KEY

L16 – 5.3 Factoring Trinomials (a>1)

If a polynomial takes the form $ax^2 + bx + c$ *then today we are looking at a>1.*

Part 1: Step #1: Finding the missing numbers

Determine what numbers fulfill the following equations:

$\overbrace{2x^2 + 7x + 3}^{6}$

$\underset{+1}{\square} + \underset{+6}{\square} = 7$

$\square \times \square = 6$

1, 6
2, 3

$\overbrace{2x^2 + 11x + 15}^{30}$

$\underset{+5}{\square} + \underset{+6}{\square} = 11$

$\square \times \square = 30$

1, 30
2, 15
3, 10
4, 15
5, 6

$6x^2 - 11x - 10$

$\underset{+4}{\square} + \underset{-15}{\square} = -11$

$\square \times \square = -60$

1, 60
2, 30
3, 20
4, 15

Part 2: Step #2: Factoring using Decomposition

$2x^2 + 7x + 3$

+1 +6
$\square + \square = 7$
$\square \times \square = 6$

$\Downarrow$

$2x^2 + 1x + 6x + 3$

$(2x^2 + 1x) + (6x + 3)$

$x(2x+1) + 3(2x+1)$

$(2x+1)(x+3)$

$2x^2 + 11x + 15$

+5 +6
$\square + \square = 11$
$\square \times \square = 30$

$\Downarrow$

$2x^2 + 5x + 6x + 15$

$(2x^2 + 5x) + (6x + 15)$

$x(2x+5) + 3(2x+5)$

$(2x+5)(x+3)$

$6x^2 - 11x - 10$

+4 -15
$\square + \square = -11$
$\square \times \square = -60$

$\Downarrow$

$6x^2 + 4x - 15x - 10$

$(6x^2 + 4x) + (-15x - 10)$

$2x(3x+2) - 5(3x+2)$

$(3x+2)(2x-5)$

KEY

$\overbrace{3x^2 + 7x}^{-60} - 20$ *(Option #1)*

+12 -5

$\square + \square = 7$

$\square \times \square = -60$

1,60
2,30
3,20
4,15
5,12
6,10

$3x^2 + 12x - 5x - 20$

$(3x^2 + 12x) + (-5x - 20)$

$3x(x+4) - 5(x+4)$

$(x+4)(3x-5)$

$3x^2 + 7x - 20$ *(Option #2)*

-5 +12

$\square + \square = 7$

$\square \times \square = -60$

$3x^2 - 5x + 12x - 20$

$(3x^2 - 5x) + (12x - 20)$

$x(3x-5) + 4(3x-5)$

$(3x-5)(x+4)$

Same answer either way. So don't worry about splitting the middle term "in the wrong order".

Part 3: Alternate Method: Factoring using Guess and Check — Not Mr. Bayer's Favorite

$2x^2 + 7x + 3$

Factors are 1,2

Factors are 1,3

So

Ⓐ $(1x+1)(2x+3)$

Ⓑ $(1x+3)(2x+1)$

Ⓒ $(2x+1)(1x+3)$

Ⓓ $(2x+3)(1x+1)$

Same as Ⓐ and Ⓑ

So only two possibilities. Now multiply out to see which one works.

$3x^2 + 7x - 20$

1,3

1,20
2,10
4,5

So options are...

Ⓐ $(1x+1)(3x-20)$

Ⓑ $(1x-1)(3x+20)$

Ⓒ $(1x+20)(3x-1)$

Ⓓ $(1x-20)(3x+1)$

Ⓔ $(1x+2)(3x-10)$

Ⓕ $(1x-2)(3x+10)$

Ⓖ $(1x+10)(3x-2)$

Ⓗ $(1x-10)(3x+2)$

Ⓘ $(1x+4)(3x-5)$

Ⓙ $(1x-4)(3x+5)$

Ⓚ $(1x+5)(3x-4)$

Ⓛ $(1x-5)(3x+4)$

"Only" 12 possibilities.
Decomposition would probably be

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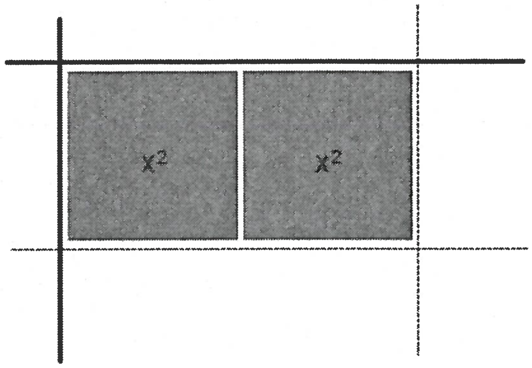
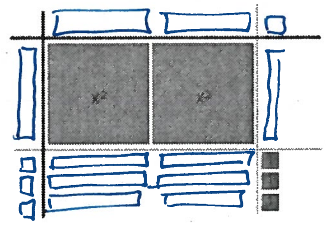
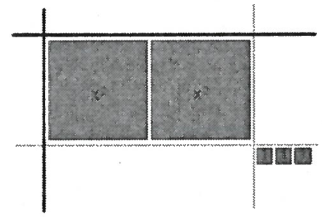
Part 4: Alternate Method: Factoring using Algebra Tiles

$2x^2 + 7x + 3$





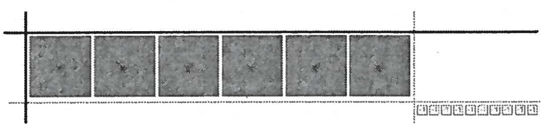
$(2x+1)(x+3)$

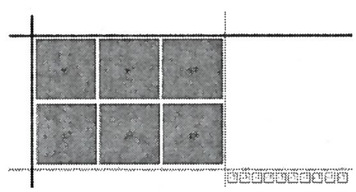


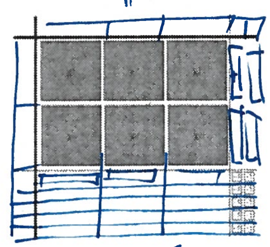
$6x^2 - 11x - 10$

$(3x+2)(2x-5)$

What are our different possible configurations?

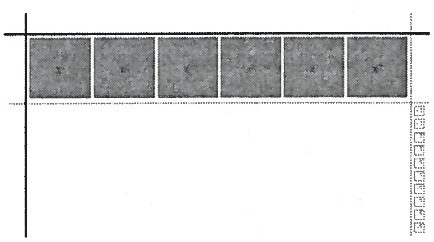


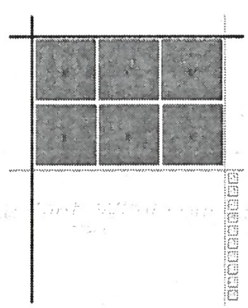


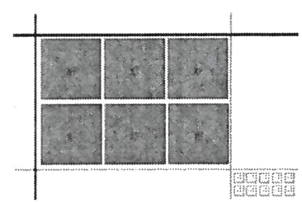


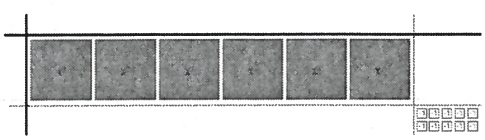
+4

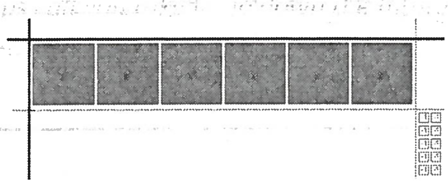
−15











Part 5: (Harder) Factoring with both Common Factors and Decomposition

$4x^3 + 14x^2 + 6x$

$2x\,(2x^2 + 7x + 3)$

$\overset{+1}{\square} + \overset{+6}{\square} = 7$

$\square \times \square = 6$

1, 6
2, 3

$2x\,[2x^2 + 1x + 6x + 3]$

$2x\,[(2x^2 + 1x) + (6x + 3)]$

$2x\,[x(2x+1) + 3(2x+1)]$

$2x\,[(2x+1)(x+3)]$

$2x\,(2x+1)(x+3)$

$18x^3y + 39x^2y - 15xy$

$3xy\,[6x^2 + 13x - 5]$

$\overset{+15}{\square} + \overset{-2}{\square} = 13$

$\square \times \square = -30$

1, 30
2, 15
3, 10
5, 6

$3xy\,[6x^2 + 15x - 2x - 5]$

$3xy\,[(6x^2 + 15x) + (-2x - 5)]$

$3xy\,[3x(2x+5) - 1(2x+5)]$

$3xy\,[(2x+5)(3x-1)]$

$3xy\,(2x+5)(3x-1)$