The AC Method

Part 1

How to be able to tell when a polynomial isn’t factorable when trying to solve

$$ax^{2}+bx+c=0$$

1. **Make a list of the coefficients**

**a =**

**b =**

**c =**

A common source of error is to start with the wrong coefficients, particularly with negative numbers. For example,

$$3x^{2}-x-5=0$$

has

a = 3,

b = $-$1, and

c = $-$5.

1. **Find ac.**

 In our example above, ac = 3\*(-5)= -15.

1. **List the factor pairs of ac, in order.**

 Continuing with our example, we would write

 **-15**

|  |  |
| --- | --- |
| 1 | -15 |
| -1 | 15 |
| 3 | -5 |
| -3 | 5 |

1. **Add the factor pairs to see which, if any, add up to b. If none do, the polynomial is not factorable. If a factor pair does sum up to b, proceed to Step 5.**

 In the list above, we would have a 3rd column of the sums of the factor pairs:

 **-15**

|  |  |  |
| --- | --- | --- |
| 1 | -15 | -14 |
| -1 | 15 | 14 |
| 3 | -5 | -2 |
| -3 | 5 | 2 |

Since none of the factor pairs adds up to b = -1 , we know the polynomial in our example,

$$3x^{2}-x-5,$$

$ $is **irreducible or non-factorable**.

 [To solve the equation $3x^{2}-x-5=0$, another method (say, completing the square) will have to be used.]

Part 2

How to factor a **factorable** quadratic using the AC-Method.

1. **Make a list of the coefficients**

**a =**

**b =**

**c =**

For example,

$$6x^{2}-x-12=0$$

has

a = 6,

b = $-$1, and

c = $-$12.

1. **Find ac.**

 In this example, ac = 6\*(-12)= -72.

1. **List the factor pairs of ac, in order.**

 Continuing with our example, we would write

 **-72**

|  |  |
| --- | --- |
| 1 | -72 |
| -1 | 72 |
| 2 | -36 |
| -2 | 36 |
| 3 | -24 |
| -3 | 24 |
| 4 | -18 |
| -4 | 18 |
| 6 | -12 |
| -6 | 12 |
| 8 | -9 |
| -8 | 9 |

1. **Add the factor pairs to see which, if any, add up to b.**

If none do, the polynomial is not factorable.

If a factor pair does sum up to b, the polynomial **IS** factorable and you go on to Step 5.

 Using the list above, we could add a 3rd column of the **sums** of the factor pairs:

 **-72 Sums**

|  |  |  |
| --- | --- | --- |
| 1 | -72 | -71 |
| -1 | 72 | 71 |
| 2 | -36 | -34 |
| -2 | 36 | 34 |
| 3 | -24 | -21 |
| -3 | 24 | 21 |
| 4 | -18 | -14 |
| -4 | 18 | 14 |
| 6 | -12 | -6 |
| -6 | 12 | 6 |
| 8 | -9 | -1 |
| -8 | 9 | 1 |

In our polynomial, $ 6x^{2}-x-12=0 $has b = $-$1.

 In the shaded row in the table above, we see that 8 and -9 have sum = -1.

 We will use these two numbers in the next step.

1. **Rewrite the polynomial equation, replacing “b” with the sum of those two factors just found.**

In the current example, we would write

 $6x^{2}-9x+8x -12=0$

1. **Factor this polynomial now using “factoring by grouping.”**

In this example we would get

 $ (6x^{2}-9x)+(8x -12)=0$

 $ 3x \left(2x-3\right)+ 4\left(2x -3\right)=0$

By factoring out the common “$\left(2x-3\right)$,” we would then have

 $\left(2x-3\right)\left(3x+4\right)=0$

 We have now successfully factored the original polynomial equation.

1. **Use the Zero Factor Principle (ZFP) to solve the equation.**

Here, that would mean we would then solve the 2 linear equations,

$$\left(2x-3\right)=0 or \left(3x+4\right)=0$$

These have solutions $x=\frac{3}{2} or x= -\frac{4}{3}$