

# Factoring (ALL METHODS)

\* Always look for a GCF first!

ex.  $10x^2 + 22x + 2$

GCF: 2

$2(5x^2 + 11x + 1)$       $x = -2.1, -.095$

## ① Grouping (4 terms)

ex.  $(4x^2 - 44x) + (-x + 11)$

Find GCF of each group

$4x(x - 11) + (-1)(x - 11)$

want these to match!

$(4x - 1)(x - 11)$

$x - 11 = 0$   
 $x = 11$

$4x - 1 = 0$   
 $x = 1/4$

## ② Trinomials (3 terms)

$[ax^2 + bx + c]$

ex. when  $a = 1$

$x^2 + 2x - 15$

+ 2	x (-15)
5 + (-3) = 2	5, -3

$(x^2 + 5x) + (-3x - 15)$

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

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

$x - 3 = 0$

$x = 3$

$x + 5 = 0$

$x = -5$

when  $a \neq 1$  \*headphones\*

$2x^2 + 17x + 21$

+ 17	x 42
14 + 3 = 17	14, 3

$(2x^2 + 14x) + (3x + 21) \rightarrow 2x(x + 7) + 3(x + 7) \rightarrow (2x + 3)(x + 7)$

### ③ Difference of Perfect Squares

\* must be 2 perfect squares AND subtraction!

$$\text{ex. } x^2 - 16$$

$$\begin{array}{cc} \downarrow & \downarrow \\ x & 4 \end{array}$$

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

$$\text{ex. } 4x^2 - 25$$

$$\begin{array}{cc} \downarrow & \downarrow \\ 2x & 5 \end{array}$$

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

### ④ Sum / Difference of Perfect Cubes

$$\text{Sum: } a^3 + b^3 \rightarrow (a + b)(a^2 - ab + b^2)$$

Same
0<sub>PP</sub>
AP<sub>os</sub>  
ways

$$\text{Diff: } a^3 - b^3 \rightarrow (a - b)(a^2 + ab + b^2)$$

$$\text{ex. } 8x^3 + 1 \rightarrow (2x + 1)(4x^2 - 2x + 1)$$

$$\begin{array}{cc} \downarrow & \downarrow \\ \frac{2x}{a} & \frac{1}{b} \end{array}$$

$$\text{ex. } x^3 - 27 \rightarrow (x - 3)(x^2 + 3x + 9)$$

$$\begin{array}{cc} \downarrow & \downarrow \\ x & 3 \end{array}$$

⑤ Multi-step / higher order

ex.  $x^6 - 26x^3 - 27$

$$(x^3 - 27)(x^3 + 1)$$

↓  
can use  
diff of  
perfect  
cubes

↓  
sum of  
perfect  
cubes

$$x^3 - 27$$

↙ ↘  
x 3

$$x^3 + 1$$

↙ ↘  
x 1

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

$+(-26)$	$x(-27)$
$-27+1 = -26$	$-27, 1$

\* Always check for a GCF first.

\* Always check to see if another method can be used to go further.

$$\Sigma X) 125x^2 + 400xy + 320y^2$$

$$5(25x^2 + 80xy + 64y^2)$$

M to 1600	A to 80
40, 40	80

$$5(25x^2 + 40xy + 40xy + 64y^2)$$

$$5((25x^2 + 40xy) + (40xy + 64y^2))$$

$$5(5x(5x + 8y) + 8y(5x + 8y))$$

$$5((5x + 8y)(5x + 8y))$$

$$5(5x + 8y)^2$$

$$k. \quad 500v^3 - 1100v^2u + 605vu^2$$

$$5v(100v^2 - 220vu + 121u^2)$$

$$100 \cdot 121 = 121,000$$

+ (-220)		x (121,000)
-110 + (-110)		-110(-110)

\* Trinomials / Grouping \*

GCF!

$$5v(100v^2 - 110vu) + (-110vu + 121u^2)$$

$$5v(10v)(10v - 11u) + (-11u)(10v - 11u)$$

$$5v(10v - 11u)(10v - 11u)$$

$$5v(10v - 11u)^2$$

Grouping!

GCF!

Ex.  $2x^7m - 54xmy^6$

\*Perfect Cubes\*

$2xm(x^6 - 27y^6)$

GCF!

Diff. Perf. Cube

$x^2 \cdot x^2 \cdot x^2 = x^6$

$3 \cdot 3 \cdot 3 = 27$   
 $y^2 \cdot y^2 \cdot y^2 = y^6$

a:  $x^2$

b:  $3y^2$

$2xm(x^2 - 3y^2)(x^4 + 3x^2y^2 + 9y^4)$
<div style="display: flex; justify-content: space-around; width: 100%;"> <span>S</span> <span>O</span> <span>AP</span> </div>

Ex.  $x^6 - 3x^4 - x^2 + 3 = 0$

$(x^6 - 3x^4) + (-x^2 + 3) = 0$

Group!

$x^4(x^2 - 3) + (-1)(x^2 - 3) = 0$

GCF!

$(x^4 - 1)(x^2 - 3) = 0$

Diff. Perf.  $\square$

a:  $x^2$       b: 1

$(x^2 + 1)(x^2 - 1)(x^2 - 3) = 0$

Diff. Perf.  $\square$

a: x      b: 1

$(x^2 + 1)(x + 1)(x - 1)(x^2 - 3) = 0$