Factoring Trinomials where a = 1

Notice the signs. Here are the patterns:

$x^2 + bx + c$ Same Signs Both Positive
$x^2 - bx + c$ Same Signs Both Negative
$x^2 + bx - c$ Different Signs Bigger product is Positive [Sign in the first ( ) is +]
$x^2 - bx - c$ Different Signs Bigger product is Negative [Sign in the first ( ) is –]

$x^2 + bx + c$ Two factors of c that ADD to give you b.
$x^2 - bx + c$ Two factors of c that ADD to give you b.
$x^2 + bx - c$ Two factors of c that SUBTRACT to give you b.
$x^2 - bx - c$ Two factors of c that SUBTRACT to give you b.

Factor completely and check by FOIL.

1) $x^2 - 17x + 70$

( )( ) First write your parenthesis.

*Next, take care of signs.

(–)( ) The first sign goes into the parenthesis.

(–)(–) The second sign is a plus, which says "same signs". Therefore since we have a minus in the first parenthesis, we need a minus in the second one too.

*Now put in variables.

(x –)(x –) The 1st term is x^2, that means we must have multiplied x and x. So the 1st term in each parenthesis must be an x.

*Decide which numbers to put in. We have to think two factors that multiply to get 70 that add to get 17. The reason why it is ADD is because the sign before the 70 was a plus. If it was a minus, we would have thought that subtract.

*List possibilities.

1 • 70 adds to get 71, so not the set to choose
2 • 35 adds to get 37, so not the set to choose
5 • 14 adds to get 19, so not the set to choose
7 • 10 adds to get 17, THIS IS THE ONE WE WANT.

*Fill in the numbers so that the bigger product is the inner product.

(x – 10)(x – 7)

The final answer is $\boxed{(x - 10)(x - 7)}$

Now, check by FOIL.

√: (x – 10)(x – 7)
$x^2 - 7x - 10x + 70$
$x^2 - 17x + 70$ We're right!

2) $x^2 - 22xy - 48y^2$

( )( ) First write your parenthesis.

*Next, take care of signs.

(–)( ) The first sign goes into the parenthesis.

(–)(+) The second sign is a minus, which says "different signs". Therefore since we have a minus in the first parenthesis, we need to put a plus sign in the second parenthesis.

*Now put in variables.

(x – y)(x + y) The 1st term is x^2, that means we must have multiplied x and x. So the 1st term in each parenthesis must be an x. The last term is y^2, that means we must have multiplied y and y. So the last term in each parenthesis must be y.

*Decide which numbers to put in. We have to think two factors that multiply to get 48 that subtract to get 22. The reason why it is SUBTRACT is because the sign before the 48 was a minus.

*List possibilities.

1 • 48 subtracts to get 47, so not the set to choose

2 • 24 subtracts to get 20, THIS IS THE ONE WE WANT.

Even though there are more sets of factors, we don't need to go on because we found the "magic set".

*Fill in the numbers so that the bigger product is the inner product.

(x – 24y)(x + 2y)

The final answer is $\boxed{(x - 24y)(x + 2y)}$

Now, check by FOIL.

√: (x – 24y)(x + 2y)

$x^2 + 2xy - 24xy + 48y^2$

$x^2 - 22xy - 48y^2$ We're right!

3) $x^2 + 8x + 33$

( )( ) First write your parenthesis.

*Next, take care of signs.

(+)( ) The first sign goes into the parenthesis.

(+)(+) The second sign is a plus, which says "same signs". Therefore since we have a plus in the first parenthesis, we need a plus in the second one too.

*Now put in variables.

(x +)(x +) The 1st term is x^2, that means we must have multiplied x and x. So the 1st term in each parenthesis must be an x.

*Decide which numbers to put in. We have to think two factors that multiply to get 33 that add to get 8. Remember we have to ADD because the sign before 33 was plus!

*List possibilities.

1 • 33 adds to get 34, so not the set to choose

3 • 11 adds to get 14, so not the set to choose

There are no other sets of factors for 33 and none of these work. There is also no GCF in this trinomial. Therefore, this trinomial does NOT factor. If a polynomial doesn't factor, we say it is PRIME.

Therefore, the answer to this problem is PRIME . (There is no check for primes!)