Factoring By Grouping   cpg2000

Factor out all common factors from the trinomial before starting this process.

Case 1 $Ax^2 + Bx + C \text{ where } A > 0 \text{ and } B > 0 \text{ and } C > 0.$

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1. Multiply A times C. List all the factor pairs of the product.

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1. $6x^2 + 23x + 20$

$6 \cdot 20 = 120$

Factor Pairs
1, 120
2, 60
3, 40
4, 30
5, 24
6, 20
8, 15
10, 12

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2. Look for a pair of factors that add to the coefficient of the middle term, B.

3. Rewrite the Bx term using this sum.

4. Group the first two terms together and the last two terms together.

5. Factor the common factor from each pair

6. Factor out the common binomial

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2. 8 + 15 = 23

3. $6x^2 + 23x + 20 = 6x^2 + 8x + 15x + 20$

4. $\left(6x^2 + 8x\right) + \left(15x + 20\right)$

5. $2x(3x + 4) + 5(3x + 4)$

6. $(3x + 4)(2x + 5)$

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Case 2 $Ax^2 + Bx + C \text{ where } A > 0 \text{ and } C > 0, \text{ but } B < 0.$

The pair found in step 2 of the process will both be negative factors.

$$6x^2 - 23x + 20$$
$$6x^2 - 8x - 15x + 20$$
$$\left(6x^2 - 8x\right) + \left(-15x + 20\right)$$
$$2x(3x - 4) - 5(3x - 4)$$
$$(3x - 4)(2x - 5)$$

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Case 3 $Ax^2 + Bx + C$ *where* $A > 0$ *and* $B > 0$ *and* $C < 0$.

1. Multiply A times C. List all the factor pairs of the absolute value of the product.	1. $3x^2 + 10x - 8$ $\left\vert 3 \cdot (-8) \right\vert = 24$ Factor Pairs 1, 24 2, 12 3, 8 4, 6
2. Look for a pair of factors that have a difference equal to the coefficient of the middle term, B.	2. $12 - 2 = 10$
3. Rewrite the Bx term using this difference.	3. $3x^2 + 10x - 8 = 3x^2 + 12x + -2x - 8$
4. Group the first two terms together and the last two terms together.	4. $\left(3x^2 + 12x\right) + \left(-2x - 8\right)$
5. Factor the common factor from each pair	5. $3x(x + 4) - 2(x + 4)$
6. Factor out the common binomial factor.	6. $(x + 4)(3x - 2)$

Case 4 $Ax^2 + Bx + C$ *where* $A > 0$ *and* $C < 0$ *and* $B < 0$.
    The pair found in step 2 of the process has the signs reversed.
$$3x^2 - 10x - 8$$
$$3x^2 - 12x + 2x - 8$$
$$\left(3x^2 - 12x\right) + \left(2x - 8\right)$$
$$3x(x - 4) + 2(x - 4)$$
$$(x - 4)(3x + 2)$$

Case 5: $Ax^2 + Bx + C$ *where* $A < 0$
    Factor out a –1, then apply one of the previous cases to the trinomial.