation

Solve for initial/final velocity, acceleration, time.

$$v(t) = v_0 + at$$

1.1 Example

If v_0 is 7 m/s, accelerates at 9.8 m/s^2, what is velocity after 5 seconds?

$$v(t) = v_0 + at = 7 + 10 * 5 = 56m/s$$

2 Second Equation

Relates an object's displacement to its average velocity and time

$$\Delta x = v_{avg} * t$$

2.1 Example

A ball slows down from 15 m/s to 3 m/s over a distance of 36 m. How long did this take?
Goal: find time

$$\Delta = \frac{v + v_0}{2} t = 4 \ seconds$$

3 Third Equation

relating our displacement to our initial velocity, time, and acceleration

$$\Delta x = v_0 t + \frac{1}{2} a t^2$$

3.1 Example

Ball thrown up at 35 m/s. How far vertically?
Goal: Find the

$$\Delta x = 35 * t + \frac{1}{2}(-10)t^2 = 61.25$$

Answer is 61.25 meters

4 Fourth Equation

relates final velocity, initial velocity, acceleration, and displacement without needing a time over which a given motion occurred

$$v_f^2 = v_0^2 + 2a\Delta x$$

4.1 Example

How far does train take to come to stop if begins at 100 m/s and takes 7 sec to come to rest?

$$0 = 100^2 + 2(-14.4) * \Delta x$$
$$-10,000 = -28.8 * \Delta x$$
$$\Delta x \approx 350$$

Answer is 350 meters