

Kinematic Eqn #3 Derivation (proof):
 get rid of t
 Start with $d = (V_{ave})(t)$

$V_f^2 = V_i^2 + 2ad$

substitute
 $V_{ave} = \frac{V_i + V_f}{2}$

$d = \left(\frac{V_i + V_f}{2}\right)t$

use Eq. 1
 $d = \left(\frac{V_i + V_f}{2}\right)\left(\frac{V_f - V_i}{a}\right)$

subst. 1.
 $V_f = V_i + at$
 $t = \frac{V_f - V_i}{a}$

$d = \frac{V_i(V_f - V_i) + V_f(V_f - V_i)}{2a}$

$2ad = -V_i^2 + V_f^2$

$V_f^2 = V_i^2 + 2ad$

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