

TOPIC: FACTORING SPECIAL PRODUCTS

Difference of Squares

◆ Recall: Multiplying the sum & difference of 2 terms (conjugates) results in:

Recall

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

(Difference of squares)

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Name	Rule	Use if there are...	Example
Difference of Squares	$a^2 - b^2 = (\quad + \quad)(\quad - \quad)$	___ terms that: • are perfect _____ • have _____ signs	$\begin{aligned} x^2 - 4 \\ &= (\quad)^2 - (\quad)^2 \\ &= (\quad + \quad)(\quad - \quad) \end{aligned}$

◆ Note: $a^2 + b^2$ is NOT a difference of squares, but a **sum**, and it _____ be factored.

EXAMPLE

Factor each binomial.

(A) $16 - 9x^2$

(B) $y^2 + 25$

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PRACTICE

Write the following difference of squares as a product of two binomials.

(A) $k^2 - 49$

(B) $81 - G^2$

EXAMPLE

Completely factor the binomial.

(A) $x^4 - 16$

(B) $-150 + 6x^2$

(C) $12y^2 - 27x^2$

EXAMPLE

Completely factor the binomial.

$(z + 5)^2 - 81$

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Perfect Square Trinomials

◆ Recall: Squaring a binomial results in a perfect square trinomial:

Recall

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

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

Name	Rule	Use if there are...	Example
Perfect Square Trinomials	$a^2 + 2ab + b^2 = (a + b)^2$	____ terms in which: • first & last terms are perfect ____ (always positive) • middle term is ____	$x^2 + 10x + 25$ $= (\quad)^2 + 2(\quad)(\quad) + (\quad)^2$ $= (\quad)^2$
	$a^2 - 2ab + b^2 = (a - b)^2$		

EXAMPLE

Factor completely.

$$4x^2 - 36x + 81$$

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PRACTICE

Factor completely.

(A) $x^2 - 40x + 400$

(B) $4m^2 + 20m + 25$

PRACTICE

Factor completely. *Hint: Factor out the GCF first.*

(A) $12x^2 + 48x + 48$

(B) $-4y^3 - 24y^2 - 36y$

EXAMPLE

Factor completely.

(A) $x^2 + 6xy + 9y^2$

(B) $10a^2b - 20ab^2 + 10b^3$

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EXAMPLE

Multiply the polynomials.

$$(A) \quad (a + b) (a^2 - ab + b^2)$$

$$(B) \quad (a - b) (a^2 + ab + b^2)$$

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Sum and Difference of Cubes

- ◆ The following products result in a sum or difference of cubes:

New

$$(a + b)(a^2 - ab + b^2) = a^3 + b^3$$
$$(a - b)(a^2 + ab + b^2) = a^3 - b^3$$

Name	Rule	Use if there are...	Example
Sum of Cubes	$a^3 + b^3 = (a \quad b)(a^2 \quad ab + b^2)$	___ terms that are perfect _____	$x^3 + 8$
Difference of Cubes	$a^3 - b^3 = (a \quad b)(a^2 \quad ab + b^2)$		$= (\quad)^3 + (\quad)^3$ $= (\quad + \quad)(\quad - \quad + \quad)$

- ◆ We can use this acronym to remember the **signs** within the factors:

 **Same, Opposite, Always Positive**

EXAMPLE

Factor completely.

$$27y^3 - 1$$

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PRACTICE

Factor completely.

(A) $27x^3 + 125$

(B) $y^3 - \frac{1}{27}$

EXAMPLE

Factor completely.

(A) $\frac{2}{3}x^3 - \frac{2}{3}y^3$

(B) $16x^3 + 54y^3$

EXAMPLE

Factor completely.

(A) $3yx^3 - 81y^4$

(B) $(p + q)^3 - 27r^3$