Lesson 5.6: Factoring Special Products

By the end of the lesson, we will be able to:

- Factor Perfect Square Trinomials
- Factor the Difference of Two Squares
- Factor the Sum or Difference of Two Cubes

In this section, we are looking at polynomials that have special “formulas” for factoring.

These are polynomials that follow the same pattern every time we factor.

PERFECT SQUARE TRINOMIALS:

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

These formulas should look familiar: they are the reverse of formulas we talked about in Section 5.2. In order for these formulas to be used, you must look for specific conditions:

1. Both the first term and the last term must be perfect squares. Examples: $x^2,\ 9x^2,\ 16x^4,\ 81,\ 25$
2. The middle term must equal 2 (or -2) times the product of the first and last terms.

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Examples: Remember that factoring out the GFC is always the first step!

Find A and B for each of the Trinomials and then factor.

a.) $x^2 + 6x + 9$

$A = x$

$B = 3$

$\boxed{(x+3)^2}$

b.) $18n^2 + 60n + 50$

$2(9n^2 + 30n + 25)$

$A = 3n$

$B = 5$

$\boxed{2(3n+5)^2}$

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THE DIFFERENCE OF TWO SQUARES:

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

Why? Let's look at the reverse pattern.

$$(x+4)(x-4) = x^2 - \cancel{4x} + \cancel{4x} - 16 = x^2 - 16$$
$$(3x+2)(3x-2) = 9x^2 - 6x + 6x - 4 = 9x^2 - 4$$

Examples: Remember that factoring out the GFC is always the first step!

Find A and B for each and then factor.

a.) $p^2 - 81$

$A = p$

$B = 9$

$\boxed{(p-9)(p+9)}$

b.) $162n^4 - 32$

$2(81n^4 - 16)$

$A = 9n^2$

$B = 4$

$2(9n^2+4)(9n^2-4)$

$A = 3n$

$B = 2$

$\boxed{2(9n^2+4)(3n+2)(3n-2)}$

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Examples: Remember that factoring out the GFC is always the first step!

Find A and B for each and then factor.

c.) $25a^4 - 9b^2$

$A = 5a^2$

$B = 3b$

$\boxed{(5a^2 - 3b)(5a^2 + 3b)}$

$A = x \quad B = 6$

d.) $\underbrace{x^2 + 12x + 36}_{} - y^2$

$(x+6)^2 - y^2$

$\boxed{(x+6+y)(x+6-y)}$

NOTE!!!

The SUM of two squares

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

is always a prime factorization.

Look for GCF.

THE SUM AND DIFFERENCE OF TWO CUBES:

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

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

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Examples: Remember that factoring out the GFC is always the first step!

Find A and B for each and then factor.

$A = x \quad B = 2$

a) $x^3 - 8$

$\boxed{(x-2)(x^2+2x+4)}$

$A = 3a \quad B = b^2$

b.) $27a^3 + b^6$

$\boxed{(3a+b^2)(9a^2-3ab^2+b^4)}$

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Examples: Remember that factoring out the GFC is always the first step!

Find A and B for each and then factor.

$A = m^2$ $B = 2n$

c.) $8m^6 - 64n^3$

$8(m^6 - 8n^3)$

$\boxed{8(m^2-2n)(m^4+2m^2n+4n^2)}$

$A = y-1$ $B = 3y$

d.) $(y-1)^3 + 27y^3$

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

$(4y-1)(y^2-2y+1-3y^2+3y+9y^2)$

$\boxed{(4y-1)(7y^2+y+1)}$

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Can you?

Homework:

Page 414: #9, 11, 15, 19, 25, 27, 31, 35, 39, 43, 47, 53, 57, 59, 61, 63, 65, 75, 77, 79, 83, 87, 91

AND

Page 442: # 67, 71, 81, 82, 85, 88

(29 problems)