Simple Trinomial Factoring | MPM2D

Expand the following binomial products…

a) $(x+2)(x+3)$

$= x^2 + 3x + 2x + 6$

$= x^2 + 5x + 6$

b) $(x+6)(x+5)$

$= x^2 + 5x + 6x + 30$

$= x^2 + 11x + 30$

c) $(x+3)(x+4)$

$= x^2 + 4x + 3x + 12$

$= x^2 + 7x + 12$

The result of expanding each binomial product of the form $(x+r)(x+s)$ above was a trinomial of the form x^2+bx+c. Describe how you calculated b and c using the values of r and s.

To get b, you add r and s

To get c, you multiply r and s

You can use the pattern you described above to **factor** the following. Write each trinomial of the form x^2+bx+c as a binomial product of the form $(x+r)(x+s)$.

a) x^2+6x+8

$r+s=6$

$r \times s = 8$

$= (x+2)(x+4)$

2 & 4

b) $x^2+7x+10$

$r+s=7$

$r \times s = 10$

$= (x+5)(x+2)$

5 & 2

c) $x^2+10x+16$

$r+s=10$

$r \times s = 16$

$= (x+8)(x+2)$

8 & 2

Summary: To factor quadratic expressions of the form x^2+bx+c…

Find two numbers r & s such that $r+s=b$

$rs = c$

What about when the values of b and/or c are negative? Expand the following binomial products.

a) $(x-2)(x+5)$

$= x^2 + 5x - 2x - 10$

$= x^2 + 3x - 10$

b) $(x-6)(x-3)$

$= x^2 - 3x - 6x + 18$

$= x^2 - 9x + 18$

c) $(x+3)(x-4)$

$= x^2 - 4x + 3x - 12$

$= x^2 - x - 12$

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i) Describe how you determined the signs of the values of b and c when both values of r and s were negative.

If r & s are both negative, then b is negative and c is positive.

ii)) Describe how you determined the signs of the values of b and c when only one of the values of r and s was negative.

If one of r or s is negative, then.. c is always negative and b depends on the size of r and s.

You can use this reasoning, along with the pattern you described earlier to **factor** the following. Write each trinomial of the form $x^2 + bx + c$ as a binomial product of the form $(x + r)(x + s)$.

a) $x^2 - 6x + 5$ $\quad r+s=-6$, $rs=5$

$=(x-1)(x-5)$

b) $x^2 + 7x - 30$

$=(x+10)(x-3)$

1×30
2×15
3×10
5×6

$r+s=7$
$rs=-30$

c) $x^2 - 5x - 24$ $\quad r+s=-5$, $rs=-24$

$=(x+3)(x-8)$

1×24 $\quad 3\times 8$
2×12 $\quad 4\times 6$

To further cement why this works, let's study the patterns from multiplying two binomials:

$(x + r)(x + s) = x^2 + sx + rx + rs$

$= x^2 + (r+s)x + rs$

Conculsion: To factor a simple trinomial $x^2 + bx + c$ find two numbers, r and s, ~~such t~~ such that $r+s=b$ and $rs=c$.

Notes: In general, you will factor over the integers, meaning that the values of r and s are integers only. Many quadratic expressions, such as $x^2 + 3x + 5$, cannot be factored over the integers. No two integers have a product of 5 and a sum of 3.

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Try to factor the following. Use the table initially if you need to. Use the "factors" space for rough work if you need it. Eventually you can start factoring simple trinomials quickly, without any structure.

a) $x^2 + 9x + 20$ $= (x+4)(x+5)$	Product: 20 Sum: 9 Factors: $4 \times 5 = 20$ $4 + 5 = 9$	b) $x^2 + 9x + 20$	Product: Sum: Factors:
c) $x^2 - 11x + 30$ $= (x-5)(x-6)$	Product: 30 Sum: -11 Factors: 1×30 2×15 3×10 5×6	d) $x^2 - 15x + 50$ $= (x-5)(x-10)$	Product: 50 Sum: -15 Factors:
e) $x^2 + 2x - 48$ $= (x+8)(x-6)$	Product: -48 Sum: 2 Factors:	f) $x^2 - 3x - 40$ $= (x-8)(x+5)$	Product: -40 Sum: -3 Factors:
g) $x^2 + x - 20$ $= (x+5)(x-4)$	Product: -20 Sum: 1 Factors:	h) $x^2 - x - 90$ $= (x-10)(x+9)$	Product: -90 Sum: -1 Factors: