Kinematics Equations

Constant Velocity

$$v = \frac{\Delta d}{\Delta t}$$

Constant Acceleration

$$a = \frac{\Delta v}{\Delta t} \qquad (\text{recall: } \Delta v = v_2 - v_1)$$

$$v_{ave} = \frac{\Delta d}{\Delta t} \qquad \left(\text{recall: } v_{ave} = \frac{v_1 + v_2}{2}\right)$$

ONLY when acc is constant

Maybe Useful Equations:

① $\Delta d = v_1 \Delta t + \frac{1}{2} a (\Delta t)^2$

② $\Delta d = v_2 \Delta t - \frac{1}{2} a (\Delta t)^2$

③ $v_2^2 = v_1^2 + 2a\Delta d$

] always given

One More Example:
An airplane must reach a velocity of 71 m/s for takeoff. If the runway is 1.0 km long, what must the constant acceleration be?

V_2 Δd a

$V_1 = 0$ m/s
$V_2 = 71$ m/s
$\Delta d = 1.0$ km
$a = ?$

$$V_2^2 = V_1^2 + 2a\Delta d$$

$$\frac{V_2^2 - V_1^2}{2\Delta d} = \frac{2a\Delta d}{2\Delta d}$$

$$a = \frac{V_2^2 - V_1^2}{2\Delta d}$$

$$a = \frac{(71\text{ m/s})^2 - 0^2}{2(1.0\times10^3\text{ m})}$$

$$a \doteq 2.5\text{ m/s}^2$$

units:

$$\frac{(\text{m/s})^2}{\text{m}} = \frac{\text{m}^2/\text{s}^2}{\text{m}} = \text{m/s}^2$$

How could you find your reaction time by using a ruler?

d_1 (start position)
d_2 (final position) $> \Delta d$

$V_1 = 0$
$a = 9.81\text{ m/s}^2$
$\Delta t = ?$

$$\Delta d = \cancel{V_1\Delta t}^{0} + \frac{1}{2}a(\Delta t)^2$$

$$\Delta d = \frac{1}{2}a(\Delta t)^2$$

$$2\Delta d = a(\Delta t)^2$$

$$(\Delta t)^2 = \frac{2\Delta d}{a}$$

$$\Delta t = \sqrt{\frac{2\Delta d}{a}}$$

TODO
① PP|89
② Calculator Pad (All)