SyMan Lesson 6: Solving Quadratic Equations

In previous exercises, you have learned to use SyMan's graphing and algebra capabilities to solve linear equations. This exercise shows you how you may use SyMan to solve quadratic equations.

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 **In the space below, write "`x\s(2)-2x-3`" in factored form.**

`x\s(2)-2x-3 = (              )(              )`

Recall that when you are factoring a trinomial like this one, you are looking for numbers that multiply to give the numeric term, `-3`, and add to give the coefficient of the 'x' term, `-2`.

Step 2 **Enter the expression from Step 1 in its factored form. Click on the "expand" button and then the "simp" button in the upper-left corner, and write down the resulting expression.**

expression from Step 1 expands into: ______________________________

The final result should be the equation "`x\s(2)-2x-3`", since all you've really done is check that the factorization was correct. You can use SyMan to check your work like this, though something that simple hardly calls for a computer. As you'll now see, SyMan is far more useful in other ways....

Step 3 **Enter the equation "`x\s(2)-2x-8 = 0`". Remember that a power like "`x\s(2)`" is entered as "`x^2`".**

In order to solve a quadratic equation for x, you must factor it into the form "`(x ± a)(x ± b)=0`", where "`a`" and "`b`" are constants. For example, to solve "`x\s(2)-2x-3 = 0`" we factor it into "`(x+1)(x-3) = 0`". Since `(x+1)` multiplied by `(x-3)` is equal to zero, '`x`' must be either `-1` or `3`. Note how much easier it is to see these solutions when the equation is written in factored form.

Step 4 **Click on the "factor" button in the upper-left corner of the screen.**

You are going to solve the equation by factoring it. Unfortunately, SyMan does not find the factors for you— you have to determine them yourself (though later we'll see an easy way to find these factors).

Step 5 **Enter the expression you wish to factor out, then click on the "OK" button. Simplify the result using the "simp" button. (Hint: try "`x+c`" where "`c`" is one of the numbers which multiply to `-8` and add to `-2`.)**

SyMan will try to factor out the expression you enter, and tell you if the factor is incorrect. You may have noticed that SyMan also factors the zero on the right-hand side of the expression. Though this is mathematically correct, it is a little distracting and we'll later see how to prevent SyMan from doing this.

Step 6 **With the equation factored, it is easy to see the x-values that satisfy the equation "`x\s(2)-2x-8 = 0`". Write these solutions in the space below:**

x = ________________ or x = ________________

Step 7 **Enter and factor the equation "`x\s(2)+5x+4 = 0`". Write the solutions for x in the space below.**

x = ________________ or x = ________________

Step 8 **Enter and graph the equation from Step 1, "`y = x\s(2)-2x-3`". Compare the graph to the factored form of the equation. In particular, look at things like the coordinates of the vertex, the x-intercepts, and the y-intercepts.**

Step 9 **Clear the graph and repeat Step 8 for the equation from Step 6, "`y = x\s(2)-2x-8` ". As in Step 8, you should see a relationship between the factored form of the equation and its graph. See if this relationship holds for the equation from Step 7, "`y = x\s(2)+5x+4`".**

Step 10 **Clear the graph, then enter and graph "`y = x\s(2)-x-12`". From the graph, you should be able to immediately write the factors below. Check your answer by telling SyMan to factor out one of the roots, then simplify the result.**

`x\s(2)-x-12 = (          )(          )`

You should have noticed that the graph passes through the x-axis at the roots of the expression. For example, `x\s(2)-2x-3 = 0` factors to `(x-3)(x+1)=0`, and the graph passes through the x-axis at `x=3` and `x=-1`. The sign change is due to the fact that either `(x-3)=0` or `(x+1)=0`, so either `x=3` or `x=-1`.

Step 11 **Use the graph of "`y = x\s(2)-3x-10`" to factor the right side of the equation.**

`x\s(2)-3x-10 = (          )(          )`

When you have completed Steps 1 through 11, go on to answer the following questions:

1.) Factor the following expressions using the graph technique covered in this worksheet. You may have to "Zoom Out" the graph to see some of the x-intercepts.

a) `x\s(2)+9x+14 = (          )(          )`

b) `x\s(2)-8x-20 = (          )(          )`

c) `x\s(2)+9x+18 = (          )(          )`

d) `x\s(2)-11x-26 = (          )(          )`

e) `x\s(2)-25 = (          )(          )`

f) `x\s(2) + 6x + 9 = (          )(          )`

2.) Factor the following as in question 1. Note that the roots are not all integers!

a) x\s(2) – \f(x,2) – \f(15,2) = ( )( )

b) 2x\s(2) +11x + 12 = ( )( )

c) x\s(2) + \f(3x,4) – \f(1,4) = ( )( )

d) x\s(2) – \f(1,4) = ( )( )

e) x\s(2) + 2x – \f(21,4) = ( )( )

f) 2x\s(2) + x – 10 = ( )( )

3.) Factor the following expressions using the graph technique covered in this worksheet. Note that these expressions are of degree three and therefore have **three** roots!

a) x\s(3) + 2x\s(2) – 19x – 20 = ( )( )( )

b) x\s(3) – 57x\s(2) + 56 = ( )( )( )

c) x\s(3) + 3x\s(2) – 70x = ( )( )( )

d) x\s(3) + 6x\s(2) + 11x + 6 = ( )( )( )

e) x\s(3) – 10x\s(2) + 31x – 30 = ( )( )( )

4.) What do you suppose happens if you try to use the same technique to factor equations which have no real roots? Describe the problem with factoring x\s(2) – 3x + 5 , which has no real roots.