Keep Calm and Do the Same Thing to Both Sides

♦ We preserve the equal sign by doing the **same thing** to **both sides**.

♦ Simplify an equation step-by-step by applying operations opposite/inverse to the ones you aim to remove.

Mutually opposite (inverse) operations

Addition and subtraction

$$x \boxed{+\, 5} = 3 \quad \Big| \; \textbf{- 5}$$
$$x = -2$$

Division and multiplication

$$\boxed{2 \times} p = 7 \quad \Big| \; \textbf{÷ 2}$$
$$p = \frac{7}{2}$$

Square root and squaring

$$\sqrt{x + 3} = a + b \quad \Big| \; \square^{\,2}$$
$$x + 3 = (a + b)^2$$

Exponent and logarithm

$$\boxed{\ln} (x + 3) = a + b \quad \Big| \; e^{\square}$$
$$x + 3 = e^{(a+b)}$$

♦ Perhaps start by removing the entities that are furthest away from your subject. Work in small steps, removing one operation at a time, thus getting closer and closer to the subject.
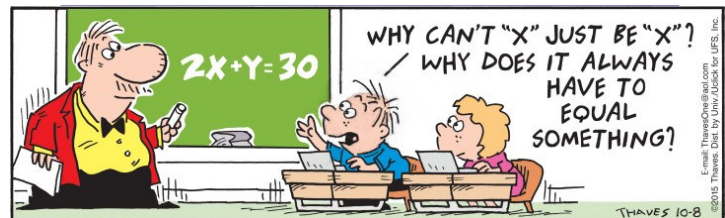
$$2x \boxed{+\, 5} = 7 \quad \Big| \; \textbf{- 5}$$
$$2x = 2$$

♦ Simplify equations with fractions by multiplying both sides by the common denominator.

$$\frac{2x}{\boxed{5}} = \frac{1}{\boxed{3}} + x \quad \Big| \; \times \textbf{15}$$

$$2x \times 3 \; = 1 \times 5 + 15x$$

♦ It is OK to do many small (but correct) steps. It is also OK to only think of the next small step instead of 'having to plan the entire route in detail from the start'.

♦ *Visit **http://mathematics.cit.ie/transposition** for fully worked examples.*

Brush up Your Transposition of Formulae Skills

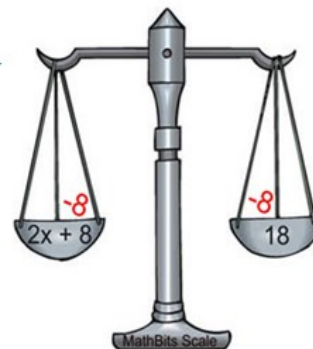**Subject**: the single variable everything else is equal to

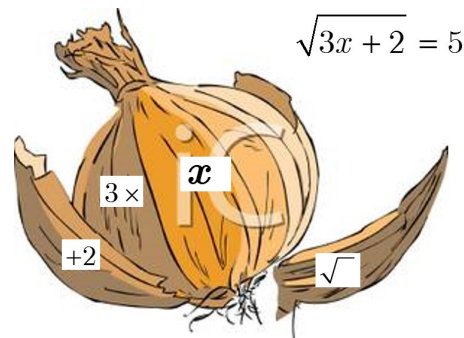$$Q = cm\left(T_1 - T_0\right)$$
$$V = l \times w \times h$$
$$r = \sqrt{x^2 + y^2}$$
$$I = \frac{V}{R}$$

♦ Keep the equation balanced.

♦ Think of peeling an onion, removing outer layers before getting to the core, as an analogy of getting to the subject in your formula.

$$\sqrt{3x + 2} = 5$$

♦ It is all the same thing: transposition of formulae, rearranging equations, solving formulae, solving equations, changing the subject.