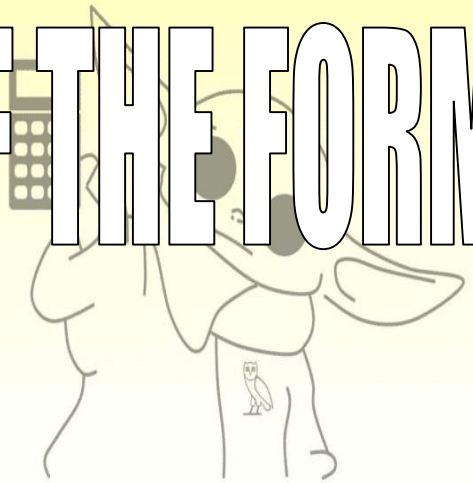
ST. JEAN DE BREBEUF

MATHEMATICS

# CHAPTER 5.3

## FACTORING TRINOMIALS OF THE FORM

$$y = x^2 + bx + c$$



# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***KEY CONCEPTS***

**Factoring** is the *opposite* of expanding.

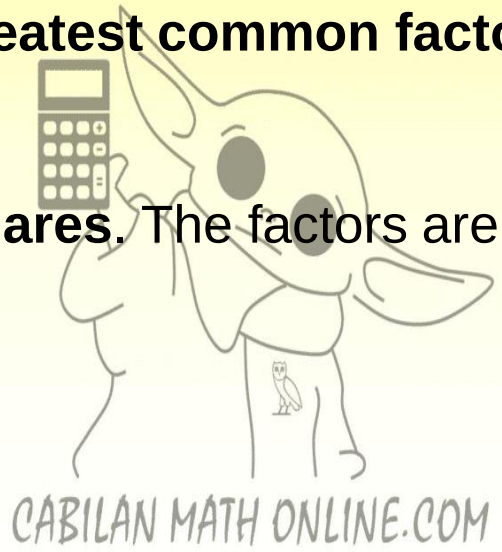
To factor *simple* trinomials in the form $\boldsymbol{x^2 + bx + c}$, find <u>two</u> numbers such that

When you <u>multiply</u> them, their **product (P)** is equal to ***c***
When you <u>add</u> them, their **sum (S)** is equal to ***b***.

To factor $\boldsymbol{x^2 + bx}$, rewrite as $\boldsymbol{x^2 + bx + 0}$ or find the **greatest common factor (GCF)**.

A polynomial in the form $\boldsymbol{x^2 - r^2}$ is a **difference of squares**. The factors are $\boldsymbol{(x + r)(x – r)}$.

*Check* the factors by **expanding**.



# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***EXAMPLE 1*** *Common Factoring*

To factor polynomials by *common factoring*, you must first identify the **greatest common factor**, or **GCF**.
→ A **number**, **variable** or **combination** of the two, which divides evenly into each term

Common factor the following expressions

(a) $\frac{\mathbf{2x}}{2} - \frac{\mathbf{18}}{2}$ GCF = 2

= 2 ( x – 9 )
(A) (B)

*** Check by **expanding**: 2 (x – 9)
= 2x – 18

***STEPS***

1. Find the GCF for both terms. Write the GCF in the space **(A)**.

2. Divide each term by the GCF. Write your answer in the space **(B)**. This will be your final answer.

# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***EXAMPLE 1*** *Common Factoring*

To factor polynomials by *common factoring*, you must first identify the **greatest common factor**, or **GCF**.
→ A **number**, **variable** or **combination** of the two, which <u>divides evenly</u> into each term

Common factor the following expressions

(b) $\underset{8x}{\underline{8x^2}} + \underset{8x}{\underline{24x}}$ GCF = 8x

$= \underbrace{8x}_{(A)}(\underbrace{x+3}_{(B)})$

* If every term has a letter, you include the letter with the **lowest** exponent

***STEPS***

1. Find the GCF for both terms. Write the GCF in the space **(A)**.

2. Divide each term by the GCF. Write your answer in the space **(B)**. This will be your final answer.

# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***EXAMPLE 1*** *Common Factoring*

To factor polynomials by *common factoring*, you must first identify the **greatest common factor**, or **GCF**.
→ A **number**, **variable** or **combination** of the two, which divides evenly into each term

Common factor the following expressions

(c) $\underset{4}{\underline{16x^2}} - \underset{4}{\underline{4x}} + \underset{4}{\underline{20}}$ GCF = 4

$= \underset{(A)}{4}(\underset{(B)}{4x^2 - x + 5})$

*** Check by **expanding**: $4(4x^2 - x + 5)$

$= 16x^2 - 4x + 20$ ✓

***STEPS***

1. Find the GCF for both terms. Write the GCF in the space **(A)**.

2. Divide each term by the GCF. Write your answer in the space **(B)**. This will be your final answer.

# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***EXAMPLE 2*** *Factoring Trinomials in the Form $y = x^2 + bx + c$*

Factor the following trinomials:

(a) $x^2 + 15x + 36$

$= (x + 3)(x + 12)$

$P = +36$, $S = +15$ → $+3$, $+12$

(b) $x^2 + 7x - 18$

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

$P = -18$, $S = +7$ → $+9$, $-2$

(c) $x^2 - 10x + 25$

$= (x - 5)(x - 5)$

$= (x - 5)^2$

$P = +25$, $S = -10$ → $-5$, $-5$

To factor **simple trinomials** in the form $x^2 + bx + c$, find two numbers such that

→When you multiply them, their **product (P)** is equal to $c$

→When you add them, their **sum (S)** is equal to $b$.

# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***EXAMPLE 3*** *Factoring a Difference of Squares*

Factor the following:

(a) $x^2 - 16$

$= ( x + 4 )( x - 4 )$

$\sqrt{x^2} =$ x

$\sqrt{16} =$ 4

(b) $x^2 - 64$

$= ( x + 8 )( x - 8 )$

$\sqrt{x^2} =$ x

$\sqrt{64} =$ 8

(c) $x^2 - 9$

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

$\sqrt{x^2} =$ x

$\sqrt{9} =$ 3

To factor a **difference of squares** in the form $x^2 - r^2$

→Open up **two** sets of brackets

→Write a **"+"** in the first bracket and **"-"** in the second

→Take the **square root** of the *first term* and place this answer in the *first* space in both brackets

→Take the **square root** of the *second term* and place this answer in the *second* space of both brackets. This will give you the final answer.

# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***EXAMPLE 3*** *Factoring a Difference of Squares*

Factor the following:

(d) $25x^2 - 121$

$= ( 5x + 11 )( 5x - 11 )$

$\sqrt{25x^2} =$ 5x

$\sqrt{121} =$ 11

To factor a **difference of squares** in the form $x^2 - r^2$

→Open up **two** sets of brackets

→Write a **"+"** in the first bracket and **"-"** in the second

→Take the **square root** of the *first term* and place this answer in the *first* space in both brackets

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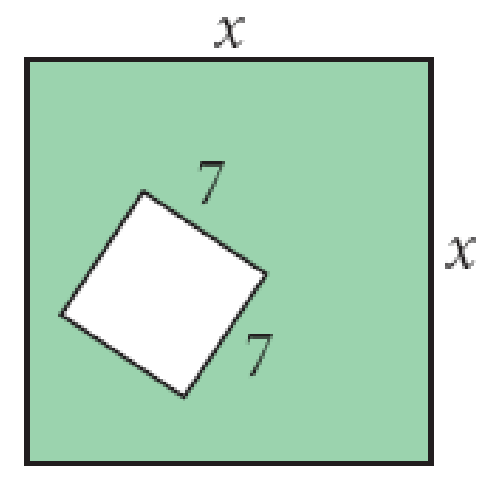
# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***EXAMPLE 4*** *Difference of Areas*

Find an expression, in factored form, for the **shaded** area of this figure.



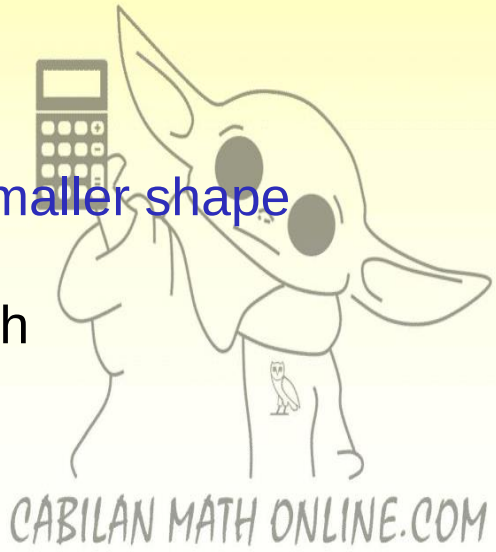

Recall that the area of a rectangle is **Area = Length × Width**

Step 1: Find the area of the larger shape

$$A_{large} = \text{Length} \times \text{Width}$$
$$= (x)(x)$$
$$= \mathbf{x^2}$$

Step 2: Find the area of the smaller shape

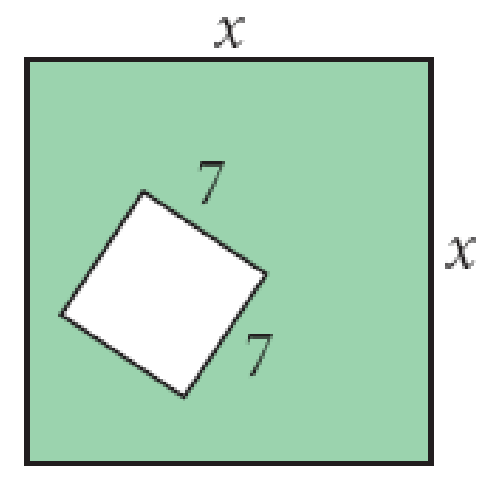
$$A_{small} = \text{Length} \times \text{Width}$$
$$= (7)(7)$$
$$= \mathbf{49}$$



# CHAPTER 5.3 FACTORING TRINOMIALS OF THE FORM $y = x^2 + bx + c$

***EXAMPLE 4*** *Difference of Areas*

Find an expression, in factored form, for the **shaded** area of this figure.




$A_{large}$ = Length × Width
= (x)(x)
= **$x^2$**

$A_{small}$ = Length × Width
= (7)(7)
= **49**

Step 3: Find the Area of the *shaded* region

Shaded area = $A_{large} - A_{small}$
= **$x^2 - 49$**

Step 4: Factor the expression

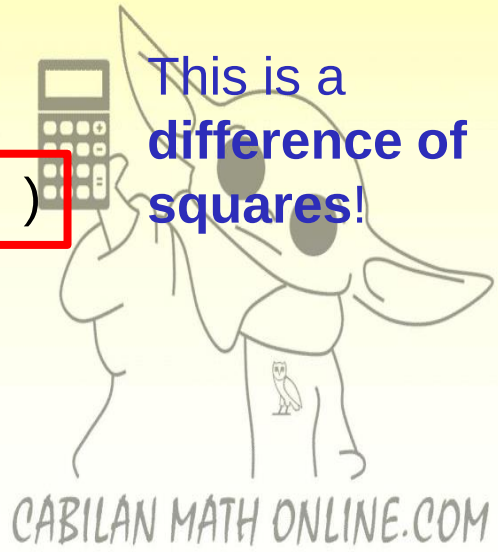
Shaded area = **$x^2 - 49$**

$= ( x + 7 )( x - 7 )$

$\sqrt{x^2} =$ x

$\sqrt{49} =$ 7

This is a **difference of squares**!



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## Homework:

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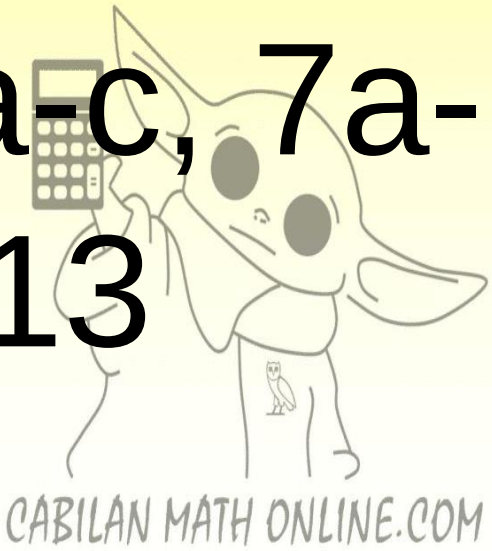
#1, 2, 3acegh, 6a-c, 7a-e, 8, 9, 11, *13