Notes 4.3 – Factoring Practice

Warmup – Make a list of all factor pairs for each number.

1.   24

1,24
2,12
3,8
4,6

2.   18

1,18
2,9
3,6

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

Investigation – Factoring

Always check for __a common factoring before factoring.__

Quadratic factoring when $a = 1$

a. $x^2 + 5x - 24$

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

	$\bullet$ -24	$+$ 5
-1	24	23
-2	12	10
-3	8	5
-4	6	2

b. $x^2 - 7x - 30$

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

	$\bullet$ -30	$+$ -7
1	-30	-29
2	-15	-13
3	-10	-7
5	-6	-1

c. $x^2 + 2x$ GCF : x

$x(x+2)$

d. $x^2 - 25$

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

	-25	0
-1	25	24
-5	5	0

Quadratic factoring when $a \neq 1$

e. $5x^2 + 16x + 3$ ac = 15   16

	1	15	16
	3	5	8

	$5x$	$+1$
x	$5x^2$	x
$+3$	$15x$	3

$(5x+1)(x+3)$

f. $4x^2 + 19x - 5$ ac = -20   19

	-1	20	19
	-2	10	8
	-4	5	1

	$4x$	-1
x	$4x^2$	$-x$
$+5$	$20x$	-5

$(4x-1)(x+5)$

g. $4x^2 + 12x + 5$ $\quad ac = 20 \quad 12$

$$\begin{array}{c|c|c} 1 & 20 & 21 \\ \hline 2 & 10 & 12 \\ \hline 4 & 5 & 9 \end{array}$$

	$2x$	$+1$
$2x$	$4x^2$	$2x$
$+5$	$10x$	5

$(2x+1)(2x+5)$

h. $10x^2 - 19x + 7$ $\quad ac = 70 \quad -19$

$$\begin{array}{c|c} -1 \; -70 & -71 \\ -2 \; -35 & -37 \\ -5 \; -14 & -19 \\ -7 \; -10 & -17 \end{array}$$

	$2x$	-1
$5x$	$10x^2$	$-5x$
-7	$-14x$	$+7$

$(2x-1)(5x-7)$

Factoring by Grouping

i. $\underbrace{x^3 + 5x^2}\; \underbrace{- 4x - 20}$

$x^2(x+5) - 4(x+5)$

$(x+5)(x^2-4)$

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

j. $\underbrace{x^3 - 4x^2}\; \underbrace{- x + 4}$

$x^2(x-4) - 1(x-4)$

$(x-4)(x^2-1)$

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

Sum or Difference of Cubes

k. $a^3 + b^3$

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

$\quad\uparrow \qquad \uparrow \qquad \uparrow$

Same opposite always plus

$\quad$ S $\qquad$ O $\qquad$ A $\quad$ P

l. $a^3 - b^3$

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

m. $x^3 - 125$

$(x-5)(x^2 + 5x + 25)$

n. $27x^3 + 1$

$(3x+1)(9x^2 - 3x + 1)$

Method	Definition	Example
Greatest Common Factor 2 or more terms	• factor out a common factor from $\underline{all}$ terms • look at coefficients and variables	$2x^2+4x \rightarrow 2x(x+2)$ GCF: $2x$ $4x^2-72 \rightarrow 4(x^2-18)$ GCF: 4
Quadratic Trinomials 3 terms	x^2+bx+c • factors of c that add to b ax^2+bx+c • factors of $a \cdot c$ that add to b	$x^2+4x-12$ $(x-2)(x+6)$ $\overset{-12}{\underset{-2 \quad 6}{\diagdown}} \quad \overset{-1 \quad 12}{\underset{-3 \quad 4}{12}}$ $2x^2-x-15$ $ac=-30$ $\overset{-6 \quad 5}{}$ $\begin{array}{c|c|c} & x & -3 \\ \hline 2x & 2x^2 & -6x \\ \hline 5 & 5x & -15 \end{array}$ $\boxed{(2x+5)(x-3)}$
Perfect Square Trinomials 3 terms	$a^2+2ab+b^2$ $(a+b)^2$ $a^2-2ab+b^2$	$x^2+10x+25$ $a=x$ $b=5$ $(x+5)^2$ $9x^2+12x+4$ $a=3x$ $b=2$ $(3x+2)^2$ $x^2-8x+16$ $a=x$ $b=4$ $(x-4)^2$ $16x^2-40x+25$ $a=4x$ $b=5$ $(4x-5)^2$

	Formula	Example
Difference Of squares 2 terms	$a^2 - b^2$ $(a+b)(a-b)$	$x^2 - 100$ $a=x$ $b=10$ $(x+10)(x-10)$ $9x^2 - 16$ $a=3x$ $b=4$ $(3x+4)(3x-4)$
Sum/Difference Of Cubes 2 terms	$a^3 + b^3$ SOAP $(a+b)(a^2 - ab + b^2)$ Same sign, opposite sign, always plus $a^3 - b^3$ $(a-b)(a^2 + ab + b^2)$	$x^3 + 27$ $a=x$ $b=3$ $(x+3)(x^2 - 3x + 9)$ $8x^3 - 125$ $a=2x$ $(2x-5)(4x^2 + 10x + 25)$ $b=5$
Factoring by Grouping 4 terms	make 2 groups of two terms each Factor GCF out of each group Factor GCF out of new terms	$\overline{x^3 + 2x^2 + 5x + 10}$ $\overline{x^2(x+2) + 5(x+2)}$ $(x+2)(x^2 + 5)$