Rearranging Equations

Rule

The main rule when rearranging equations is that **anything done to one side of the equals sign must be done to the other side.**

Example 1: Changing the subject

In the equation, $x = y \times z$, the subject is currently x.

However, to solve for z you can **rearrange the equation** to make z the subject. You can think of this process as trying to 'free' the z from the other variables in the equation to make it stand by itself on one side of the equals sign.

So, to make z the variable, follow this process:

Starting with: $x = y \times z$

Divide both sides by y. This will cancel y out on the right hand side of the equation (any number divided by itself equals 1, meaning that $\frac{y}{y}$ = 1 and any number x 1 equals itself, i.e. x times $\frac{y}{y}$ equals x).

This makes z the subject of the equation.

$\frac{x}{y} = \frac{y \times z}{y}$ $\frac{x}{y} = \frac{y \times z}{y}$

When cancelling out all y, we get: $\frac{x}{y} = z$, which can be re-written as: $z = \frac{x}{y}$

We have now made z the subject, and can put in the values for x and y to solve for z.

Example 2: Changing the subject when looking for a denominator

Sometimes, we want to solve for a denominator, which can seem a bit trickier. However, the same concept applies: anything we do to one side of the equals sign must be done to the other.

Say we have:

$\frac{2x}{ay} = z$

Currently, the subject is z, but to rearrange the equation and make the subject y, we follow the same process:

First, remove y from its position as a denominator by multiplying both sides with ay.

$\frac{2x}{ay} \times ay = z \times ay$ $\frac{2x}{ay} \times ay = z \times ay$

Once all the 'ay' have been cancelled out on the right-hand side, we are left with: $2x = z \times ay$.
We can also write this as $2x = azy$. This is because whenever we don't see another sign between variables, we assume they are multiplied.

Now that y is no longer a denominator, we can rearrange the equation as we did in Example 1 above. To 'free' the y, we need to remove a and z. We do this by dividing both sides by az.

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$\frac{2x}{az} = \frac{azy}{az}$ $\frac{2x}{az} = \frac{\cancel{az}y}{\cancel{az}}$ Which is the same as: $\frac{2x}{az} = y$

Activity

Rearrange the following equations, making x the subject (free the x). Be sure to show your working on paper as you go. This method will allow you to trace through your steps if your answer is different, and find where you went wrong. This is also advised in examinations too, so the marker can see your process (and potentially award you marks even when your end result is incorrect).

1. $y = x + 2b$
2. $2xa = \frac{y}{b}$
3. $\frac{y}{x} = 2ab$

Answers

1. Subtract $2b$ from both sides to get $y - 2b = x$
2. Divide both sides by $2a$ to get $x = \frac{y}{2ab}$
3. First multiply both sides with x to get $y = 2abx$. Then, divide both sides with $2ab$ to get $\frac{y}{2ab} = x$.

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