PHYSICS MATH SKILLS - SOLUTIONS

1. a) $\frac{d}{t} = \frac{vt}{t}$

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

b) $\frac{d}{v} = \frac{vt}{v}$

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

2. a) $\frac{F}{a} = \frac{ma}{a}$

$m = \frac{F}{a}$

b) $\frac{F}{m} = \frac{ma}{m}$

$a = \frac{F}{m}$

3. a) $y = mx + b$ $\quad -b \quad -b$

$y - b = mx$

$\frac{y-b}{m} = \frac{mx}{m}$

$x = \frac{y-b}{m}$

b) $y = mx + b$ $\quad -b \quad -b$

$y - b = mx$

$\frac{y-b}{x} = \frac{mx}{x}$

$m = \frac{y-b}{x}$

4. a) $2x + 3y = z$ $\quad -3y \quad -3y$

$2x = z - 3y$

$\frac{2x}{2} = \frac{z-3y}{2}$

$x = \frac{z-3y}{2}$

b) $2x + 3y = z$ $\quad -2x \quad -2x$

$3y = z - 2x$

$\frac{3y}{3} = \frac{z-2x}{3}$

$y = \frac{z-2x}{3}$

5. a) $\sqrt{v_f^2} = \sqrt{v_i^2 + 2ad}$

$v_f = \sqrt{v_i^2 + 2ad}$

b) $V_f^2 = V_i^2 + 2ad$ $\quad -V_i^2 \quad -V_i^2$

$\frac{V_f^2 - V_i^2}{2a} = \frac{2ad}{2a}$

$d = \frac{V_f^2 - V_i^2}{2a}$

c) $V_f^2 = V_i^2 + 2ad$ $\quad -V_i^2 \quad -V_i^2$

$\frac{V_f^2 - V_i^2}{2d} = \frac{2ad}{2d}$

$a = \frac{V_f^2 - V_i^2}{2d}$

6. a) $d = V_i t + \frac{1}{2}at^2$ $\quad -V_i t \quad -V_i t$

$(d - V_i t) = \frac{1}{2}at^2$ $\quad \times 2 \quad \times 2$

$\frac{2(d - V_i t)}{t^2} = \frac{at^2}{t^2}$

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

b) $d = V_i t + \frac{1}{2}at^2$ $\quad -\frac{1}{2}at^2 \quad -\frac{1}{2}at^2$

$\frac{d - \frac{1}{2}at^2}{t} = \frac{V_i t}{t}$

$V_i = \frac{d - \frac{1}{2}at^2}{t}$ or $V_i = \frac{2d - at^2}{2t}$

7. a) $P = \frac{Fd}{t}$ $\quad \times t \quad \times t$

$\frac{Pt}{d} = \frac{Fd}{d}$

$F = \frac{Pt}{d}$

b) $P = \frac{Fd}{t}$ $\quad \times t \quad \times t$

$\frac{Pt}{F} = \frac{Fd}{F}$

$d = \frac{Pt}{F}$

c) $P = \frac{Fd}{t}$ $\quad \times t \quad \times t$

$\frac{Pt}{P} = \frac{Fd}{P}$

$t = \frac{Fd}{P}$

8. a) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{f} = \frac{1}{d_o} \times \frac{d_i}{d_i} + \frac{1}{d_i} \times \frac{d_o}{d_o}$

$\frac{1}{f} = \frac{d_i}{d_o d_i} + \frac{d_o}{d_o d_i}$

$\left(\frac{1}{f}\right)^{-1} = \left(\frac{d_i + d_o}{d_o d_i}\right)^{-1}$

$f = \frac{d_o d_i}{d_i + d_o}$

COMBINE RIGHT HAND SIDE INTO A SINGLE FRACTION (COMMON DENOMINATOR)

TAKE THE RECIPROCAL OF BOTH SIDES

b) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ (multiply by $-\frac{1}{d_o}$)

$\frac{1}{f} - \frac{1}{d_o} = \frac{1}{d_i}$

$\frac{1}{f} \times \frac{d_o}{d_o} - \frac{1}{d_o} \times \frac{f}{f} = \frac{1}{d_i}$

$\frac{d_o}{f d_o} - \frac{f}{f d_o} = \frac{1}{d_i}$

$\left(\frac{d_o - f}{f d_o}\right)^{-1} = \left(\frac{1}{d_i}\right)^{-1}$

$d_i = \frac{f d_o}{d_o - f}$

COMBINE LEFT HAND SIDE INTO A SINGLE FRACTION (COMMON DENOMINATOR)

TAKE THE RECIPROCAL OF BOTH SIDES

9. a) $\frac{mgh}{mg} = \frac{\frac{1}{2}mv^2}{mg}$

$h = \frac{v^2}{2g}$

b) $mgh = \frac{1}{2}mv^2$ (×2 on both sides)

$\frac{2mgh}{m} = \frac{mv^2}{m}$

$\sqrt{2gh} = \sqrt{v^2}$

$v = \sqrt{2gh}$

10. a) $m = \dfrac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$ $\times\sqrt{1-\frac{v^2}{c^2}}$ $\times\sqrt{1-\frac{v^2}{c^2}}$

$$m_0 = m\sqrt{1-\frac{v^2}{c^2}}$$

b) $m = \dfrac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$ $\times\sqrt{1-\frac{v^2}{c^2}}$ $\times\sqrt{1-\frac{v^2}{c^2}}$

$$\frac{m\sqrt{1-\frac{v^2}{c^2}}}{m} = \frac{m_0}{m}$$

$$\left(\sqrt{1-\frac{v^2}{c^2}}\right)^2 = \left(\frac{m_0}{m}\right)^2$$ REMEMBER TO SQUARE THE TOP AND BOTTOM

$$1-\frac{v^2}{c^2} = \frac{m_0^2}{m^2}$$ -1 -1

$$-\frac{v^2}{c^2} = \frac{m_0^2}{m^2} - 1$$ $\times -1$

$$\frac{v^2}{c^2} = \left(1-\frac{m_0^2}{m^2}\right)$$ $\times c^2$ $\times c^2$

$$\sqrt{v^2} = \sqrt{\left(1-\frac{m_0^2}{m^2}\right)c^2}$$

$$v = \sqrt{1-\frac{m_0^2}{m^2}}\,c$$