

Special Products | MPM2D

Motivation: Expand the following binomial products...

$$\begin{array}{lll}
 \text{a) } (x+3)^2 = (x+3)(x+3) & \text{b) } (x+5)^2 = (x+5)(x+5) & \text{c) } (x-4)^2 = (x-4)(x-4) \\
 = x^2 + 3x + 3x + 9 & = x^2 + 5x + 5x + 25 & = x^2 - 4x - 4x + 16 \\
 = x^2 + 6x + 9 & = x^2 + 10x + 25 & = x^2 - 8x + 16
 \end{array}$$

$$\begin{array}{lll}
 \text{d) } (2x+3)^2 & \text{e) } (3x+2y)^2 & \text{f) } (4c-3d)^2 = (4c-3d)(4c-3d) \\
 = (2x+3)(2x+3) & = (3x+2y)(3x+2y) & = 16c^2 - 12cd - 12cd + 9 \\
 = 4x^2 + 6x + 6x + 9 & = 9x^2 + 6xy + 6xy + 4y^2 & = 16c^2 - 24cd + 9d^2 \\
 = 4x^2 + 12x + 9 & = 9x^2 + 12xy + 4y^2 &
 \end{array}$$

Do you notice a special pattern? To multiply these binomial squares you can...

- Square the first term
- Find twice the product of the terms
- Square the last term

The result when you square a binomial is called a **perfect square trinomial**...

A trinomial of the form $a^2 + 2ab + b^2$ OR
 $a^2 - 2ab + b^2$ that is the result of squaring
a binomial.

Examples: Try multiplying these binomial products by using the pattern! Write down the pattern first.

$$\left. \begin{array}{l}
 \text{a) } (x+4)^2 \\
 = (x)^2 + 2(x)(4) + (4)^2 \\
 = x^2 + 8x + 16
 \end{array} \right\} \begin{array}{l}
 \text{b) } (k-5)^2 \\
 = (k)^2 - 2(k)(5) + (5)^2 \\
 = k^2 - 10k + 25
 \end{array} \begin{array}{l}
 \text{c) } (3y+7x)^2 \\
 = (3y)^2 + 2(3y)(7x) + (7x)^2 \\
 = 9y^2 + 42xy + 49x^2
 \end{array}$$

~~$x^2 + 16$~~

OR

$$\left. \begin{array}{l}
 = 49x^2 + 42xy + 9y^2
 \end{array} \right\}$$

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Motivation: Expand the following binomial products...

a) $(x - 2)(x + 2)$

$$= x^2 + 2x - 2x - 4$$

$$= x^2 - 4$$

b) $(x + 5)(x - 5)$

$$= x^2 - 5x + 5x - 25$$

$$= x^2 - 25$$

c) $(2x - 1)(2x + 1)$

$$= 4x^2 + 2x - 2x - 1$$

$$= 4x^2 - 1$$

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

$$= 9x^2 + 15xy - 15xy - 25y^2 \quad \left. \begin{array}{l} \\ e) (4a - 5b)(4a + 5b) \end{array} \right\} = 16a^2 + 20ab - 20ab - 25b^2$$

$$= 9x^2 - 25y^2 \quad \left. \begin{array}{l} \\ = 16a^2 - 25b^2 \end{array} \right\}$$

Do you notice a special pattern? To multiply these binomial squares you can...

- Multiply the first two terms
- Multiply the last two terms.

The result when you multiply the sum and difference of two terms is called a **difference of squares**...

An expression of the form

$a^2 - b^2$ that comes from the product of two conjugates.

Literacy Connections

When you change the operation between the two terms of a binomial, the two forms are called conjugates. $x + 3$ and $x - 3$ are conjugates.

Examples: Try multiplying these binomial products by using the pattern! Write down the pattern first.

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

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

$$= x^2 - 16$$

b) $(3k - 7)(3k + 7)$

$$= (3k)^2 - (7)^2$$

$$= 9k^2 - 49$$

c) $(4e - 3f)(4e + 3f)$

$$= 16e^2 - 9f^2$$

$$x^2 - 12x + 16$$

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Example: Are the following expressions perfect square trinomials? If so, could you write them in the form $(a + b)^2$ or $(a - b)^2$?

a) $\sqrt{x^2 - 8x + 16}$

$$a = x$$

$$b = 4$$

$$2ab = 2(x)(4) = 8x \checkmark$$

$$x^2 - 8x + 16 = (x - 4)^2$$

b) $\sqrt{x^2 + 20x + 25}$

$$a = x$$

$$b = 5$$

$$2ab = 2(x)(5) = 10x$$

Not a perfect square trinomial

c) $\sqrt{4x^2 + 6x + 9}$

$$a = 2x$$

$$b = 3$$

$$2ab = 2(2x)(3) = 12x$$

Not a perfect square trinomial

Example: Are the following expressions differences of squares. If so, could you write them in the form $(a + b)(a - b)$?

a) $x^2 - 100$ ✓

$$= (x + 10)(x - 10)$$

OR

$$= (x - 10)(x + 10)$$

b) $\sqrt{9x^2 - 1}$ ✓

$$= (3x + 1)(3x - 1)$$

c) $25x^2 + 9$

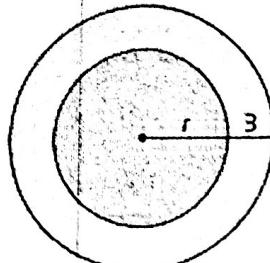
↑
sum

Not a difference of squares.

Example: The radius of a circular helicopter landing pad is increased by 3 m.

a) Find a simplified expression for the area of the new circle.

b) Find a simplified expression for the increase in area.



Tomorrow a)

a warm-up.