

## Section 1.1

In general, we will be factoring quadratic trinomials of the form:

$$ax^2 + bx + c$$

Today, we start by factoring

$$x^2 + bx + c \quad (a=1)$$

$$x^2 + bx + c = (x + p)(x + q)$$

*Note: Red arrows point from the word "Factors" to the variables p and q in the equation above.*

$$x^2 + bx + c = x^2 + px + qx + pq$$

$$x^2 + \underline{bx} + \underline{c} = x^2 + \underline{(p+q)x} + \underline{pq}$$

In order to factor  $x^2 + bx + c$ ,  
we need to find 2 numbers

$p, q$ , so that:

$$p + q = b ; \quad \overset{\text{multiply}}{\downarrow} p \cdot q = c$$

(NOTE: this ONLY works if  
 $a=1$ )

Ex 1 Factor  $x^2 + \underline{6}x + \underline{8}$ .

$\otimes$	$+8$	$(2, 4)$	$(1, 8)$	<del><math>(-2, -4)</math></del>	<del><math>(-1, -8)</math></del>
$\oplus$	$+6$	$6$	$9$		

$$x^2 + 6x + 8 = (x+2)(x+4) \quad \text{😊}$$

Check  $\Rightarrow x^2 + 2x + 4x + 8 = \underline{x^2 + 6x + 8}$

Ex 2 Factor  $x^2 - 15 + 2x$

$$x^2 + 2x - 15$$

⊗ -15	(1, -15)	(5, -3)	(3, -5)	(-1, 15)
⊕ +2	-14	+2	-2	14

$$x^2 + 2x - 15 \Rightarrow \begin{matrix} \text{⊗} -15 \\ \text{⊕} +2 \end{matrix} \Rightarrow (5, -3)$$

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

check

$$x^2 + 5x - 3x - 15 = x^2 + 2x - 15$$

Ex 3 Factor  $x^2 - 5x - 4$

~~(\*)~~  $-4 \mid (1, -4), (-1, 4), (2, -2)$

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$+5 \mid -3 \quad 3 \quad 0$

No factors exist  $\therefore$  cannot be factored

Ex 4 Factor  $-2x^3 + 2x^2 + 24x$

$$x(-2x^2 + 2x + 24)$$

$$= -2x(x^2 - 1x - 12)$$

$$\textcircled{\times} -12 \mid (-4, 3), (6, -2), (-3, 4), (-1, 12), (1, -12), (2, 6)$$

$$\textcircled{+} -1 \mid -1 \quad \neq 1$$

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

Check

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

Ex 5 Factor  $x^2 - (5y)x + (6y^2)$

$\otimes + 6y^2$	$(2y, 3y)$	$(1y, 6y)$	$(-2y, -3y)$	$(-1y, -6y)$
$\oplus -5y$	$5y$	$7y$	$-5y$	

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

Check

$$x^2 - 2yx - 3yx + 6y^2$$

$$x^2 - 5yx + 6y^2$$

# Special Cases

## Difference of Squares

Notice

$$(a-b)(a+b)$$

$$= a^2 - \cancel{ab} + \cancel{ab} - b^2$$

$$= a^2 - b^2$$

↑  
diff.

Ex 6 Factor  $x^2 - 4y^2$

$$\sqrt{1^{\text{st}}} = \sqrt{x^2} = x$$

$$\sqrt{2^{\text{nd}}} = \sqrt{4y^2} = 2y$$

$$x^2 - 4y^2 = (x + 2y)(x - 2y)$$

Ex 7 Factor  $x^4 - 16$

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



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

$$\sqrt{16} = 4$$

$$x^4 - 16 = (x^2 + 4)(\underline{x^2 - 4})$$

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

$$\sqrt{4} = 2$$

$$x^4 - 16 = (x^2 + 4)(\underline{x + 2})(\underline{x - 2})$$