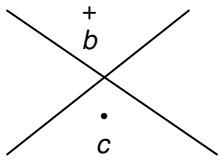
Elementary Algebra
Skill-Builder # PF – 3B
Factoring Quadratic Trinomials with Leading Coefficient of 1: Two-Variable Case

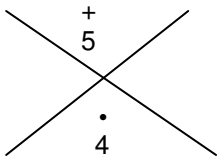
Sometimes the quadratic trinomial could have a second variable so it would look like $ax^2 + bxy + cy^2$. Note that the trinomial is arranged in descending powers of *x* (2, 1, 0) and in ascending powers of *y* (0, 1, 2). The trinomial is actually quadratic in both the variables *x* and *y.* We can still use the same sum-product diagram for the case where $a = 1$.



Examples Factor the following.

1. $x^2 + 5xy + 4y^2$

Solution: Note that the trinomial is quadratic in *x* as well as in *y* so we can find the factors using the same strategy as in the one-variable case: find two numbers whose sum is 5 and whose product is 4. We can use the "X" diagram (or not):



The two numbers we need are 1 and 4 since 1 + 4 gives 5 and $1 \cdot 4$ gives 4. Now, when we write the factored form, we have to make sure not to forget the second variable *y* in the answer. Thus, the factored form of $x^2 + 5xy + 4y^2$ is $(x + y)(x + 4y)$. One can of course check if this answer is correct by applying FOIL to the answer.

Of course one can use any other pair of variables.

2. $n^2 - np + 12p^2$

Solution: The important thing to note is the trinomial is quadratic in *n* as well as in *p* and thus, one can proceed as before: find the factors of 12 that add up to -1. With or without the "X" diagram, one should come up with the pair 3 and -4. Thus, $n^2 - np + 12p^2$ factors into $(n + 3p)(n - 4p)$.

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Factor completely:

1. $x^2 - 9x + 20y^2$	**2.** $x^2 + 6x + 8y^2$
3. $y^2 - 5xy - 14x^2$	**4.** $y^2 + 4xy - 21x^2$
5. $w^2 - wk - 42k^2$	**6.** $k^2 + 2kw - 15w^2$
7. $n^2 + nx - 6x^2$	**8.** $n^2 + 5nm - 50m^2$

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Answers

1. $(x-4y)(x-5y)$	**2.** $(x+4y)(x+2y)$
3. $(y-7x)(y+2x)$	**4.** $(y+7x)(y-3x)$
5. $(w-7k)(w+6k)$	**6.** $(k+5w)(k-3w)$
7. $(n+3x)(n-2x)$	**8.** $(n+10m)(n-5m)$

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