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

$$x + 5 = 3 \quad \big| \; \mathbf{-5}$$
$$x = -2$$

Division and multiplication

$$2 \times p = 7 \quad \big| \; \mathbf{\div 2}$$
$$p = \frac{7}{2}$$

Square root and squaring

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

Exponent and logarithm

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

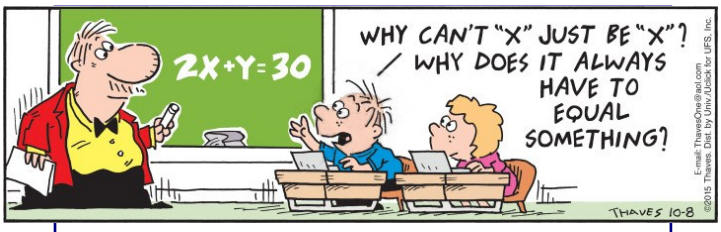
- Perhaps start by removing the entities that are furthest away from your subject. Work in small steps, removing one operation at a time, thus getting closer and closer to the subject.

$$2x + 5 = 7 \quad \big| \; \mathbf{-5}$$
$$2x = 2$$

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

$$\frac{2x}{5} = \frac{1}{3} + x \quad \big| \; \times \mathbf{15}$$
$$2x \times 3 = 1 \times 5 + 15x$$

- 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.*

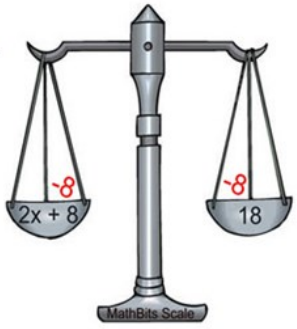


Brush up Your Transposition of Formulae Skills

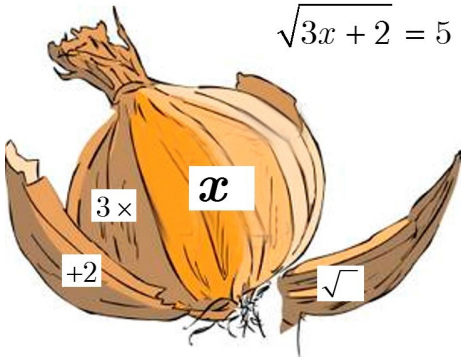
Subject: the single variable everything else is equal to

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

- 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.



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

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