Equations

Rules and Common Errors

- Whatever you do to one side of the equation, you have to do to the **whole** of the other side

- When rearranging to make a particular term the subject, always do additions and subtractions before multiplications and divisions

- If you have to take the square root of both sides of the equation and there is a fraction involved – make sure that you take the square root of the **whole** fraction

Rules and Common Errors

- $x - (-y) = x + y$
- $\sqrt{x^2 + y^2} \neq x + y$
- $\frac{1}{\frac{1}{x}} = x$
- $\frac{\frac{a}{b}}{\frac{x}{y}} = \frac{ay}{bx}$
- $\left(\frac{x}{2}\right)^2 = \frac{x^2}{4}$

Rearrange the following – spend 15 minutes on this

1. $3x + y = 8$ make x the subject
2. $a - 5b = c$ make b the subject
3. $y = mx + c$ make c the subject
4. $y = mx + c$ make m the subject
5. $a^2 + 2b = t$ make a the subject
6. $v^2 = u^2 + 2as$ make s the subject
7. $\frac{a}{b+c} = 4$ make a the subject
8. $\frac{a}{b+c} = 4$ make c the subject
9. $\frac{8}{2x^2} = y$ make x the subject
10. $\frac{2}{a^2-x} = 3y$ make a the subject

answers

1.

$3x + y = 8$ make x the subject

2.

$a - 5b = c$ make b the subject

3.

$y = mx + c$ make c the subject

4.

$y = mx + c$ make m the subject

5.

$a^2 + 2b = t$ make a the subject

6.

$v^2 = u^2 + 2as$ make s the subject

7.

$$\frac{a}{b+c} = 4$$

make a the subject

8.

$$\frac{a}{b+c} = 4$$

make c the subject

9.

$$\frac{8}{2x^2} = y$$

make x the subject

10.

$$\frac{2}{a^2-x} = 3y$$

make a the subject

Lower 6th Physics equations

Module 2 – Foundations of physics	
vectors	$F_x = F\cos\theta$ $F_y = F\sin\theta$

Module 3 – Forces and motion	
uniformly accelerated motion	$v = u + at$ $s = \frac{1}{2}(u+v)t$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
force	$F = \frac{\Delta p}{\Delta t}$ $p = mv$
turning effects	moment = Fx torque = Fd
density	$\rho = \frac{m}{V}$
pressure	$p = \frac{F}{A}$ $p = h\rho g$
work, energy and power	$W = Fx\cos\theta$ $\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100\%$ $P = \frac{W}{t}$ $P = Fv$
springs and materials	$F = kx$ $E = \frac{1}{2}Fx$; $E = \frac{1}{2}kx^2$ $\sigma = \frac{F}{A}$ $\varepsilon = \frac{x}{L}$ $E = \frac{\sigma}{\varepsilon}$

Module 4 – Electrons, waves and photons	
charge	$\Delta Q = I\Delta t$
current	$I = Anev$
work done	$W = VQ$; $W = \mathcal{E}Q$; $W = VIt$
resistance and resistors	$R = \frac{\rho L}{A}$ $R = R_1 + R_2 + \ldots$ $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots.$
power	$P = VI$, $P = I^2R$ and $P = \frac{V^2}{R}$
internal resistance	$\mathcal{E} = I(R + r)$; $\mathcal{E} = V + Ir$
potential divider	$V_{out} = \frac{R_2}{R_1 + R_2} \times V_{in}$ $\frac{V_1}{V_2} = \frac{R_1}{R_2}$
waves	$v = f\lambda$ $f = \frac{1}{T}$ $I = \frac{P}{A}$ $\lambda = \frac{a\,x}{D}$
refraction	$n = \frac{c}{v}$ $n\sin\theta = \text{constant}$ $\sin C = \frac{1}{n}$
quantum physics	$E = hf$ $E = \frac{hc}{\lambda}$ $hf = \phi + KE_{max}$ $\lambda = \frac{h}{p}$

Adding Fractions

- There is one particular question that comes up at A Level that involves the need to add fractions algebraically

- Many pupils struggle with this at first

- To add fractions they must have a **common denominator**

Adding Fractions

For example:

$\frac{1}{2} + \frac{1}{3} = \frac{(3+2)}{6} = \frac{5}{6}$ …… no problem !

Adding Fractions

But, when letters appear in the denominator, some pupils struggle:

For example:

$$\frac{1}{R}+\frac{1}{3}=\frac{(3+R)}{3R}$$

Another example:

$$\frac{2}{3R}+\frac{3}{4R}=\frac{(8+9)}{12R}=\frac{17}{12R}$$

Note, the common denominator is 12R, **not** $12R^2$

Add the following fractions algebraically – spend 5 minutes on this

1. $\frac{2}{R} + \frac{3}{4}$

2. $\frac{3}{5R} + \frac{1}{3R}$

3. $\frac{2}{R} + \frac{1}{3R} + \frac{3}{4R}$

answers

1.

$$\frac{2}{R} + \frac{3}{4}$$

2.

$$\frac{3}{5R} + \frac{1}{3R}$$

3.

$$\frac{2}{R} + \frac{1}{3R} + \frac{3}{4R}$$