

**Elementary Algebra**  
**Skill-Builder # PF – 3C**

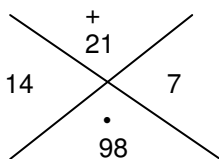
**Factoring Quadratic Trinomials with Leading Coefficient of 1: “Large” Constant Term**

Sometimes the quadratic trinomial has a “large” constant term. For this case, one can try listing all the possible pairs of factors until one comes up with the pair that gives the middle coefficient when the numbers in the pair are added. One can also use prime factorization and “play” with the resulting factors. Let us see how this method works.

**Examples** Factor the following.

1.  $x^2 + 21x + 98$

Solution: The constant term 98 is fairly large so let’s factor it into  $98 = 2 \cdot 49 = 2 \cdot 7 \cdot 7$ . We see that  $2 \cdot 7$  which is 14 and the factor 7 will give 21 when added.



Thus, the factored form of the problem is  $(x + 14)(x + 7)$ .

Of course the “constant” term can have a second variable attached to it.

2.  $a^2 - 18ab - 144b^2$

Solution: Let’s break down 144 into  $12 \cdot 12 = 4 \cdot 3 \cdot 4 \cdot 3 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$ . Let’s “play” with the four 2’s and two 3’s, i.e. let’s figure out which combination of factors will produce a pair of numbers that will give  $-18$  when added. Now, consider

$$\underbrace{2 \cdot 2 \cdot 2}_8 \cdot \underbrace{2 \cdot 3 \cdot 3}_{12} \quad \text{This combination can't lead to 18 when "subtracted".}$$

$$\underbrace{2 \cdot 2 \cdot 2 \cdot 2}_{16} \cdot \underbrace{3 \cdot 3}_9 \quad \text{This combination can't lead to 18 when "subtracted".}$$

$$2 \cdot \underbrace{2 \cdot 2 \cdot 2 \cdot 3}_{24} \cdot 3 = 24 \cdot 6 \quad \text{AHA! We can get 18 when we subtract 24 and 6!}$$

The pair we need is  $-24$  and  $6$ ; the polynomial factors into  $(a - 24b)(a + 6b)$ .

Have fun playing with the factors of the constant term!

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Factor completely:

1. $x^2 + 20x + 64$	2. $y^2 - 27y + 72$
3. $n^2 - 11n - 80$	4. $m^2 - 5m - 84$
5. $x^2 - 9xy - 70y^2$	6. $a^2 + 22ab + 96b^2$
7. $w^2 + 11wy - 102y^2$	8. $n^2 - 45nm - 196m^2$

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**Answers**

1. $(x+16)(x+4)$	2. $(y-24)(y-3)$
3. $(n-16)(n+5)$	4. $(m-12)(m+7)$
5. $(x-14y)(x+5y)$	6. $(a+16b)(a+6b)$
7. $(w+17y)(w-6y)$	8. $(n-49m)(n+4m)$

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