

The purpose of this worksheet is to help you become familiar with some of *Derive*'s algebra capabilities.

Getting Started:

See the "Running *Derive*TM 6" handout for instructions on how to access *Derive*. You should see a screen similar to the one shown in Figure 1 below (without the algebraic expression).

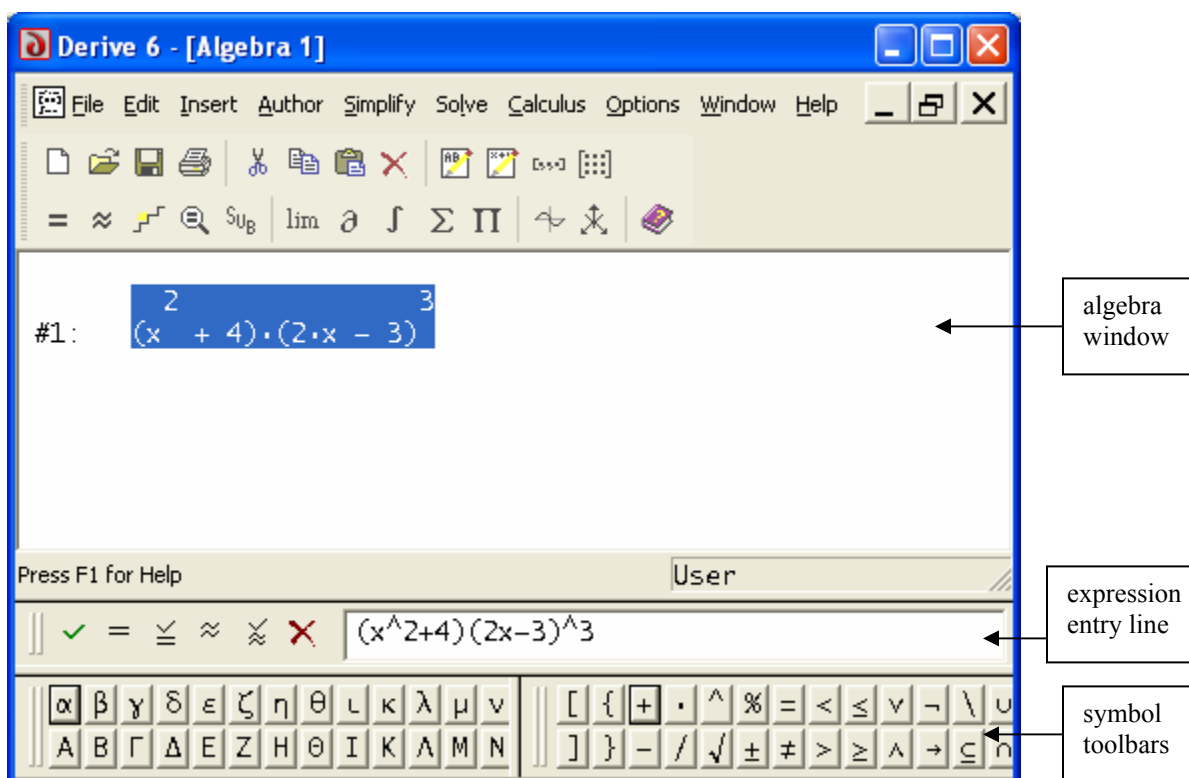


Figure 1: *Derive* Screen

Authoring an Expression:

To enter an expression into *Derive*, click in the *expression entry line* (the box at the bottom of the window directly above the *symbol toolbars*). Type the expression using the keyboard or by clicking appropriate symbols from the toolbar. When you have the correct expression, press "Enter" on the keyboard, or click on the green check mark.

Try This:

Enter $(x^2+4)(2x-3)^3$. You may use an asterisk (*) for multiplication, but you do not have to. Be sure to press "Enter" or click the check mark when you are finished typing. You should see your expression on line #1 of the *algebra window*. Enter the expression $9x^5 + 12x^4 - 83x^3 - 139x^2 + 118x - 21$. If you were successful, this should be on line #2 of the *algebra window*.

Expanding an Expression:

Highlight an expression from the list in the algebra window by clicking once on the expression. Note that the most recently authored expression is highlighted by default. From the Simplify menu at the top of the window, choose “Expand”. By default, the *expansion variable* is x , and the *factoring type* is “rational.” (See Figure 2 below.) In this course, we will almost always accept those defaults, and just click the “Expand” button.

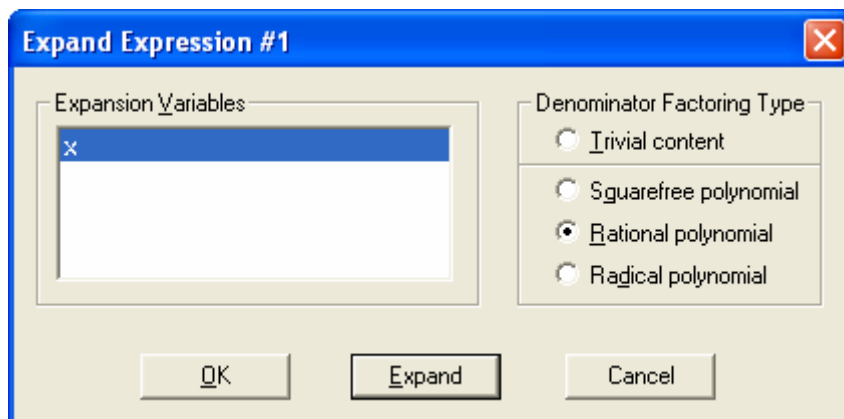


Figure 2: "Expand" Dialog Box

Factoring an Expression:

Highlight an expression from the list in the algebra window. From the Simplify menu, choose “Factor.” Again, we will almost always accept the defaults (see Figure 3 below). So just click the “Factor” button.

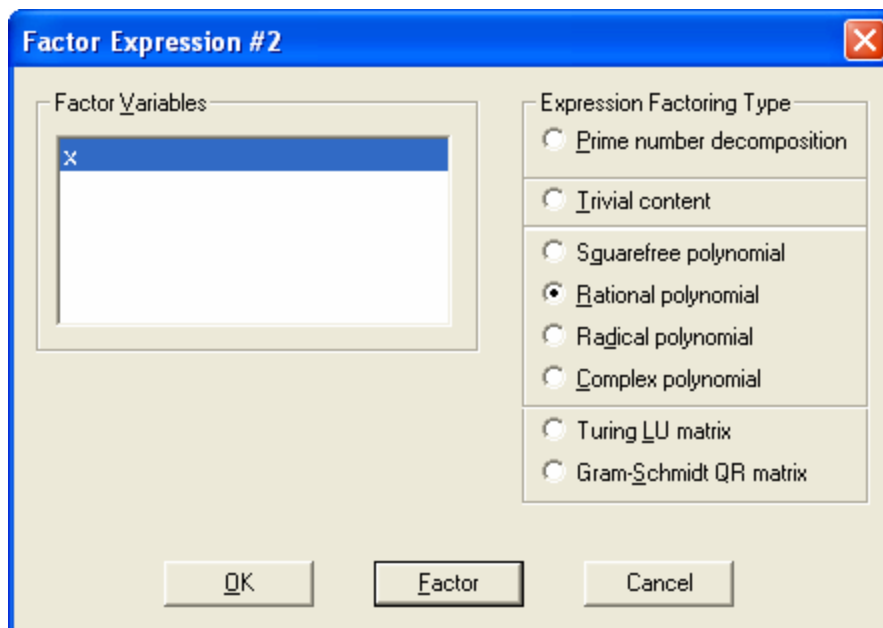


Figure 3: "Factor" Dialog Box

Try This:

Click once on Expression #1 to highlight it. Then expand it. You should see the result $8x^5 - 36x^4 + 86x^3 - 171x^2 + 216x - 108$ as Expression #3.

Click once on Expression #2 to highlight it, and then factor it. You should see the result $(x-3)(x^2 + 5x + 7)(3x-1)^2$ as Expression #4.

Operations with Rational Expressions:

To add or subtract rational (fraction) expressions, highlight the appropriate line in the algebra window. Then choose “Factor” from the Simplify menu. Accept the defaults, and click the “Factor” button in the dialog box.

Try This:

Author the expression $\frac{1}{x} + \frac{3}{x+4}$. Use the slash (/) for division, and remember to use parentheses around $x+4$. When you’re done, this should be Expression #5 and should already be highlighted. Now simplify to complete the addition. You should see the result $\frac{4(x+1)}{x(x+4)}$ as Expression #6.

Author the expression $\frac{1-x}{x} + \frac{3x^2+5}{2x-1}$, and then simplify it. The final result should be $\frac{3x^3 - 2x^2 + 8x - 1}{x(2x-1)}$. Try choosing “Basic” from the Simplify menu instead of “Factor,” just to see what happens.

Solving Equations:

An equation is an expression that has an equal sign. If you ask Derive to “solve” an expression that doesn’t have an equal sign (or an inequality), you may be surprised at the result. To solve an equation, author it, including the equal sign, and then highlight it if necessary. Choose “Expression” from the Solve menu at the top of the screen. We will almost always want only the real number solutions to any equations, so choose the “Real” solution domain from the “Solve” dialog box (see Figure 4 below). Then click the “Solve” button in the dialog box. If the equation has multiple solutions, the solutions will be separated by the “or” operator (\vee).

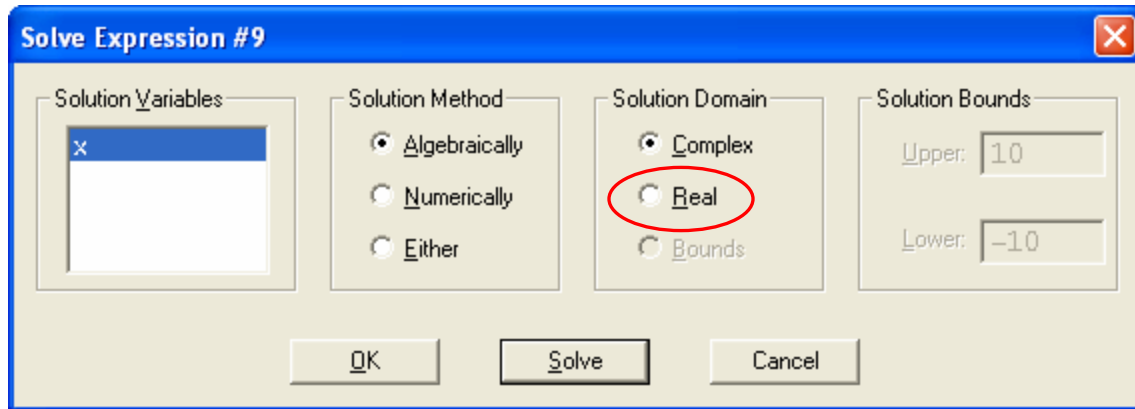


Figure 4: "Solve" Dialog Box

Try This:

Author the equation $3x + 5 = 17x - 8$. Then solve it. You should see $x = \frac{13}{14}$ as your result.

Author the equation $x^4 + 2x^2 - 3 = 0$, and then solve it. You should see $x = -1 \vee x = 1$ as your result. Recall that this notation means the equation has two solutions: $x = 1$ and $x = -1$. If you chose the "Complex" solution domain from the "Solve" dialog box, your result would include the two complex numbers $i\sqrt{3}$ and $-i\sqrt{3}$.

Copying Results from Derive onto Your Homework Paper:

Derive uses a dot to indicate multiplication: $3 \cdot x \cdot (x - 3)$, for example. When you write this expression on your paper, when your teacher writes it on the blackboard, or when someone types it in a document like the one you're reading now, we usually indicate multiplication by juxtaposition, without the dots: $3x(x - 3)$.

On your paper, multiple solutions to a single equation should be separated with commas: $x = 1, x = -1$. You could also use the word "or" in place of the comma. Do not use the " \vee " symbol you see on the Derive screen.

When you ask Derive to solve an equation that has no solutions (of a given type), you'll see the result "False." On your paper, you should write that the equation has no solutions.

Exercises

Use *Derive*TM 6 for the following exercises. Use standard mathematical notation to record the results **on a separate sheet of notebook paper**. Do not turn in a print-out of your Derive session. Note that “standard” notation is not always the same as Derive’s notation. Remember that I should be able to tell what the question was, from the answer written on your paper.

1. Type each of the following in the expression entry line (and press enter). Describe the results and what you think they mean.

3xy
CALculus
illness
pink
p*ink
sqrtx

2. Factor each of the following expressions.

- (a) $16x^6 - 96x^5 + 232x^4 - 312x^3 + 297x^2 - 216x + 81$
- (b) $2hx^2 + 4x^2 - h^2x - 2hx - 2h^2 - h^3$
- (c) $x^2 + 5x + 1$ (This has no additional factors as a “rational polynomial,” so factor it as a “radical polynomial.”)

3. Expand each of the following expressions.

- (a) $3(t+4)^2(t^2 - 6t + 17)$
- (b) $\frac{3x^2 + 4}{x^2 - 1} \cdot \frac{2x - 8}{x + 1}$
- (c) $(a+b)^2(3a-4)$ (In the “Expand” dialog box, be sure to highlight both variables.)

4. Solve each of the following equations. Include only the real number solutions.

- (a) $4x^2 + 5x = 17$
- (b) $\frac{3x}{x+2} - \frac{6x^2}{5} = 2x$
- (c) $2x^4 = -7 - 9x^2$