1.1 – Factoring Trinomials of the form $x^2 + bx + c$, where a=1

Name: KEY
Date:

Goal: to use models and algebraic strategies to multiply binomials and to factor trinomials.

Toolkit:	**Main Ideas:**
• Factoring	

Descending order: the terms are written in order from the tern with the greatest exponent to the term with the least exponent.
Ascending order: the terms are written in order from the term with the least exponent to the term with the greatest exponent.

Steps for Factoring a Trinomial in the form: x^2+bx+c, where a=1

With any factoring question, first check to see if you can factor out a GCF from ALL terms!

Step 1: If needed, re-order the terms in descending powers of the variable *(biggest to smallest)*
Step 2: Find two numbers that multiply to equal the *c* term and add to equal the *b* term (add to the middle, multiply to the end)
Step 3: Factor into two binomials using the numbers from step 2, with the variable from the question placed first in each Bracket

*** we will refer to this method as ***"the simple way"*** ***

Multiplying two binomials

Ex 1) Expand and Simplify: $(x-1)(x-7)$ use FOIL

$= x^2 - 7x - 1x + 7$

$\boxed{= x^2 - 8x + 7}$

Remember: expanding and factoring are opposite operations....they UNDO each other!

Factoring a trinomial in the form $x^2 + bx + c$

Notice that a (the number in front of the x^2) will always end up being 1 in these questions!

Ex 2) Factor the trinomial: $x^2 - 8x + 7$ ....we should end up with $(x-1)(x-7)$!

$-7 \times -1 = 7$

$-7 + -1 = -8$

$\boxed{= (x-7)(x-1)}$

Ex 3) Factor: $a^2 - 2a - 8$

$-4 \times 2 = -8$

$-4 + 2 = -2$

$\boxed{= (a-4)(a+2)}$

Factoring a trinomial written in ascending order

Ex 4) Factor: $-30 + 7m + m^2$ $\rightarrow$ $m^2 + 7m - 30$

reorder

$-3 \times 10 = -30$

$-3 + 10 = +7$

$\boxed{= (m-3)(m+10)}$

GCF of -5!

Ex 5) Factor: $\frac{-5h^2}{-5} - \frac{20h}{-5} + \frac{60}{-5}$

Always check to see if there is a GCF you can factor out first! IF there is a negative number in front of the x^2, factor out the negative as well.

now, $a=1$, "simple way"

$= -5(h^2+4h-12)$

$-2 \times 6 = -12$

$-2 + 6 = 4$

$\boxed{= -5(h-2)(h+6)}$

Difference of Squares

Difference of Squares

$a^2 - b^2 = (a+b)(a-b)$

Ex 6) Factor: $x^2 - 16$

$\sqrt{x^2} = x$

$\sqrt{16} = 4$

$\boxed{= (x+4)(x-4)}$

Ex 7) Factor: $x^4 - 9$

$\sqrt{x^4} = x^2$

$\sqrt{9} = 3$

$\boxed{= (x^2+3)(x^2-3)}$

Ex 8) Factor: $\frac{50x^2}{2} - \frac{2y^2}{2}$

GCF of 2!

$= 2(25x^2 - y^2)$

$\sqrt{25x^2} = 5x$

$\sqrt{y^2} = y$

$\boxed{= 2(5x+y)(5x-y)}$

1.2 – Factoring $ax^2 + bx + c$

Learning Target: to factor trinomials of the form $ax^2 + bx + c$, where the a value $\neq 1$

Toolkit:

- Multiplying binomials
- Factoring by grouping

When $a \neq 1$ in a trinomial of the form $ax^2 + bx + c$, and it can't be factored out, then another process is needed.

This process is called DECOMPOSITION, and uses factoring by grouping.

Steps for factoring $ax^2 + bx + c$, $a \neq 1$ by DECOMPOSITION

Step 1: As with any factoring question, check to see if you can factor out a GCF

Step 2: If needed, re-order the terms in **descending** powers of the variable

Step 3: Find two numbers that multiply to equal ac and add to equal b *(multiply to the product (×) of the first and last, and add to the middle!)*

Step 4: Rewrite the expression but split or *decompose* the middle (b) term, using the two numbers from step 3

Step 5: Now the expression has FOUR terms, so we can **factor by grouping** the first two terms and the last two terms

Step 6: When factoring by grouping, the two resulting binomials need to be identical! These matching binomials are now the COMMON FACTOR, and can be factored out…and what is left become the components of the second bracket.

Ex. 1) Factor:

GCF? no! Reorder? no!

$4x^2 + 11x + 6$

a=4, a≠1, so... decomp!

$8 \times 3 = 24 \quad (4 \times 6)$

$8 + 3 = 11$

so... split $11x$ into $8x + 3x$ (or $3x + 8x$)

factor by grouping *remove GCF from both pairs

$= 4x^2 + 8x + 3x + 6$

So... binomials match; factor out $(x+2)$ from both terms

$= 4x(x+2) + 3(x+2)$

$\boxed{= (x+2)(4x+3)}$

Ex 2) $-7m - 10 + 6m^2$

$= 6m^2 - 7m - 10$

$= 6m^2 - 12m + 5m - 10$

$= 6m(m-2) + 5(m-2)$

$= \boxed{(m-2)(6m+5)}$

GCF? no
reorder? yes!

a = 6, so decomp!

$\underline{-12} \times \underline{5} = \underset{(6)(-10)}{\underline{-60}}$ (a×c)

$\underline{-12} + \underline{5} = \underline{-7}$ (b)

so... split $-7m$ into $-12m + 5m$!

Ex 3) $8p^2 - 18p - 5$

$= 8p^2 + 2p - 20p - 5$

$= 2p(4p+1) - 5(4p+1)$

$= \boxed{(4p+1)(2p-5)}$

GCF? no
reorder? no

a = 8, so decomp!

$\underline{2} \times \underline{-20} = \underset{(8)(-5)}{\underline{-40}}$ (a×c)

$\underline{2} + \underline{-20} = \underline{-18}$ (b)

so... split $-18p$ into $2p$ and $-20p$!

Ex 4) $\frac{24}{2}x^2 - \frac{10}{2}x - \frac{4}{2}$

$= 2(12x^2 - 5x - 2)$

$= 2(12x^2 + 3x - 8x - 2)$

$= 2[3x(4x+1) - 2(4x+1)]$

$= \boxed{2(4x+1)(3x-2)}$

GCF? yes!
reorder? no

a = 12, so decomp!

$\underline{3} \times \underline{-8} = \underset{(12)(-2)}{\underline{-24}}$

$\underline{3} + \underline{-8} = \underline{-5}$

so... split $-5x$ into $3x - 8x$!

Ex 5) $\frac{-16x^3}{-4x} + \frac{20x^2}{-4x} + \frac{24x}{-4x}$

$= -4x(4x^2 - 5x - 6)$

$= -4x(4x^2 - 8x + 3x - 6)$

$= -4x[4x(x-2) + 3(x-2)]$

$= \boxed{-4x(x-2)(4x+3)}$

GCF? yes!
reorder? no

a = 4, so decomp!

$\underline{-8} \times \underline{3} = \underset{(4)(-6)}{\underline{-24}}$

$\underline{-8} + \underline{3} = -5$

so... split $-5x$ into $-8x + 3x$!

square brackets here... just to help keep work organized