

Factoring Trinomials: bottoms-up method

Math 096 feb. 2009

Here are the steps to factor the trinomial $ax^2 + bx + c$ using the bottoms-up method.

Step 1. Factor out the GCF.

This should always be done first when factoring any polynomial.

Step 2. Factor the trinomial $x^2 + bx + a \cdot c$

Factoring this trinomial should be much easier since it has only x^2 instead of ax^2 .

Step 3. Divide the constant term in each factor by a and reduce.

See one of the examples if this doesn't make sense.

Step 4. Flip the bottoms up. That is, if any denominator remains make it a coefficient of x instead.

Again, the examples will make this more clear.

Step 5. Multiply the GCF by the result from step 4 and you are done.

If you did not pull out a GCF then the result from step 4 is the answer.

Examples

1. Factor $6x^2 - 17x + 10$.

Step 1. Factor out the GCF.

Not necessary in this one.

Step 2. Factor the trinomial $x^2 + bx + a \cdot c$

$$x^2 - 17x + 60 = (x - 12)(x - 5)$$

Step 3. Divide the constant term in each factor by a and reduce.

$$(x - 12)(x - 5) \text{ becomes } (x - \frac{12}{6})(x - \frac{5}{6}) = (x - 2)(x - \frac{5}{6})$$

Step 4. Flip the bottoms up. That is, if any denominator remains make it instead a coefficient of x .

$$(x - 2)(x - \frac{5}{6}) \text{ becomes } (x - 2)(6x - 5)$$

Step 5. Multiply the GCF by the result from step 4 and you are done.

We did not have a GCF in step 1, so the answer is $(x - 2)(6x - 5)$.

2. Factor $8x^2 - 10x - 3$.

Step 1. Again, not necessary in this one.

Step 2. $x^2 - 10x - 24 = (x - 12)(x + 2)$

Step 3. $(x - 12)(x + 2)$ becomes $(x - \frac{12}{8})(x + \frac{2}{8}) = (x - \frac{3}{2})(x + \frac{1}{4})$

Step 4. $(x - \frac{3}{2})(x + \frac{1}{4})$ becomes $(2x - 3)(4x + 1)$

Step 5. We did not have a GCF in step 1, so the answer is $(2x - 3)(4x + 1)$

3. Factor $32x^2 + 56x + 24$.

Step 1. The GCF is 8, so factor 8 out of every term to get

$$32x^2 + 56x + 24 = 8(4x^2 + 7x + 3)$$

Now we ignore the GCF until the end and **focus on factoring** $4x^2 + 7x + 3$

Step 2. $x^2 + 7x + 12 = (x + 4)(x + 3)$

Step 3. $(x + 4)(x + 3)$ becomes $(x + \frac{4}{4})(x + \frac{3}{4}) = (x + 1)(x + \frac{3}{4})$

Step 4. $(x + 1)(x + \frac{3}{4})$ becomes $(x + 1)(4x + 3)$

Step 5. The GCF is 8, so the answer is $8(x + 1)(4x + 3)$