uniformly-accelerated motion

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Let
x_0 is initial displacement.
x is displacement.
v_0 is initial velocity.
v is final velocity.
a is uniform acceleration.
t is time.

So

$$a = \frac{dv}{dt} \quad \text{i.e.} \quad v = at + v_0$$

$$v = at + v_0 \iff \frac{dx}{dt} = at + v_0 \quad \text{i.e.} \quad x = \frac{1}{2}at^2 + v_0 t + x_0$$

$$\begin{aligned} v^2 - v_0^2 &= (v - v_0)(v + v_0) \\ &= at \times ((at + v_0) + v_0) \\ &= 2a\left(\frac{1}{2}at^2 + v_0 t\right) \\ &= 2a(x - x_0) \end{aligned}$$

Hence we get following

$$\boxed{\left\{ \begin{array}{rcl} v &=& at + v_0 \\ x &=& \frac{1}{2}at^2 + v_0 t + x_0 \\ v^2 - v_0^2 &=& 2a(x - x_0) \end{array} \right.}$$

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