Chapter 5:

Multiply Binomials

$(x+2)(x-3)$ means $x(x-3)$
and $+2(x-3)$

Use the distributive property

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

① ② ③ ④

* combine like terms

$= x^2 - x - 6$

Finding GCF:

① ask yourself "What is the largest number I can evenly divide all terms

ex 16, 24, 64

list factors

16 - 1x16, 2x8, 4x4

24 - 1x24, 2x12, 3x8, 4x6

64 - 1x64, 2x32, 4x16, 8x8

* largest common factor = 8

② If you have variables, the largest common factor is the <u>lowest</u> exponent

<u>ex</u> $16x^2 + 24x^5$

$\rightarrow GCF = 8x^2$

To factor this expression, divide by GCF

$$\frac{16x^2}{8x^2} + \frac{24x^5}{8x^2} = 8x^2(2 + 3x^3)$$

③ With multiple variables: (lowest exponent all)

$$16x^2y^4 + 24x^5y^3 \Rightarrow GCF = 8x^2y^3$$

$$8x^2y^3(2y + 3x^3)$$

* subtract exponents when ÷

Factoring

Method 1:

$x^2 + 5x + 6$

① list factors of last term

$6 \rightarrow 1 \times 6, 2 \times 3$

② Ask what factors would add to get middle term

$2 + 3 = 5$

$\therefore (x + 3)(x + 2)$

$\underbrace{3 + 2}_{5}$

ex 2

$x^2 - 5x + 6$

factors
① $6 \rightarrow 1 \times 6,\ 2 \times 3$
② $2 + 3 = 5$ add
but * $-2 + -3 = -5$

$(x - 3)(x - 2)$

-3
-2
-5

check

ex 3

$x^2 - 5x - 6$

note sign w/ last term
if + = add ; if − means subtract

① factors
$6 - 1 \times 6,\ 2 \times 3$
② which subtract to get middle term
$6 - 1 = 5$
so $-6 + 1 = -5$

$(x + 1)(x - 6)$

$+$
-6
-5

Method 2:

① multiply front and back terms
② make a table of all combinations of factors (include +/−)

ex

$x^2 - 5x + 6$

$1 \times 6 = 6$

Prod 6	Sum −5
1×6	$1 + 6 = 7$
-1×-6	$-1 + -6 = -7$
2×3	$2 + 3 = 5$
-2×-3	$-2 + -3 = -5$ *

③ Substitute for $-5x$ and factor front + back
$x^2 - 2x - 3x + 6 = x(x - 2) - 3(x - 2) = (x - 2)(x - 3)$

Factoring when ax^2 is $\neq 1$

Method 1

negative means subtract or 2 different signs in brackets

① factor out common factor.

$$24x^2 - 30x - 9 = 3(8x^2 - 10x - 3)$$

1×8, 2×4 — 1×3

② list factors of front and back

③ Ask "what combination will give me the middle term?"

ex 1

$3(8x + 1)(1x - 3)$

1

-24

-23 NO

$3(2x - 1)(4x + 3)$

-4

6

2 NO

$3(4x + 1)(2x - 3)$

2

-12

-10 yes

Method 2

① multiply front + back (factor 1st!)

② make chart

$3(8x^2 - 10x - 3)$

$8 \times 3 = -24$	sum -10
-1×24	$24 + -1 = 23$ NO
-2×12	$12 + -2 = +10$ NO
2×-12	$-12 + 2 = 10$

③ substitute in + factor front + back

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

$3(4x(2x-3) + 1(2x-3))$

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

Difference of Squares

* no middle term
* perfect squares on front & back

ex $x^2 - 9$

$(x+3)(x-3)$

* note signs are different

$x^2 \underbrace{-3x + 3x}_{} - 9$

middle term cancels out!

ex 2

$25x^2 - 16$

$\sqrt{25}$ $\sqrt{25}$ $\sqrt{16}$ $\sqrt{16}$

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

opposite signs

Perfect Squares

* middle term is 2x the product of the $\sqrt{}$ of the front & back
* perfect squares front & back

ex $x^2 + 10x + 25$

$\sqrt{1} = 1$ $\sqrt{25} = 5$

$1 \times 5 = 5 \underline{\underline{\times 2}} = 10$

in factored form $(x+5)(x+5)$ or $(x+5)^2$

* note signs are the same

ex 2 $4x^2 + 12x + 9$

ask is $\sqrt{4} \times \sqrt{9} \times 2$ = middle #? $\sqrt{4} \times \sqrt{9} = 6 \times 2 = 12$ yes so ∴ perfect square

$4x^2 + 12x + 9$

$\sqrt{4}$ $\sqrt{4}$ $\sqrt{9}$ $\sqrt{9}$

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

same sign