

# The Factor Game

The Factor Game is very useful for factoring trinomials.

## Rules of the Factor Game:

1. You are given two numbers: the **Product number** (Product #) and the **Sum number** (Sum #);
2. you are to find a **factor pair** of the Product # that will **add** to the Sum #. This factor pair is called the **solution**.

**Special Notes:** i) It's actually possible that there is no solution.

ii) If there is a solution, there will be only *one* solution (two numbers—a factor pair) for each set of Product and Sum numbers.

- If the product number is positive, then the factors in the factor pairs will have the same sign as the sign of the sum number, either both positive or both negative.
- If the product number is negative, then the factors in the factor pairs will have different signs, and the larger factor has the same sign as the sign of the sum number.

**Example 1:** Find the solution to the Factor Game for each Product # and Sum # as shown.

- a) Product # = 60 and Sum # = -19      b) Product # = -12 and Sum # = 1

**Answer:** a) Product # = 60 and Sum # = -19. Because the Product # is positive and the Sum # is negative, it must be that each factor of the factor pair is negative.

There are many possible factor pairs of 60, so the solution probably isn't obvious. Let's generate a *partial* list of factor pairs for 60; if we don't find it in the partial list, we can generate more factor pairs until we either find the solution or declare that there is no solution..

Factor pairs of:	+ 60	<u>Sum</u>	
	/ \		
- 1	- 60	- 61	too large ...
- 2	- 30	- 32	still too large, but closer ...
- 3	- 20	- 23	closer still ...
- 4	- 15	- 19	This is it! ✓

There are more factor pairs of 60, but we don't need to look at them because we've already found the solution: **-4 and -15**.

- b) Product # = -12 and Sum # = 1. Because the product number is negative, one factor is positive and the other is negative; the larger factor is positive because the sum number is positive.

Factor pairs of:	- 12	<b><u>Sum</u></b>	(Think of the sum number as +1.)
	/ \		
	- 4 + 3	- 1	The sum needs to be positive; switch signs and try again.
	+ 4 - 3	+ 1	This is it. ✓

The solution is: **+4 and -3.**

It's possible that there is no solution, as shown in Example 2.

**Example 2:** Find the solution to the Factor Game for each Product # and Sum # as shown.

Product # = -30 and Sum # = -12

**Procedure:** For (a), the product number is positive, so the signs of the factors will be the same.  
For (b), the product number is negative, so the signs of the factors are different.

**Answer:** Product # = -30 and Sum # = -12. Because the product number is negative, one factor is positive and the other is negative; the larger factor is negative because the sum number is negative.

Factor pairs of:	- 30	<b><u>Sum</u></b>	
	/ \		
	+ 1 - 30	- 29	too large ...
	+ 2 - 15	- 13	too large ...
	+ 3 - 10	- 7	too small!
	+ 5 - 6	- 1	way too small!

None of the factor pairs of -30 add to -12, so there is **no solution.**

*Find the solution for the given Product number and Sum number. If there is no solution, state so.*

1. Product # = 20, Sum # = 12

2. Product # = 25, Sum # = 10

3. Product # = 28, Sum # = -16

4. Product # = 18, Sum # = -11

5. Product # = -45, Sum # = 12

6. Product # = -40, Sum # = 18

7. Product # = -24, Sum # = -5

8. Product # = -15, Sum # = -14

**9.** Product # = -9, Sum # = 0

**10.** Product # = -64, Sum # = 0

**11.** Product # = 25, Sum # = 0

**12.** Product # = 49, Sum # = 0

**13.** Product # = 30, Sum # = -17

**14.** Product # = -30, Sum # = -13

**15.** Product # = 30, Sum # = -8

**16.** Product # = -20, Sum # = 9

**17.** Product # = 36, Sum # = 12

**18.** Product # = -36, Sum # = -9

**19.** Product # = -48, Sum # = -2

**20.** Product # = -48, Sum # = 13

**21.** Product # = 48, Sum # = 16

**22.** Product # = 54, Sum # = -15

**23.** Product # = 48, Sum # = -2

**24.** Product # = 42, Sum # = 1

**25.** Product # = 56, Sum # = 15

**26.** Product # = -72, Sum # = -1

**27.** Product # = 60, Sum # = -23

**28.** Product # = 60, Sum # = 17

**29.** Product # = 120, Sum # = 23

**30.** Product # = 120, Sum # = -29

**31.** Product # = -180, Sum # = 3

**32.** Product # = -180, Sum # = -24