

## Using the eqnarray package

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Imagine that you have an equation that you want to manipulate, for example, to simplify it. Often this is done over a number of steps to help the reader understand how to get from the original equation to the final result. This should be a relatively simple task, but as we shall see, the skills for displaying mathematics from the previous tutorial are not adequate.

Using what we know so far:

$$\begin{aligned} 10xy^2 + 15x^2y - 5xy &= 5(2xy^2 + 3x^2y - xy) \\ &= 5x(2y^2 + 3xy - y) \\ &= 5xy(2y + 3x - 1) \end{aligned} \tag{1}$$

This clearly looks rather ugly. One way to the various elements neatly aligned is to use a table, and place equations inline. Let's have a go:

$$\begin{array}{l} 10xy^2 + 15x^2y - 5xy \\ = 5(2xy^2 + 3x^2y - xy) \\ = 5x(2y^2 + 3xy - y) \\ = 5xy(2y + 3x - 1) \end{array}$$

That doesn't look too bad. Perhaps the extra space between the equation on the left and the equals sign being larger than the gap on the right doesn't look perfect. That could be rectified by adding an extra column and putting the equals sign in the central one:

$$\begin{array}{l} 10xy^2 + 15x^2y - 5xy \\ = \\ = 5(2xy^2 + 3x^2y - xy) \\ = 5x(2y^2 + 3xy - y) \\ = 5xy(2y + 3x - 1) \end{array}$$

Looking better. Another issue is that the vertical space between the rows makes the equations on the right-hand side look a little crowded. It would be nice to add a little space — make the rows in the table a little taller.

$$\begin{array}{l} 10xy^2 + 15x^2y - 5xy \\ = \\ = 5(2xy^2 + 3x^2y - xy) \\ = 5x(2y^2 + 3xy - y) \\ = 5xy(2y + 3x - 1) \end{array}$$

However, by this stage, we've had to do quite a bit of extra leg work, and there is still one important disadvantage at the end of it. You can't add equation numbers. Because once you are within the `tabular` environment, you can only use the inline type

of maths display. For equation numbers, you need to use the display mode `equation` package, but you can't in this instance. This is where `eqnarray` becomes extremely useful.

`eqnarray`, as the name suggests borrows from the `array` package which is a simplified tabular environment. The `array` package was introduced in tutorial 9 for producing matrices. Here is how to use `eqnarray` for this example:

$$10xy^2 + 15x^2y - 5xy = 5(2xy^2 + 3x^2y - xy) \quad (2)$$

$$= 5x(2y^2 + 3xy - y) \quad (3)$$

$$= 5xy(2y + 3x - 1) \quad (4)$$

As you can see, everything is laid out nicely and as expected. Well, except that each row within the array has been assigned its own equation number. Whilst this feature is useful in some instances, it is not required here — just the one number will do! To suppress equation numbers for a given row, add a `\nonumber` command just before the end of row command (`\`).

$$10xy^2 + 15x^2y - 5xy = 5(2xy^2 + 3x^2y - xy)$$

$$= 5x(2y^2 + 3xy - y)$$

$$= 5xy(2y + 3x - 1) \quad (5)$$

If you don't care for equation number at all, then rather than adding `nonumber` to every row, use the starred version of the environment, i.e., `\begin{equarray*} ... \end{equarray*}`.

NB There is a limit of 3 columns in the `eqnarray` environment. If you need any-more flexibility, you are best advised to seek the AMS Maths packages.