

SyMan Lesson 5: Factoring By Grouping

This exercise shows you how you may use SyMan to factor expressions by grouping. Subsequent exercises will introduce other ways of factoring expressions.

As you follow along with the example below, be sure to read the explanation after each step. These explanations tell you why you are doing each step, and give further helpful advice.

Step 1 Enter the expression " $12xy + 8x + 9y + 6$ ".

Step 2 Use the mouse to click on the "+" between the first two terms in the active equation window (the box at the top right side of the screen).

The first two terms should be highlighted in black after you click on them. You can select any two terms this way— all you have to do is click on the operator between them ("+", "-", "*", or even the horizontal dividing line in an expression like $\frac{1}{x+1}$.) By selecting part of an expression, you can force SyMan to manipulate only specific terms, rather than the whole expression.

Step 3 Click on the "factor" button in the upper left corner.

If you look carefully, you'll notice that the factor " $4x$ " is common to the first two terms, and it may help to factor the " $4x$ " out.

Step 4 SyMan will ask what you wish to factor out— enter " $4x$ " and write the resulting expression in the space below ("simp" it first). Check that this is correct by expanding and simplifying this result by hand.

$$12xy + 8x + 9y + 6 = \underline{\hspace{10em}}$$

Step 5 Select the last two terms of the active equation by clicking on the "+" between them.

There is a common factor to the last two terms, so we should factor it out as well.

Step 6 Click on the "factor" button and enter the expression you wish to factor out from the selected terms. Simplify the result and write it below:

$$4x(3y + 2) + 9y + 6 = \underline{\hspace{10em}}$$

Step 7 You should notice that the factor $(3y + 2)$ is common to both terms and can therefore be factored out. Use SyMan to factor and simplify the active equation, then write the final result below:

$$12xy + 8x + 9y + 6 = (\quad) (\quad)$$

Note that if you do not select any part of the active equation, SyMan tries to factor the whole thing— which is what you wanted in this particular case. For other examples, you may only want to factor part of an expression, so you will have to select it first.

Step 8 Confirm that the final factored form is correct by expanding and simplifying it. Use the "expand" and "simp" buttons in the upper left corner.

Step 9 Repeat steps 1-8 for the expression " $4ab - 12b + a^2 - 3a$ ". Note that the common factors are different from the first example! (and don't forget that " a^2 " is entered as " a^2 ")

When you have completed Steps 1 through 9, go on to answer the following questions:

- 1.) Factor the following expressions using the grouping technique covered in this worksheet.
- a) $xy - x + 3y - 3 = (\quad) (\quad)$
- b) $15ab - 6a + 20b - 8 = (\quad) (\quad)$
- c) $-xy + x + 4y - 4 = (\quad) (\quad)$
- d) $4qr - 36q + 2r - 2q = (\quad) (\quad)$
- e) $-6j + jk + 30 - 5k = (\quad) (\quad)$
- f) $ac + ad - bc - bd = (\quad) (\quad)$
- 2.) Factor the following as in question 1. To enter a fraction like $\frac{1}{2}$, type (1/2) with the brackets. For example, $\frac{1}{2}y$ is entered as (1/2)y. Note that the common factors are not all integers!
- a) $xy + x - \frac{1}{2}y - \frac{1}{2} = (\quad) (\quad)$
- b) $-ab + \frac{1}{2}b + \frac{3}{4}a - \frac{3}{8} = (\quad) (\quad)$
- c) $\frac{1}{2}cd - 2c + 2d - 8 = (\quad) (\quad)$
- d) $x^2y - 30x^2 + \frac{1}{10}y - 3 = (\quad) (\quad)$
- e) $3j - \frac{1}{2}jk - 2 + \frac{1}{3}k = (\quad) (\quad)$
- f) $\frac{1}{10}ac + \frac{1}{6}ad + \frac{1}{5}bc + \frac{1}{3}bd = (\quad) (\quad)$