

7.4

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## Factoring the Difference of two Squares

difference of two squares  $\rightarrow x^2 - y^2$

### Formula

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

$$\text{first}^2 - \text{last}^2 = (\text{first} + \text{last})(\text{first} - \text{last})$$

ex)  $x^2 - 2^2 = (x+2)(x-2)$

note:

■  $x^2 - 4$

check:  $(x+2)(x-2) = x^2 - 2x + 2x - 4$   
 $= x^2 - 4$

note:  $25x^2 = (5x)^2$

ex)  $36x^2 - 9 = (6x)^2 - 3^2 = (6x+3)(6x-3)$

check:  $36x^2 - 18x + 18x - 9$

## Multistep Factoring

Sometimes need to factor out a GCF first.

ex)  $8x^3 - 50x$

$$1. 8x^3 = 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \quad \text{GCF} = 2 \cdot x$$

$$50x = 2 \cdot 5 \cdot 5 \cdot x$$

$$2. 2x \cdot 4x^2 - 2x \cdot 25$$

$$3. 2x(4x^2 - 25)$$

rewrite

$$2x[(2x)^2 - 5^2] = \boxed{2x(2x+5)(2x-5)}$$

check:  $2x(4x^2 - 10x + 10x - 25)$

$$2x(4x^2 - 25)$$

$$8x^3 - 50x \quad \checkmark$$

Sometimes factor more than once!

ex)  $16x^4 - 81 = (4x^2)^2 - (9)^2$

$$= (4x^2 + 9)(4x^2 - 9)$$

$$= (4x^2 + 9)((2x)^2 - (3)^2)$$

$$= (4x^2 + 9)(2x + 3)(2x - 3)$$

check:  $(4x^2 + 9)(2x + 3)(2x - 3)$

$$= (8x^3 + 12x^2 + 18x + 27)(2x - 3)$$

$$= 16x^4 + 24x^3 + 36x^2 + 54x - 24x^3 - 36x^2 - 54x - 81$$

$$= 16x^4 - 81 \quad \checkmark$$

## Factoring Perfect Square Trinomials

$$A^2 + 2AB + B^2 = (A+B)^2$$

$$A^2 - 2AB + B^2 = (A-B)^2$$

ex)  $x^2 + 10x + 25 = (x)^2 + 2(x)(5) + (5)^2$   
 $A^2 + 2AB + B^2$  so  $A=x$   $B=5$   
 $= (x+5)^2$   
 $(A+B)^2$

ex)  $9x^2 - 12x + 4 = (3x)^2 - 2(3x)(2) + (2)^2$   
 $A^2 - 2AB + B^2$  so  $A=3x$   $B=2$   
 $= (3x-2)^2$   
 $(A-B)^2$

OR you can do these as normal trinomials!

i.e.  $x^2 + 10x + 25$

$(+)(+)$

$(x+)(x+)$  two #'s that multiply to 25 & add to 10!

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

$(x+5)^2$

whichever method you prefer!

ALWAYS factor out GCF first!

trick to remember formulas

$$A^3 + B^3 = (A+B)(A^2 - AB + B^2)$$

Same sign      different sign      plus sign

$$A^3 - B^3 = (A-B)(A^2 + AB + B^2)$$

same sign      different sign      plus sign