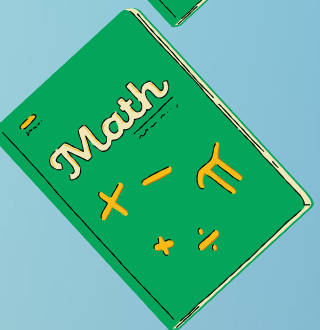
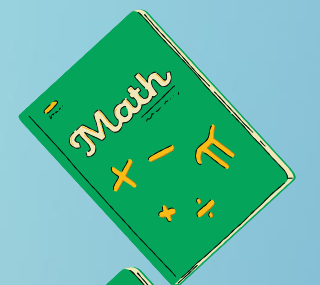
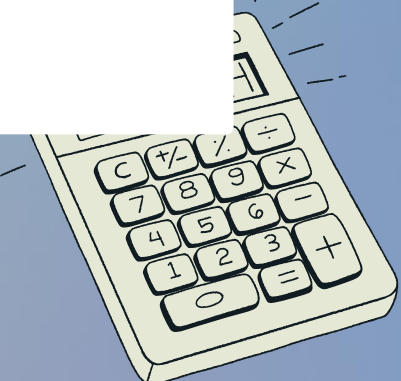




Chapter 4

ALGEBRA, EQUATIONS AND INEQUATIONS



Outlines

1. Intro to Algebra
 2. Simplifying Expressions
 3. Multiplying Expressions
 1. The FOIL Method
 5. Factoring-GCF
 6. Factoring-Difference of Two Squares
 7. Factoring-Quadratics
 8. Factoring- Combined
 9. Advanced Numerical Factoring
 10. Factoring- Rational Expressions
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$$3 + 2$$

$$3 + 2$$

$$3 + 2$$

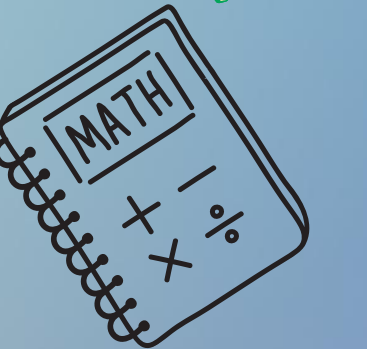
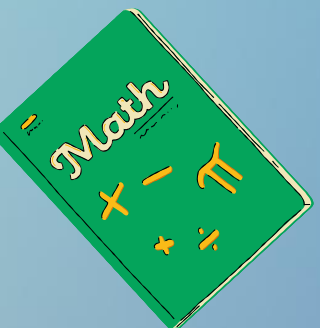
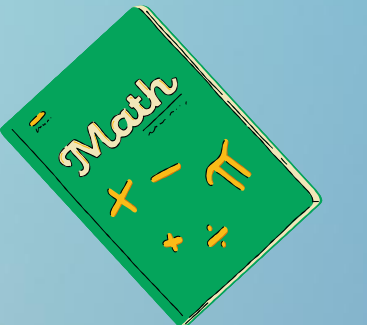
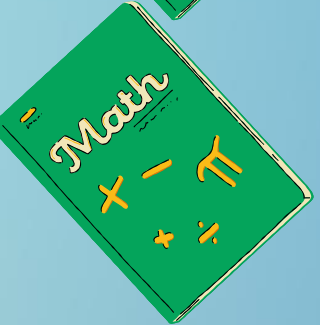


Key Vocabulary

Variable
Coefficient
Constant
Term
Like terms
Expression

Factor
Monomial
Binomial
Polynomial
Expand
Simplify

Trinomial
Linear
Quadratic
Cubic



$$3+2$$



$$3+2$$



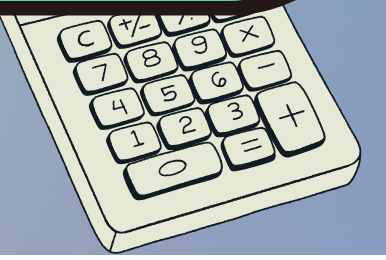
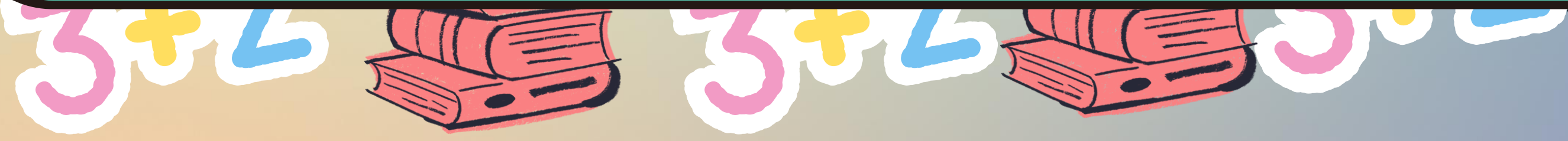
$$3+2$$

Search one mathematics education article from:

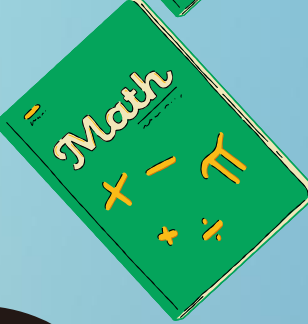
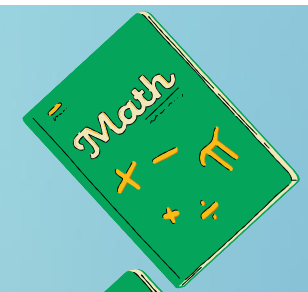
- Google Scholar
- ERIC

Write:

- Title
- Author
- Three mathematics vocabulary words found in the article
- One theory or One finding



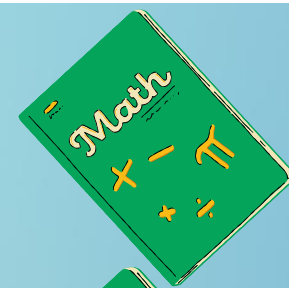
Warm-up and Introduction


$$5x + 3, \quad 2a - 7, \quad 4x^2 + 3x - 6$$

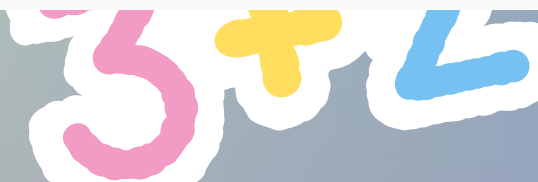
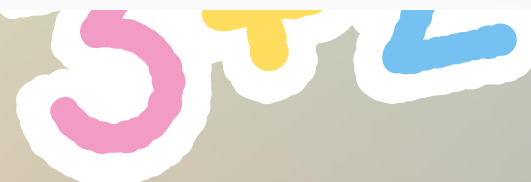
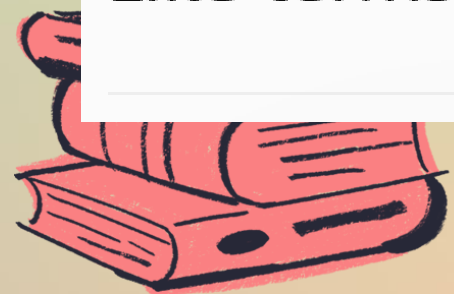
- What represent variables?
- Which numbers are coefficients?
- Which numbers are constants?
- How many terms are in each expression?
- Are these expressions or equations? Why?



Key Vocabulary

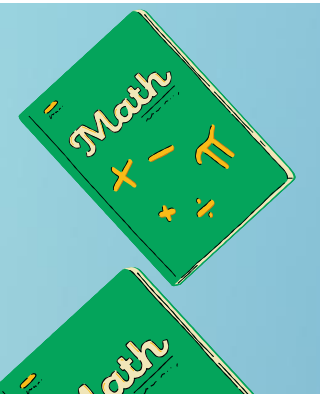


Term	Meaning	Example
Variable	A letter representing an unknown value	x in $3x + 5$
Coefficient	A number multiplying a variable	3 in $3x$
Constant	A number without a variable	5 in $3x + 5$
Term	A number, variable, or product separated by $+$ or $-$	$3x$ and 5
Like terms	Terms with the same variables & exponents	$3x$ and $7x$





Key Vocabulary

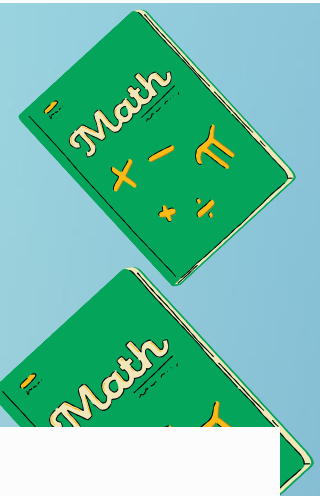


Expression	A mathematical phrase without an equal sign	$(2x+7)$
Factor	A quantity multiplied by another quantity	$(x+2)$ in $((x+2)(x+3))$
Monomial	A polynomial with one term	$(4x^2)$
Binomial	A polynomial with two terms	$(x+5)$
Trinomial	A polynomial containing exactly three terms	x^2+5x+6
Polynomial	An expression containing one or more terms	$(2x^2+3x-4)$





Key Vocabulary



Linear expression

An expression whose highest variable exponent is 1

$$3x + 7$$

Quadratic expression

An expression whose highest variable exponent is 2

$$2x^2 + 3x - 5$$

Cubic expression

An expression whose highest variable exponent is 3

$$x^3 - 2x^2 + 4x - 1$$

Expand

Remove brackets by multiplication

$$3(x + 2) = 3x + 6$$

Simplify

Write an expression in its simplest form

$$3x + 2x = 5x$$



$$3 + 2$$



$$3 + 2$$



$$3 + 2$$





Algebra Vocabulary and Interpretation

how to interpret expressions.


$$4x + 7$$

Read as:

“Four x plus seven.”

“Seven more than four times x.”

“The sum of four x and seven.”



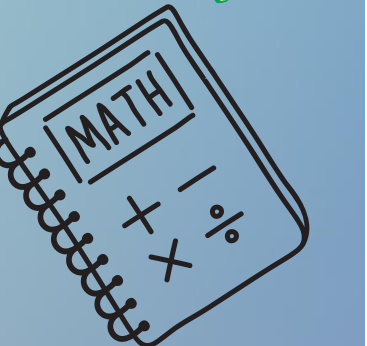
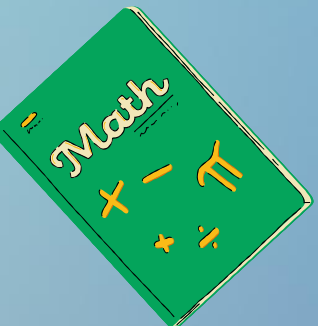
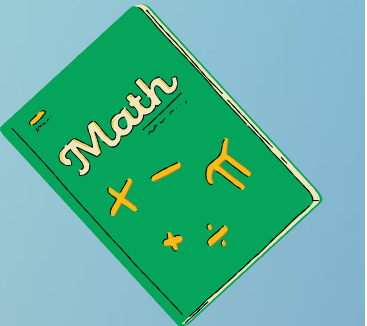
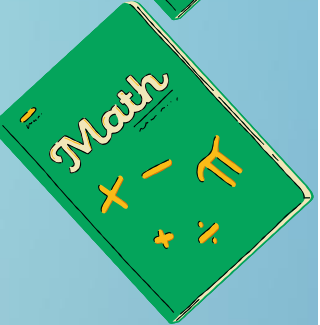
$$3 + 2$$



$$3 + 2$$



$$3 + 2$$





how to interpret expressions.



$$3(x - 5)$$

Read as:

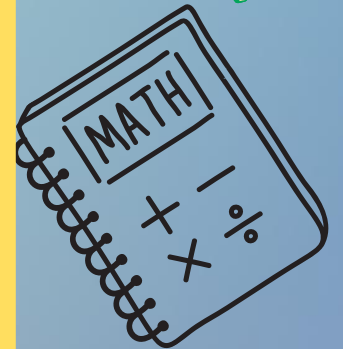
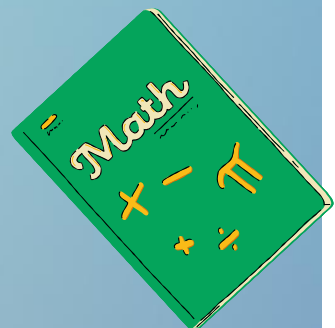
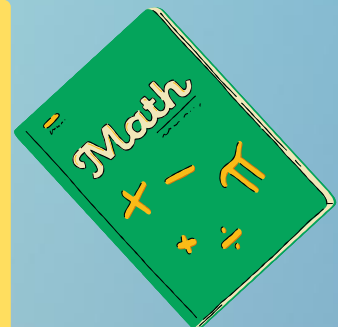
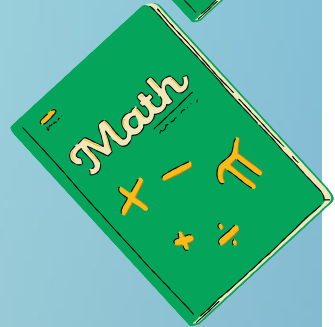
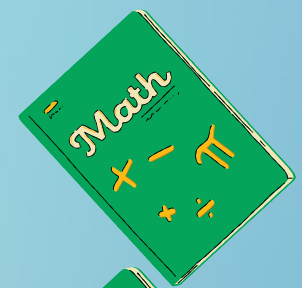
"Three times the difference between x and five."

"Three times the quantity x minus five"

"Three times, open parenthesis, x minus five, close parenthesis"

"Three, open parenthesis, x minus five, close parenthesis"

"Three times x minus five"





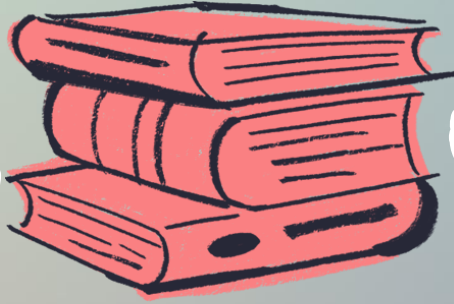
how to interpret expressions


$$2x^2 - 3x + 8$$



Read as:

- "Two x squared minus three x plus eight" (Most standard and common way to read it)
- "Two x to the power of two minus three x plus eight" (A slightly more formal variant for the exponent)

- 
- 
- 
- 
- 
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- 
- $2x^2$ is the quadratic term.
 - $-3x$ is the linear term.
 - 8 is the constant term.
 - The expression has three terms.



Quick Check

1. $5x - 2$

2. $2(a + 4)$

3. $x^2 + 6x + 9$

"Five x minus two"

"Two times the quantity a plus four"

"Two times, open parenthesis,

"a" plus four, close parenthesis



$3 + 2$



$3 + 2$

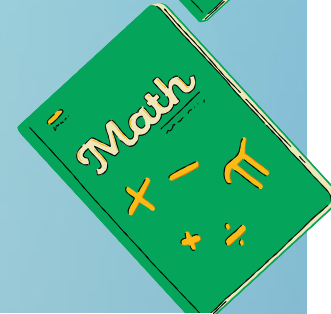
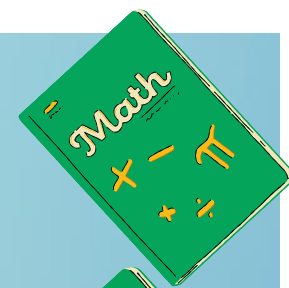


$3 + 2$





Quick Check



1. $5x - 2$

2. $2(a + 4)$

3. $x^2 + 6x + 9$

1. Two less than five times x .

2. Twice the sum of a and four.

3. The sum of x^2 , $6x$, and nine.



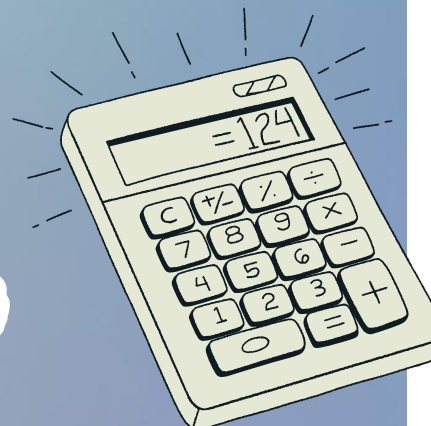
$3 + 2$



$3 + 2$

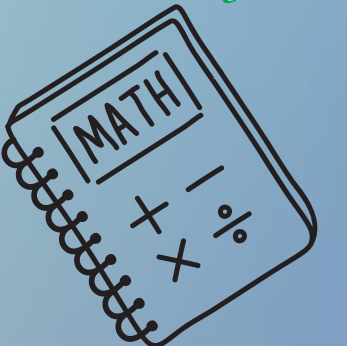
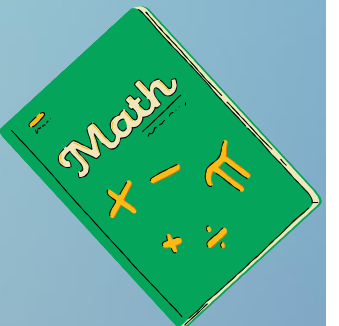
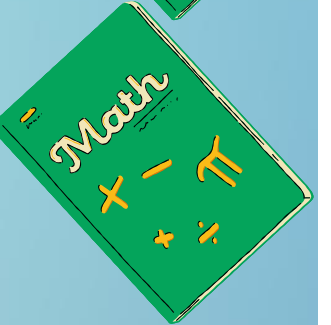


$3 + 2$



02

Simplifying Expressions



$$3 + 2$$



$$3 + 2$$



$$3 + 2$$

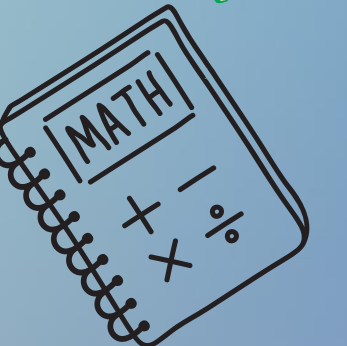
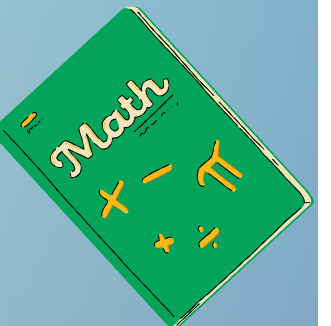
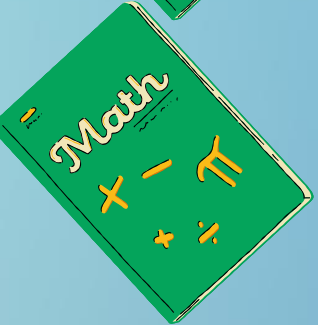




only like terms can be combined

Example 1

$$3x + 5x = \bullet$$



$$3 + 2$$



$$3 + 2$$



$$3 + 2$$



only like terms can be combined

Example 2

$$7a+4-2a+3$$

Group the like terms:

$$\boxed{} + \boxed{} = \boxed{}$$



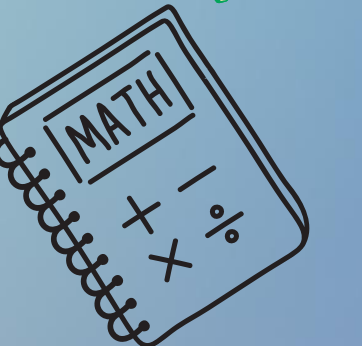
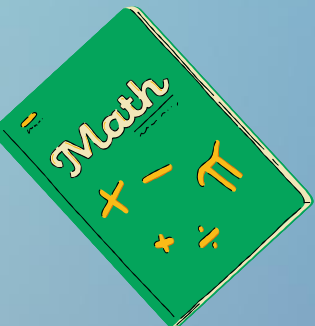
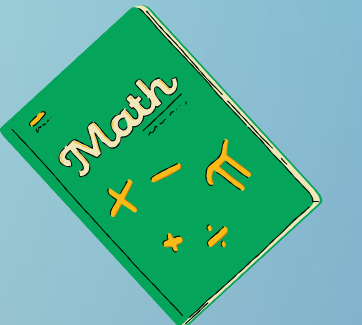
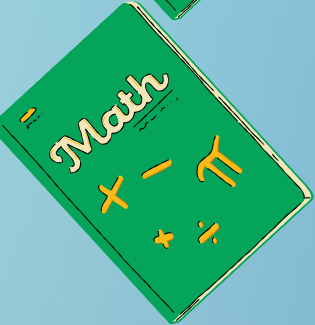
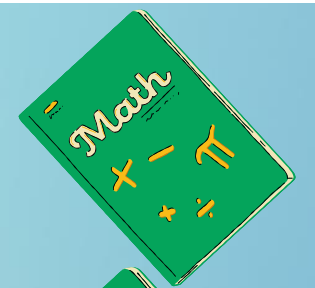
$$3+2$$



$$3+2$$



$$3+2$$





only like terms can be combined

Example 3

$$4x^2 + 3x - 2x^2 + 5x$$

 +  = 



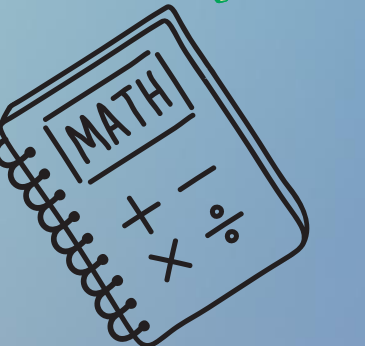
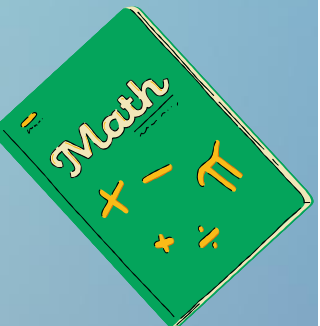
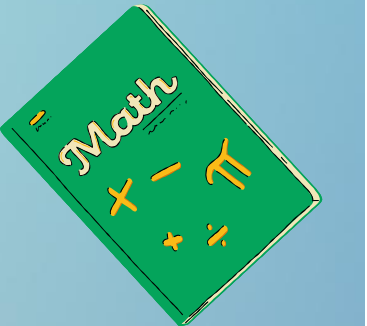
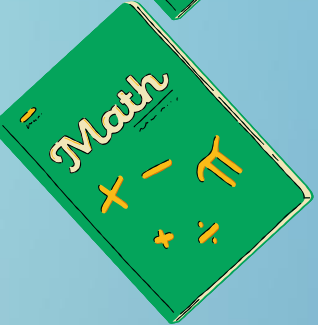
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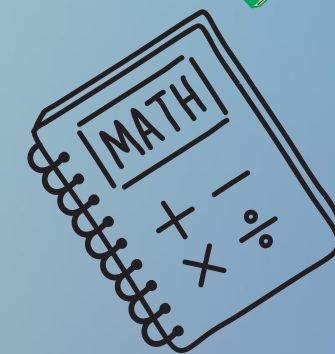
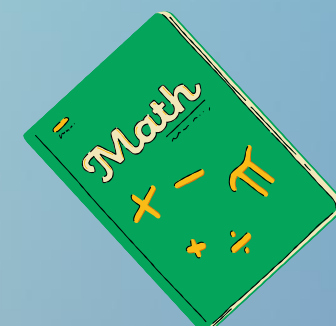
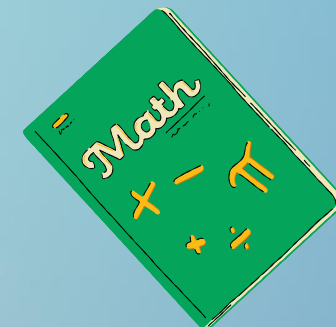
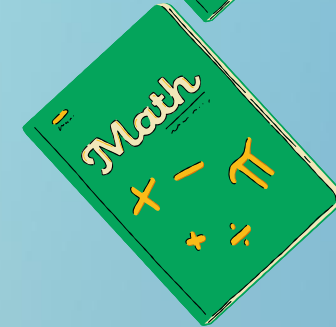


$$3 + 2$$



$$3 + 2$$





3+2



3+2



3+2



Guided Practice

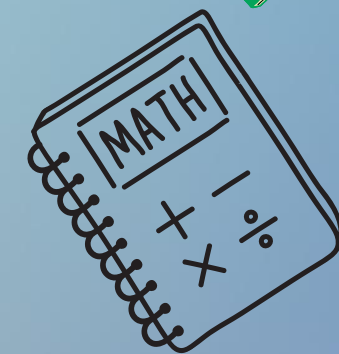
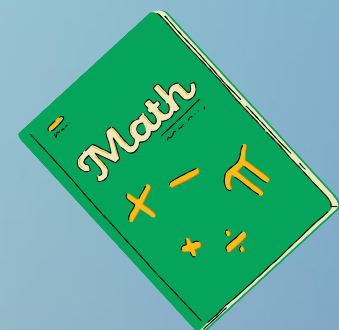
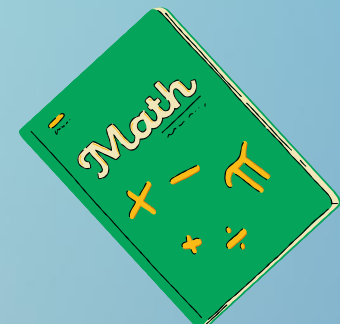
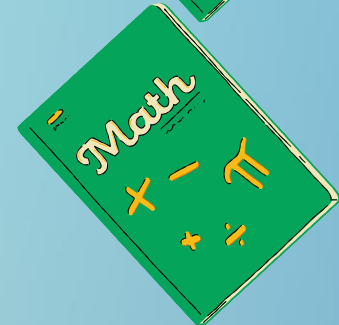
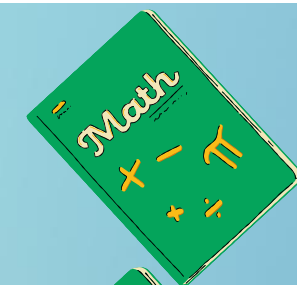
Students simplify:

1. $6x + 2x$

2. $9a - 4a + 3$

3. $3x + 7 - 5x + 2$

4. $5y^2 + 4y - 2y^2 + 6y$



3+2



3+2



3+2



Guided Practice

Students simplify:

1. $6x + 2x$

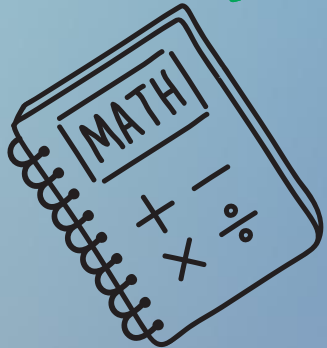
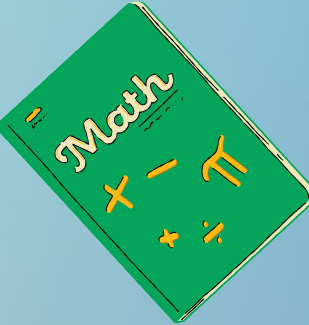
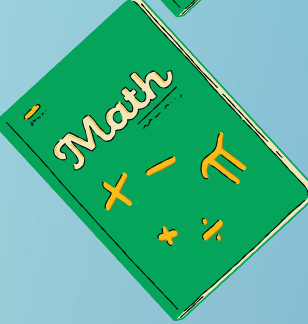
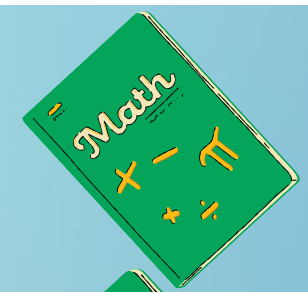
2. $9a - 4a + 3$

3. $3x + 7 - 5x + 2$

4. $5y^2 + 4y - 2y^2 + 6y$

Answers:





Sequencing Language English Instructions for Math Teachers



$$3+2$$



$$3+2$$



$$3+2$$





Language used to explain mathematical procedures

Useful Sequencing Expressions

- First, identify the like terms.
- Next, group the like terms together.
- Then, add or subtract the coefficients.
- After that, check the signs.
- Finally, write the simplified expression.
- The next step is to ...
- Before we ..., we need to ...
- Make sure that ...
- Remember to ...



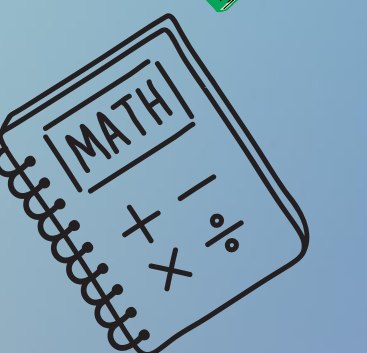
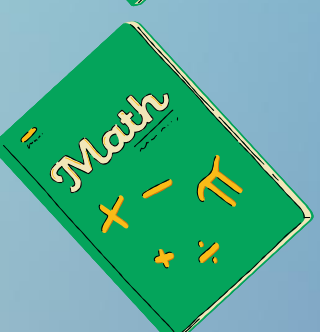
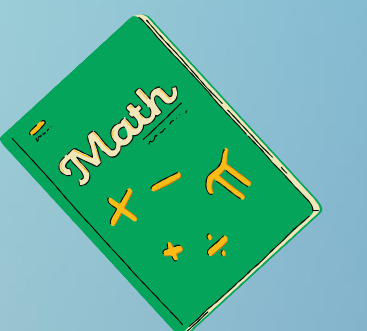
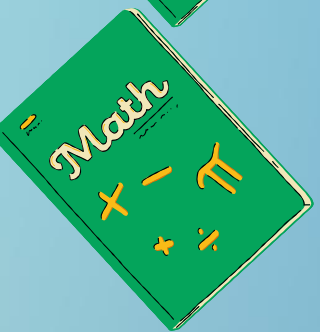
$$3+2$$



$$3+2$$



$$3+2$$



4 steps

- 1. First,
- 2. Then,
- 3. After that,
- 4. Finally

5 steps

- 1. First,
- 2. Next,
- 3. Then,
- 4. After that,
- 5. Finally

6 steps

- 1. First,
- 2. Second,
- 3. Next,
- 4. Then,
- 5. After that,
- 6. Finally

7 steps

- 1. First,
- 2. Second,
- 3. Third,
- 4. Next,
- 5. Then,
- 6. After that,
- 7. Finally



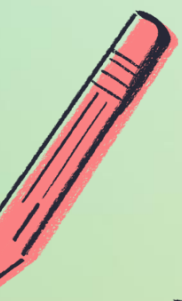
Group Activity



$$7a - 2 + 3a + 8$$



$$8b - 6 + 4b + 3$$



$$9y + 7 - 5y - 2$$

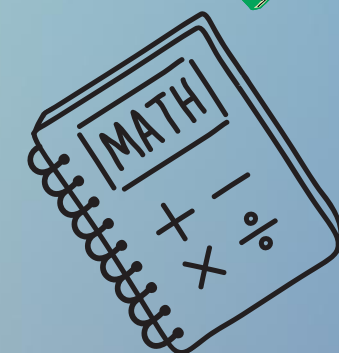
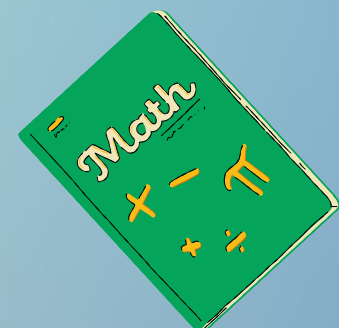
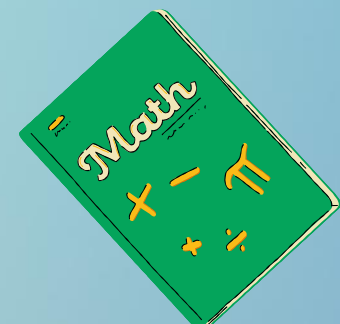
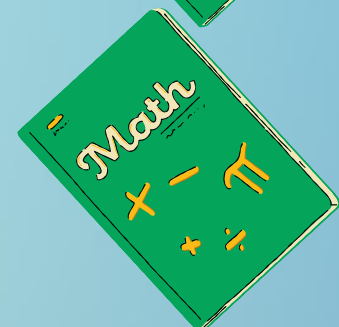
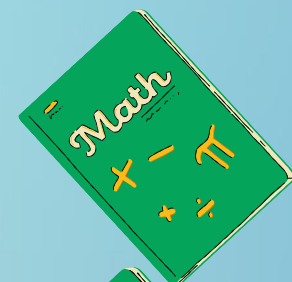


$$4x + 3 + 2x - 7$$

$$5x + 4 + 2x - 9$$

$$6m - 3 + 2m + 10$$

$$4p + 12 - 7p - 5$$



3+2



3+2

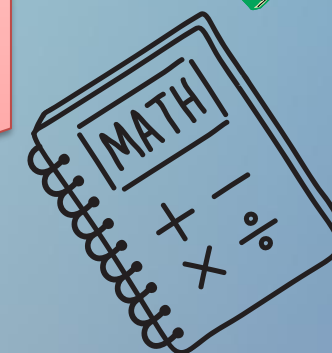
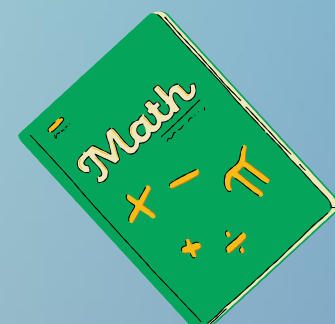
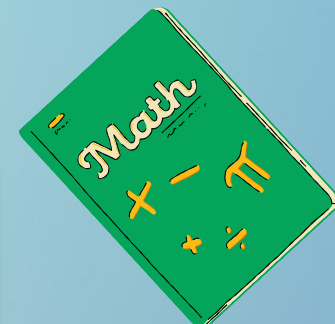
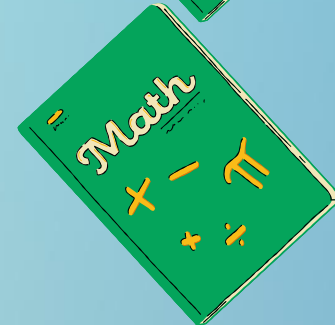
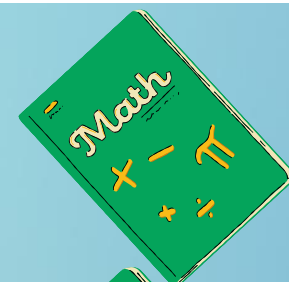
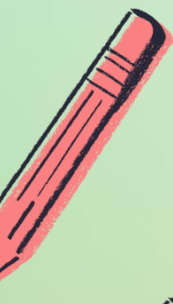


3+2



3.

Multiplying Expression



$$3 + 2$$



$$3 + 2$$



$$3 + 2$$





Commutative & Associative Properties

factors in any orders and/or groupings and not change the product.

Multiplication:

$$a \cdot b = b \cdot a$$

$$(a \cdot b) \cdot c = a \cdot (b \cdot c)$$



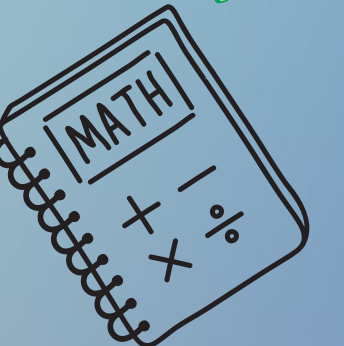
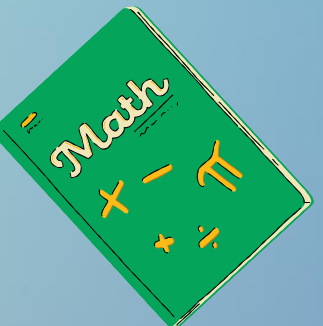
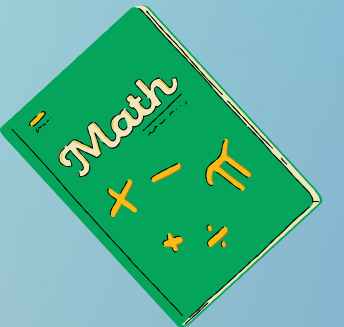
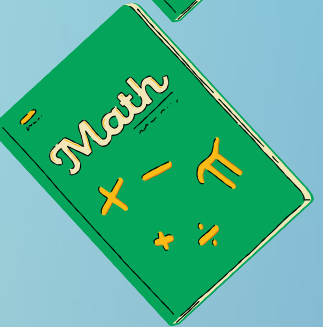
$$3 + 2$$



$$3 + 2$$



$$3 + 2$$





Distributive Properties

Also, we need to be clear on the Distributive Law.

Multiplication distributes over addition and subtraction:

$$A(B + C) = AB + AC$$

$$A(B - C) = AB - AC$$

Multiplication does **NOT** distribute over multiplication!!

$$3 \times (xy) \neq (3x)(3y) \rightarrow 3 \times (xy) = 3xy$$



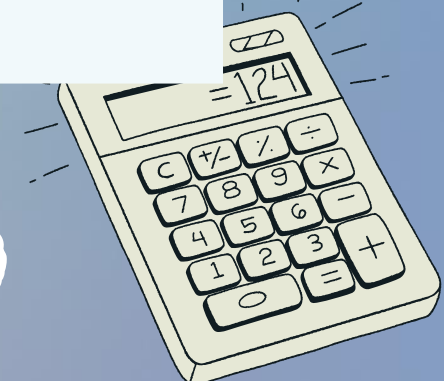
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$$3 + 2$$

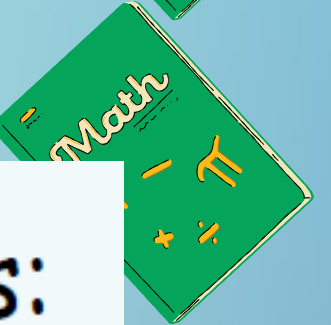
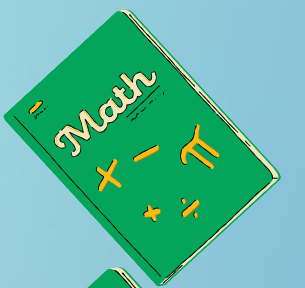


$$3 + 2$$





High Powers



For higher powers of x , recall the rule for multiplying powers:

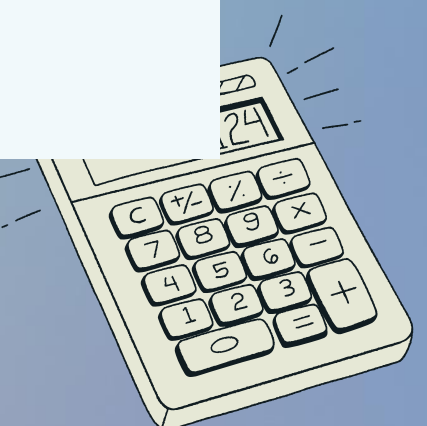
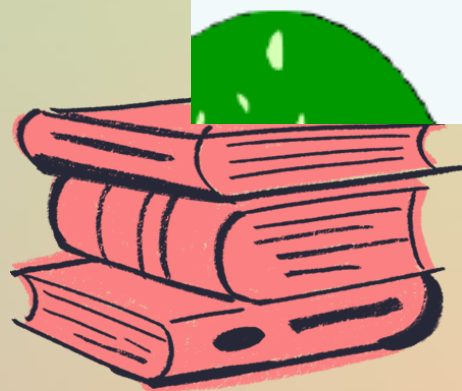
$$(x^a)(x^b) = x^{a+b}$$

For example

$$(3x)(4x^2) = 12x^3$$

$$(7x^2y^2)(6xy^3) = 42x^3y^5$$

The powers of different variables stay separate.



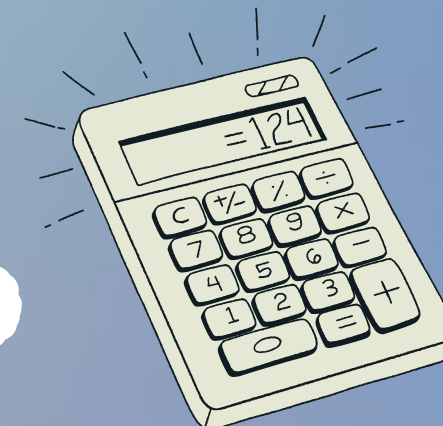
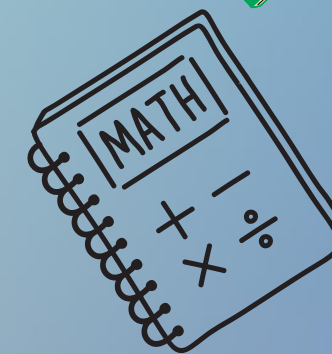
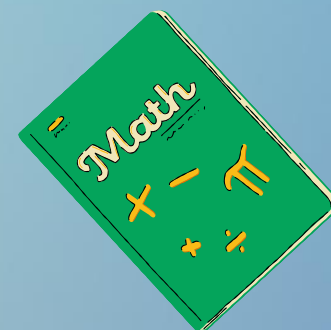
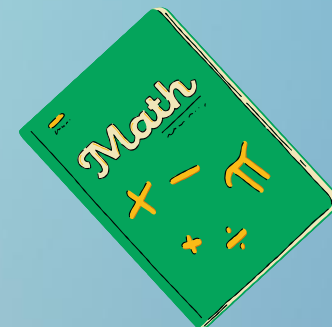
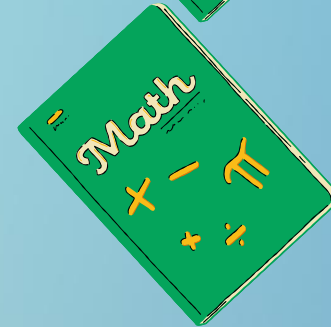
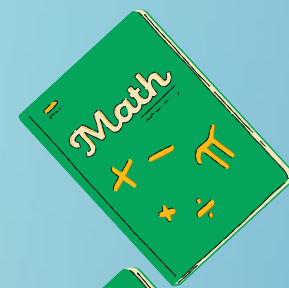


Practice problems:

$$(5x^5)(6x^6) = 30 x^{11}$$

$$(3x^3y^2)(7x^5y^6) = 21 x^8 y^8$$

$$(2xy)(3xz)(4yz) = 24 x^2 y^2 z$$



3+2



3+2



3+2



Distributive Properties A monomial times a binomial

Review the distributive property:

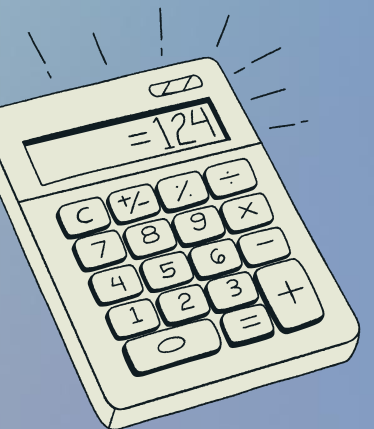
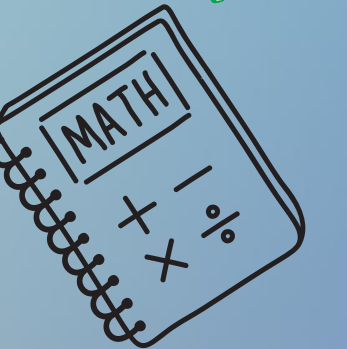
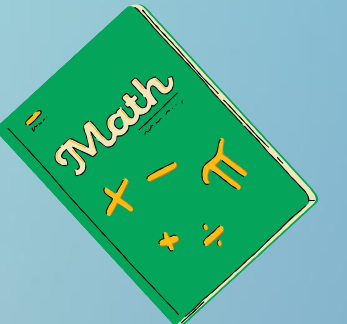
$$a(b+c)=ab+ac$$

Example 1: Monomial by Binomial

$$3x(x+4)$$

Multiply $3x$ by every term inside the brackets:

$$3x(x)+3x(4)=3x^2+12x$$

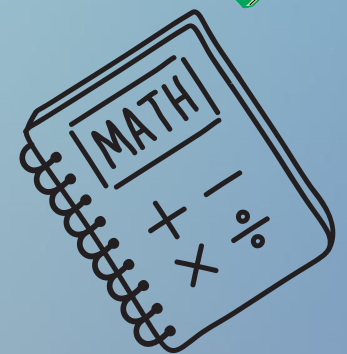
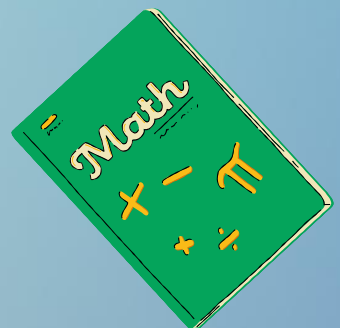
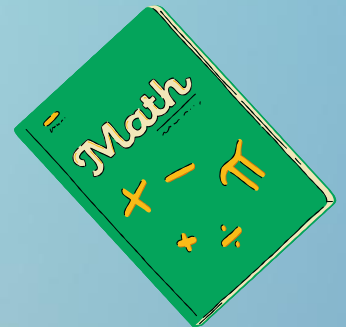
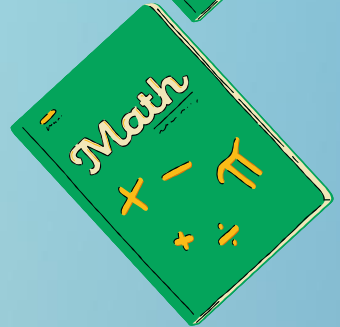




Distributive Properties

dividing by a number is the same as multiplying by its reciprocal

$$\frac{15x^6y^{12}}{3} = 15x^6y^{12} \times \frac{1}{3} = 5x^6y^{12}$$





3.2 A monomial times a binomial

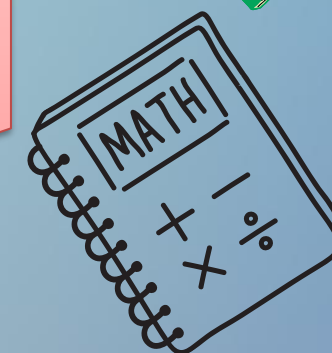
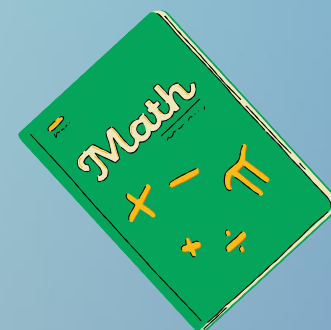
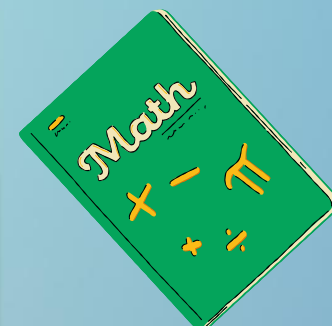
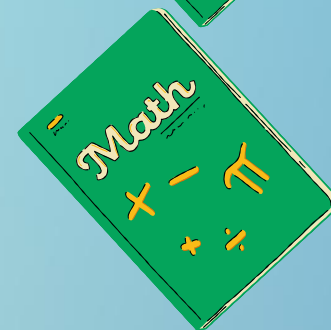
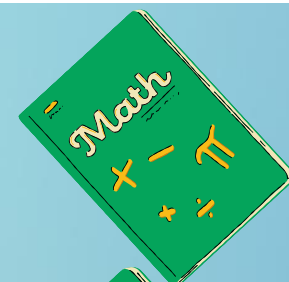
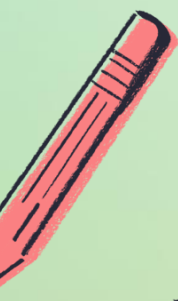
For this, we use the Distributive Law :

$$\underline{A}(\underline{B + C}) = AB + AC$$

$$\begin{aligned} 7x^2(x^3 + 2x^2) &= (7x^2)(x^3) + (7x^2)(2x^2) \\ &= 7x^5 + 14x^4 \end{aligned}$$

Clearly, we could extend this pattern for a monomial times a trinomial or any higher polynomial.

4. The FOIL Method



$$3+2$$



$$3+2$$

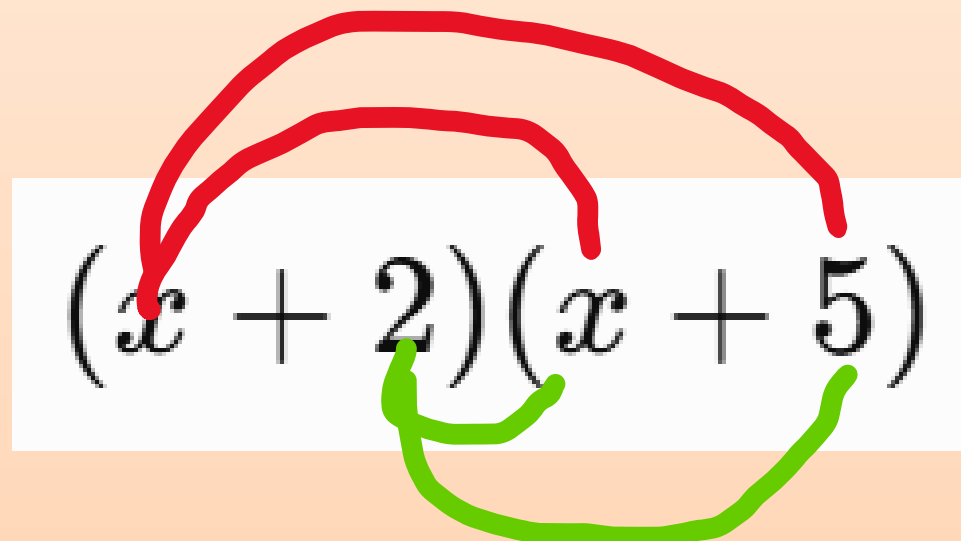


$$3+2$$





FOIL is used to multiply two binomials


$$(x + 2)(x + 5)$$

F — First

O — Outer

I — Inner

L — Last

- First: $x \cdot x = x^2$
- Outer: $x \cdot 5 = 5x$
- Inner: $2 \cdot x = 2x$
- Last: $2 \cdot 5 = 10$

Combine like terms:





FOIL is used to multiply two binomials

Example 2

$$(2x - 3)(x + 4)$$

- First: $2x \cdot x = 2x^2$
- Outer: $2x \cdot 4 = 8x$
- Inner: $-3 \cdot x = -3x$
- Last: $-3 \cdot 4 = -12$

Therefore:

$$2x^2 + 8x - 3x - 12 = 2x^2 + 5x - 12$$



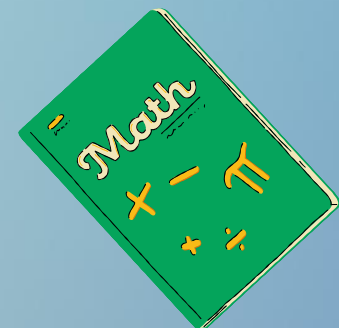
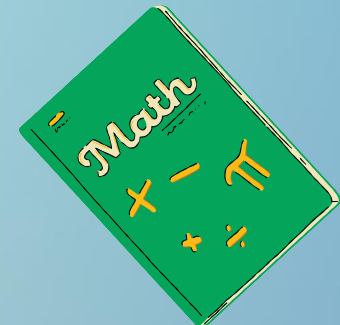
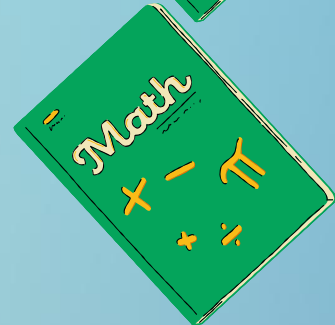
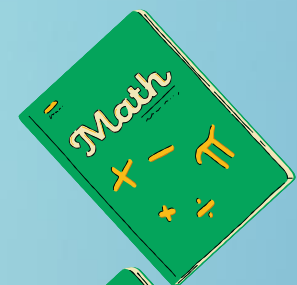
3+2



3+2



3+2





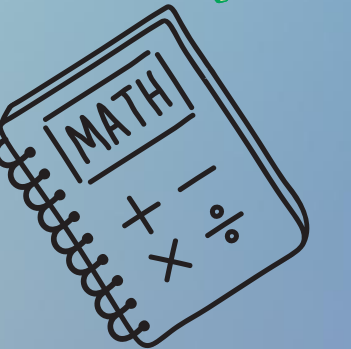
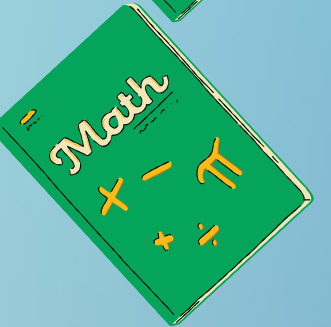
FOIL is used to multiply two binomials

Practice

1. $(x + 3)(x + 6)$

2. $(x - 2)(x + 5)$

3. $(2x + 1)(x + 4)$



3+2



3+2

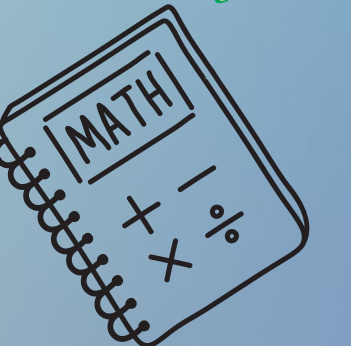
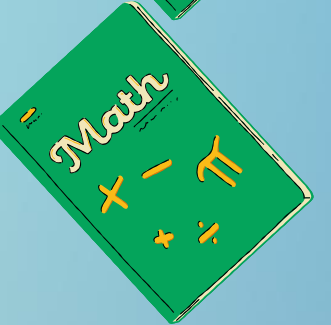


3+2



Common Mistakes

1. Multiplying only the first and last terms
2. Forgetting the negative sign
3. Combining terms that are not like terms
4. Writing $x \cdot x$ as $2x$ instead of x^2
5. Forgetting to simplify the middle terms



$$3 + 2$$



$$3 + 2$$



$$3 + 2$$



Common Mistakes

A very common algebraic mistake pattern.

$$(a + b)^2 \neq a^2 + b^2$$

$$(a - b)^2 \neq a^2 - b^2$$

It is absolutely illegal to "distribute" an exponent across addition or subtraction.

$$(a + b)^2$$

กำลังสองสมบูรณ์

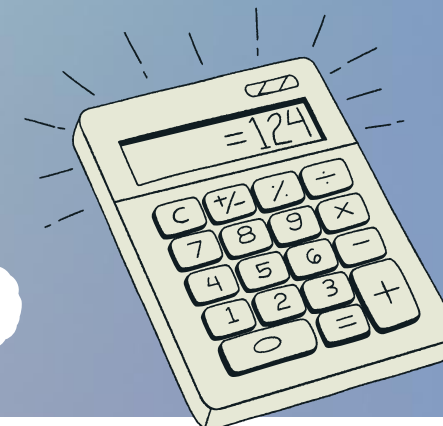
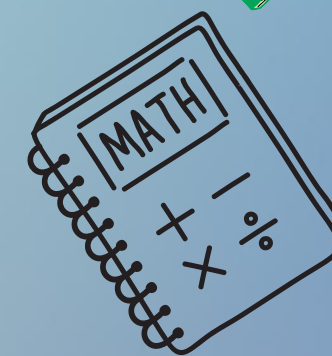
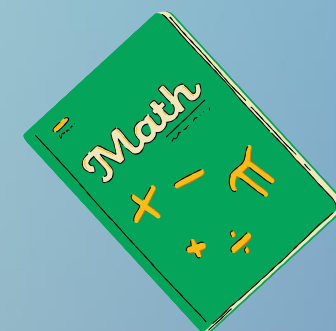
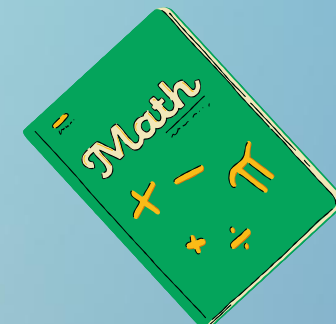
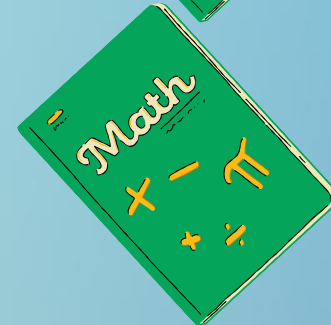
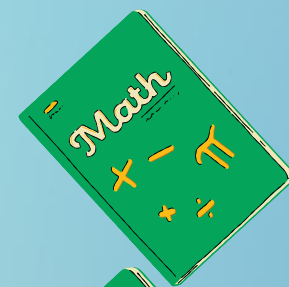
$$(a - b)^2$$

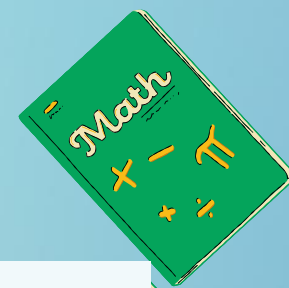
$$= (a + b)(a + b)$$

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

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

This rule: $(a + b)^2 = a^2 + 2ab + b^2$ is called the Square of a Sum.





กำลังสองของผลต่าง

A similar rule, the **Square of a Difference**, can also be found by using FOIL:

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

These two formulas, the **Square of a Sum** and the **Square of a Difference**, are good to remember, because they are two of the most important patterns in all of algebra.



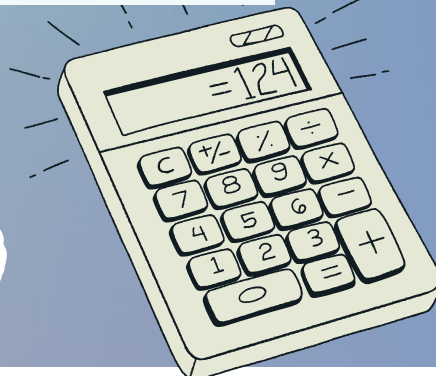
3+2

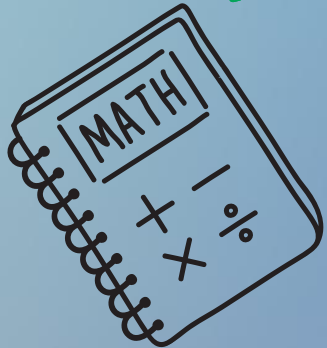
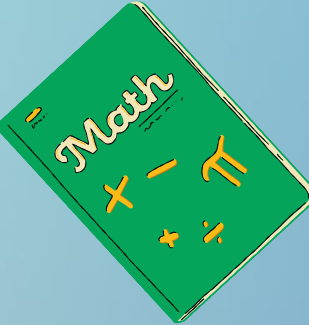
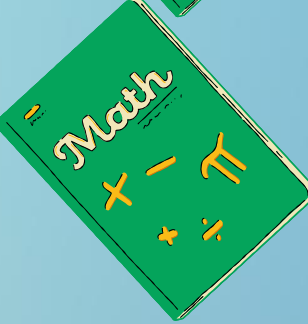
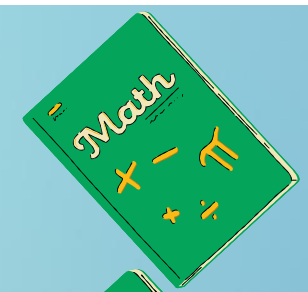
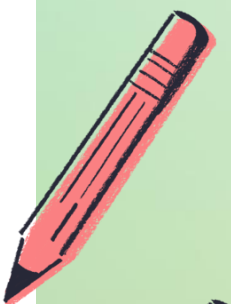


3+2



3+2





5. Factoring Using the GCF


$$3 + 2$$



$$3 + 2$$



$$3 + 2$$



The **greatest common factor (GCF)** is the largest factor shared by all terms in an expression. To factor using the GCF, divide every term by the GCF and place the remaining expression inside parentheses.

$$12x^2 + 18x$$

The GCF of $12x^2$ and $18x$ is $6x$.

$$12x^2 + 18x = 6x(2x + 3)$$



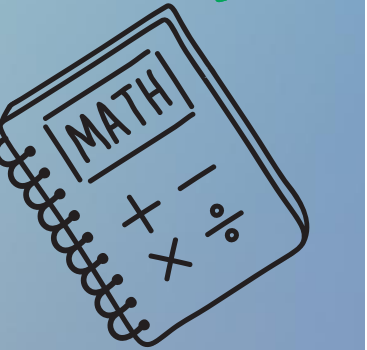
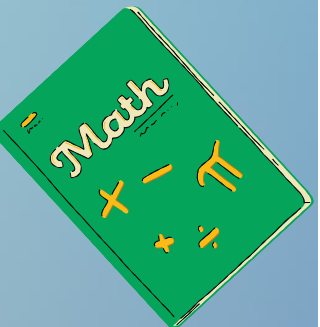
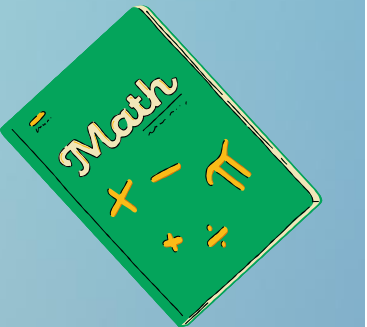
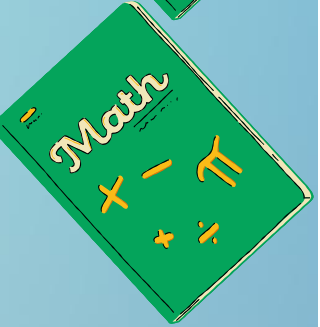
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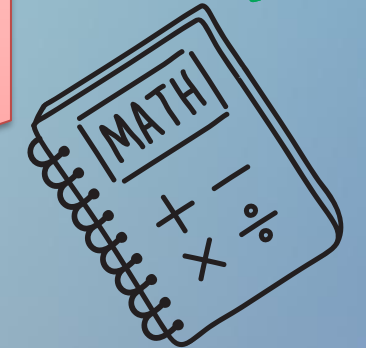
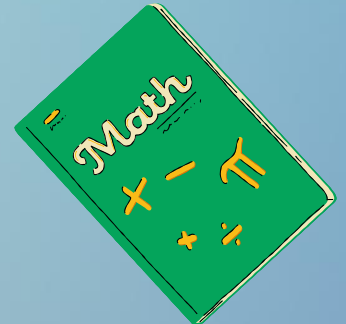
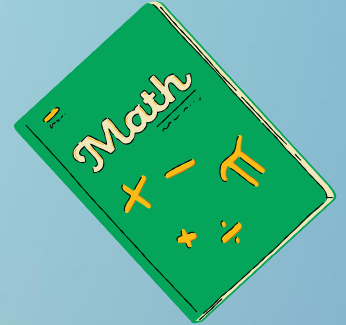
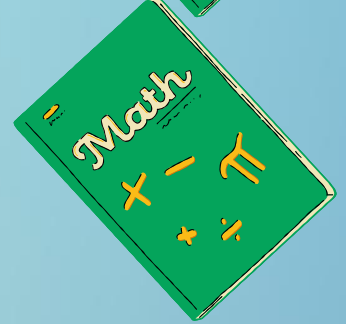
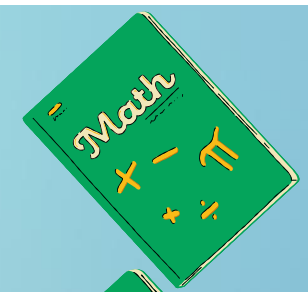
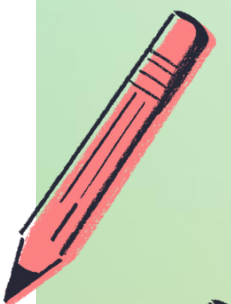


3+2



3+2

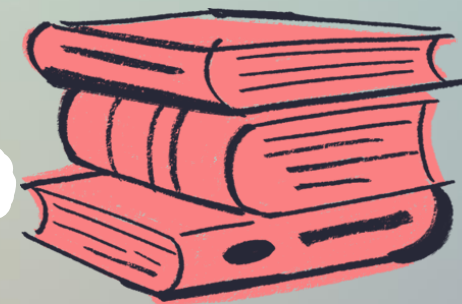




$$3+2$$



$$3+2$$



$$3+2$$

6. Factoring the Difference of Two Squares



A difference of two squares occurs when one perfect square is subtracted from another:

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

by using FOIL on the right side

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



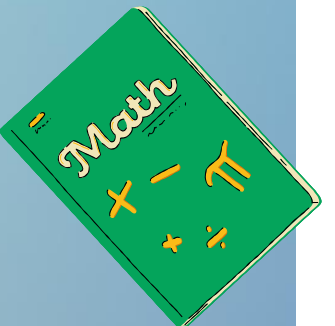
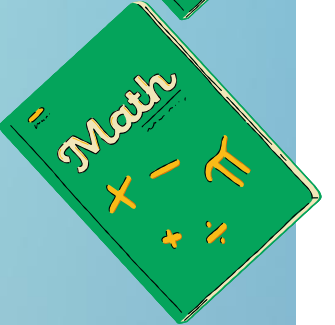
3+2



3+2



3+2





Key vocabulary: difference, perfect square, square root, conjugate factors, binomial.

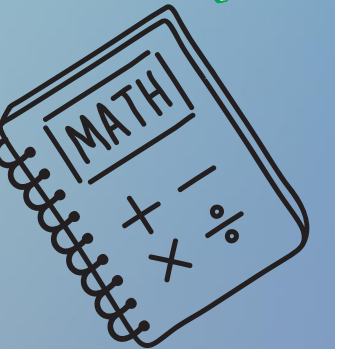
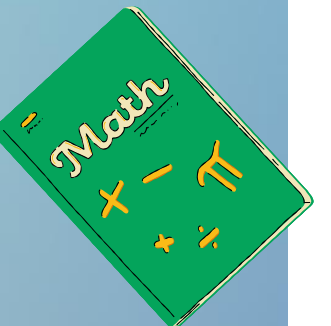
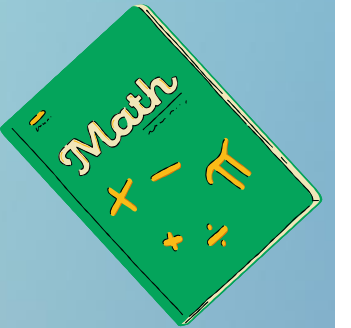
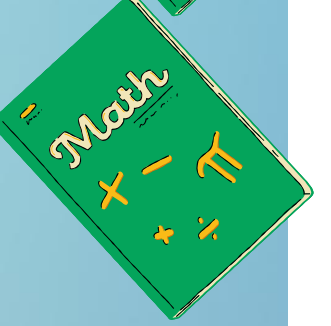
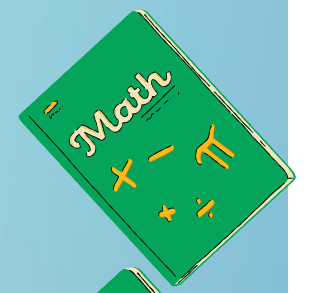
16 is a perfect square because $4 \times 4 = 16$.
The square root of 16 is 4 (Since $4 \times 4 = 16$.)

$$x^2 - 25$$

Because x^2 and $25 = 5^2$ are perfect squares:

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

This method applies only to a **difference**, not a sum.



2



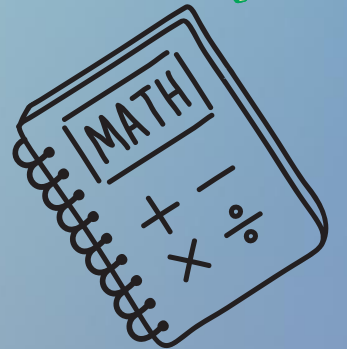
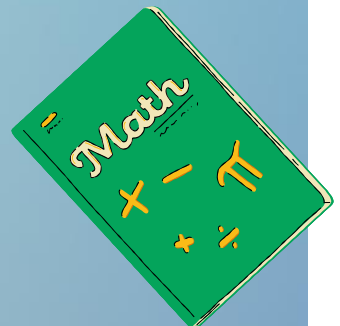
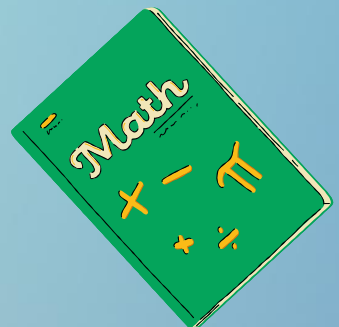
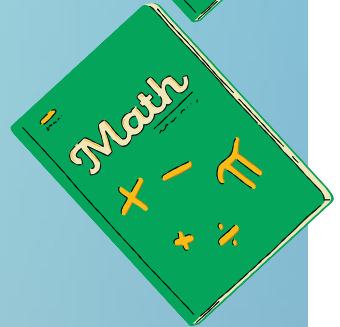
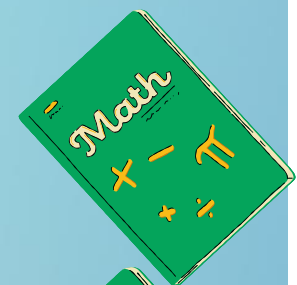
3+2



3+2



3+2



$$x^2 - 49$$

=

$$9x^2 - 16$$

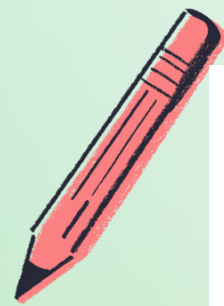
=

$$25x^2 - 64y^2$$

=

$$x^2y^2 - 1$$

=



3+2



3+2



3+2



The big three patterns to know are:

1) The Square of a Sum:

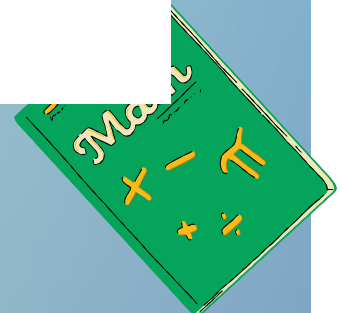
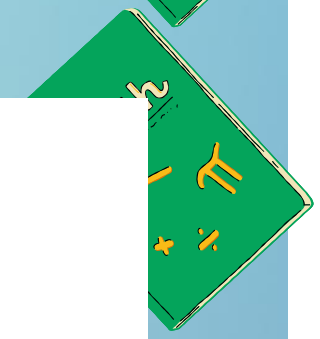
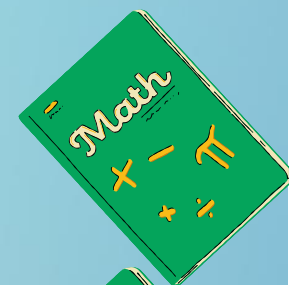
$$(a + b)^2 = a^2 + 2ab + b^2$$

2) The Square of a Difference:

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

3) The Difference of Two Squares:

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





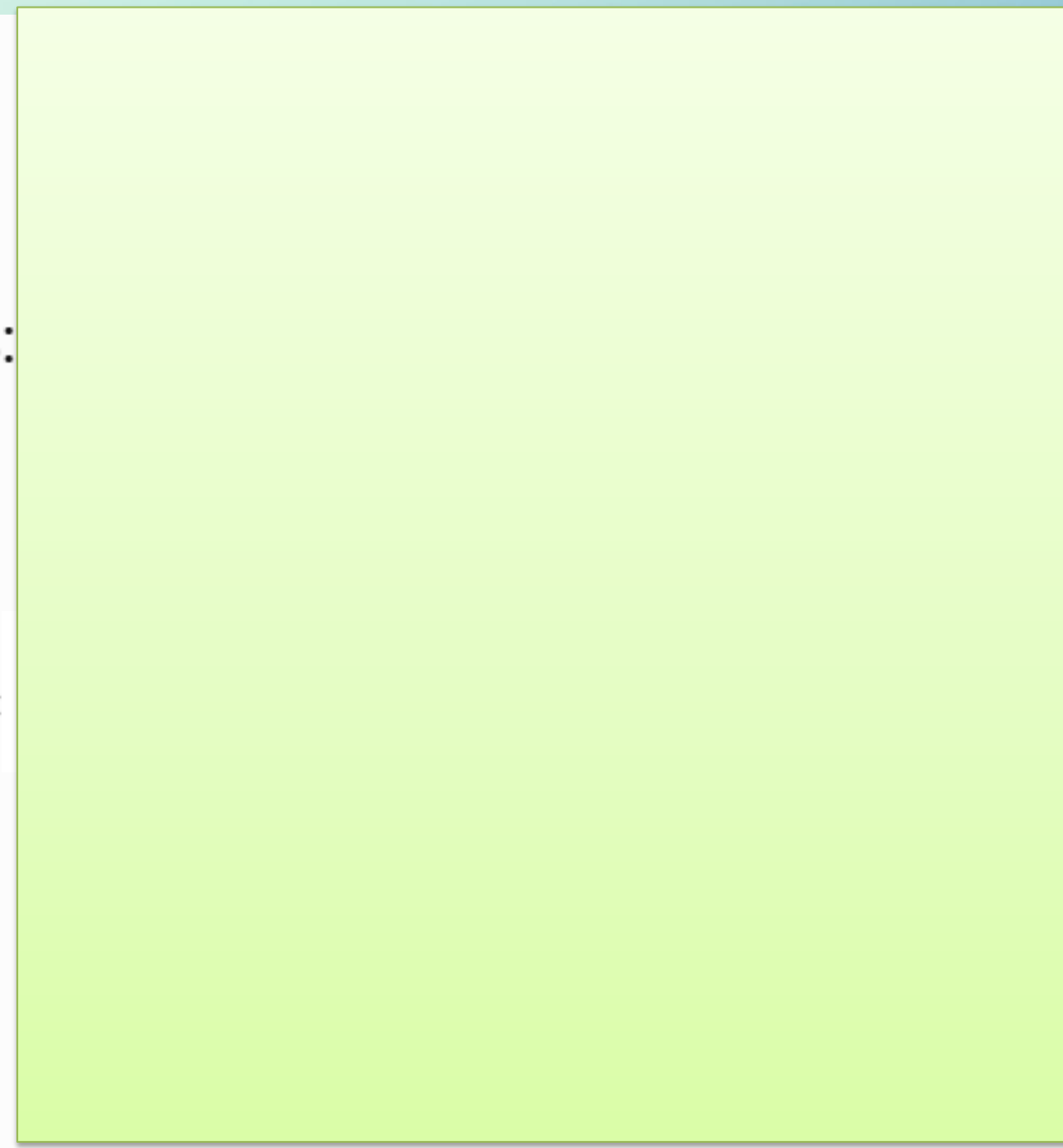
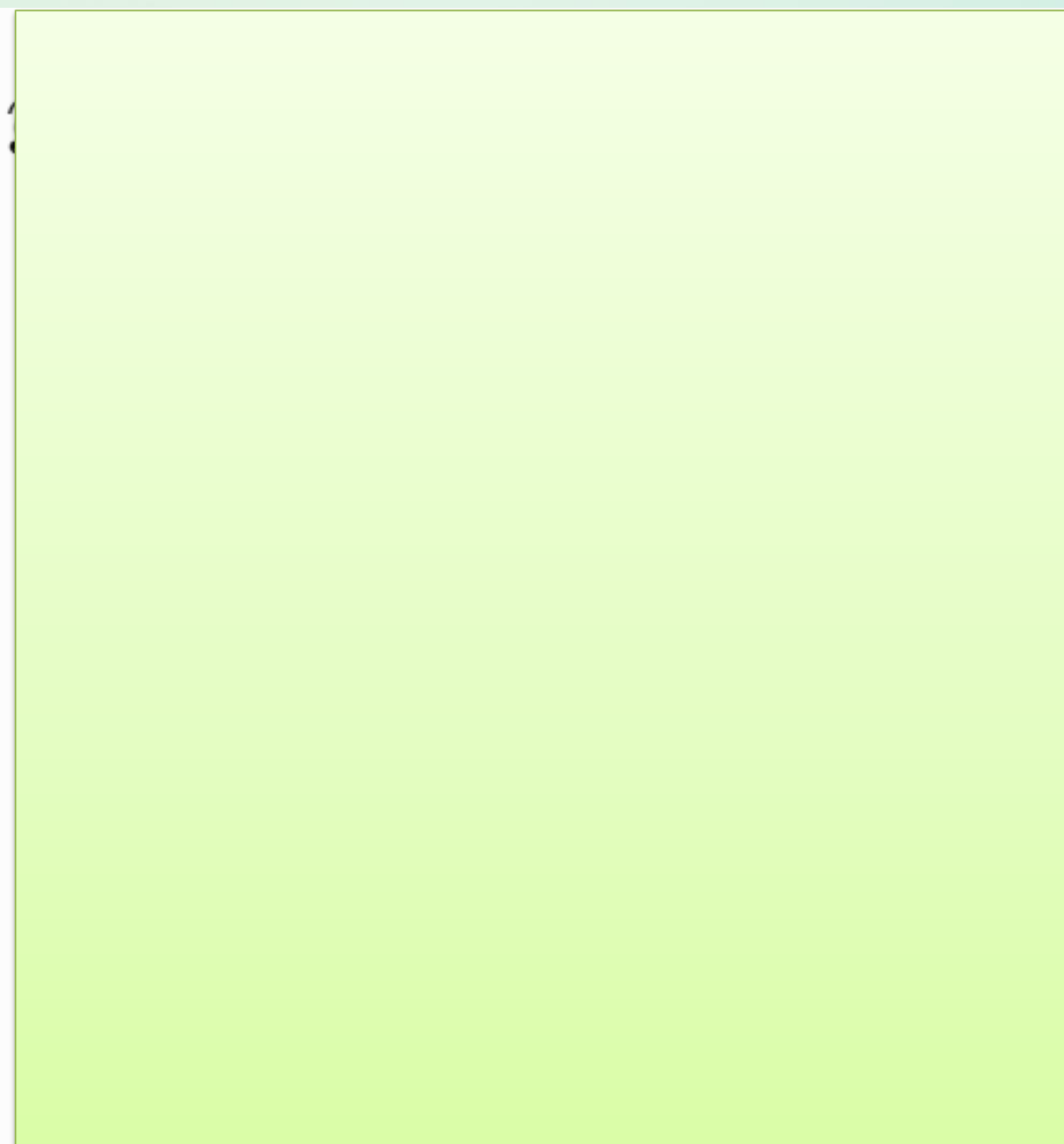
If $y = 5 + x$ and $y = 12 - X$, and if $y^2 = x^2 + K$, then K equals which of the following?

A.17

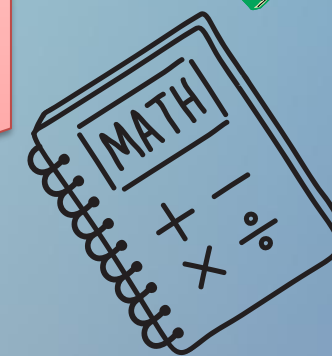
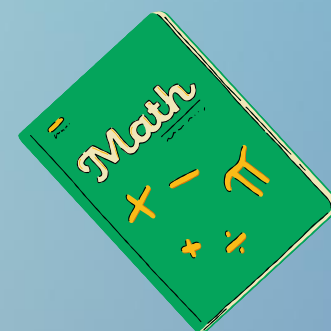
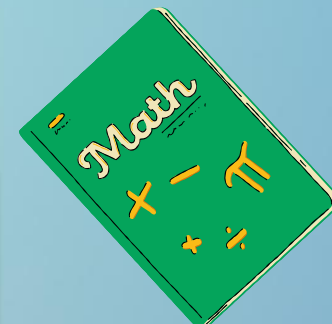
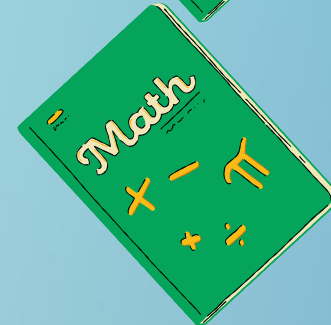
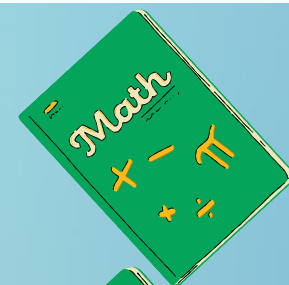
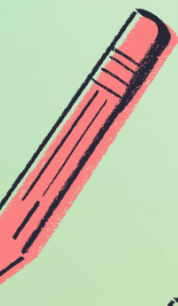
B.25

C.60

D.119



7. Factoring Quadratics



$$3+2$$



$$3+2$$



$$3+2$$





A quadratic expression usually has the standard form:

$$ax^2 + bx + c$$



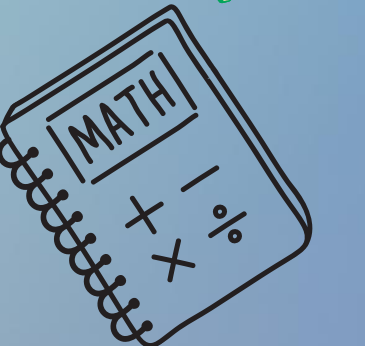
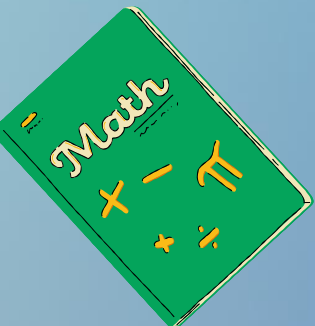
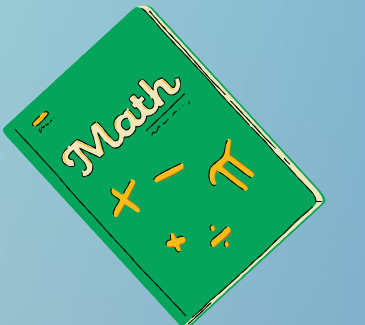
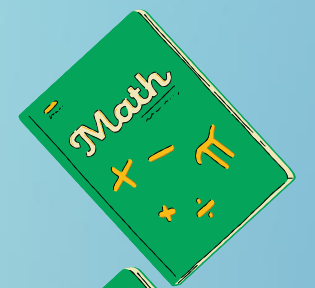
3+2



3+2



3+2





A quadratic expression usually has the standard form

$$x^2 - bx + c = (x + p)(x - q) \leftarrow$$

$$ax^2 + bx + c$$

For a simple quadratic where $a = 1$, find two numbers whose product is c and whose sum is b .



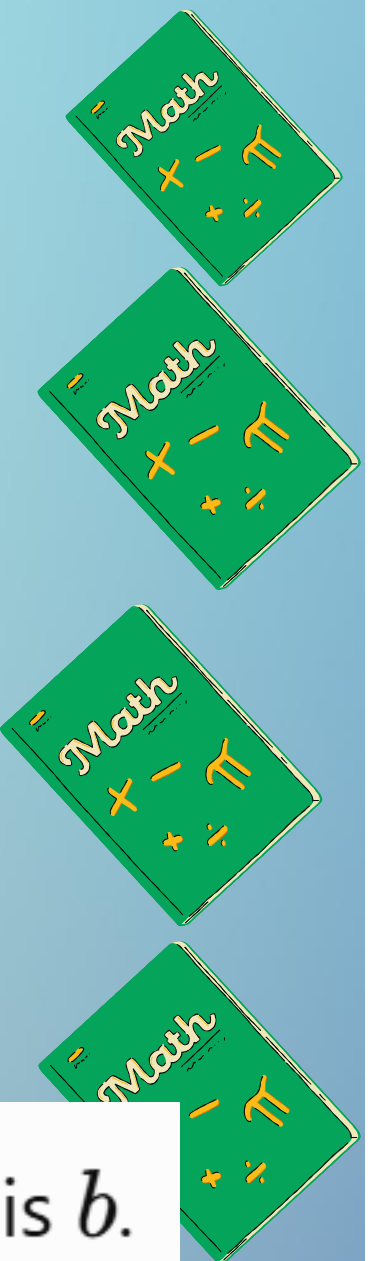
3+2



3+2



3+2





Example:

$$x^2 + 7x + 12$$

The numbers 3 and 4:

- Multiply to give 12.
- Add to give 7.

Therefore:

$$x^2 + 7x + 12 = (x + 3)(x + 4)$$



$$3 + 2$$



$$3 + 2$$



$$3 + 2$$





For $a \neq 1$, students may use **splitting the middle term** or the **AC method**.

$$2x^2 + 7x + 3$$

Since $a \times c = 2 \times 3 = 6$, find two numbers with a product of 6 and a sum of 7:

$$\begin{aligned} &2x^2 + 6x + x + 3 \\ &= 2x(x + 3) + 1(x + 3) \\ &= (2x + 1)(x + 3) \end{aligned}$$



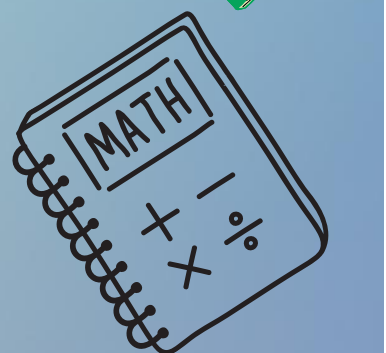
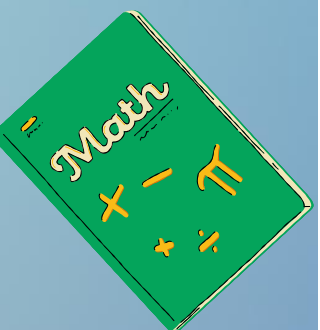
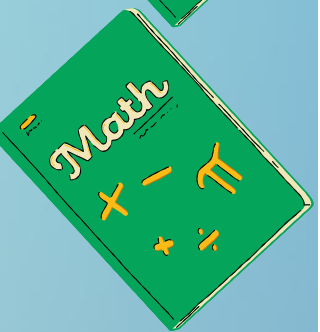
3+2

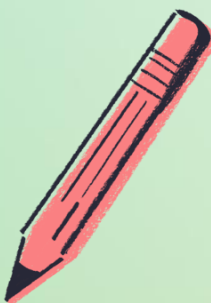


3+2



3+2





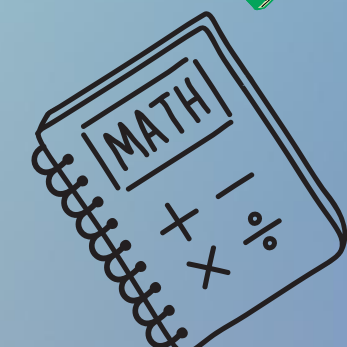
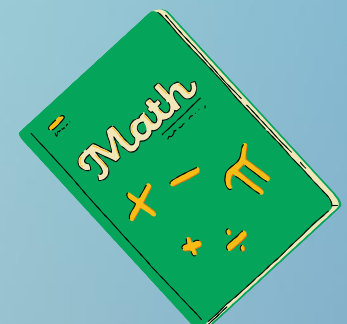
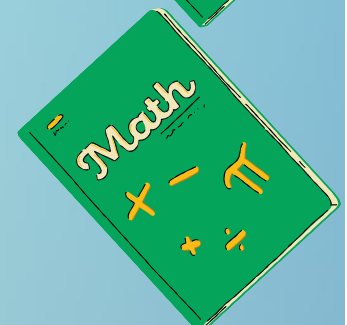
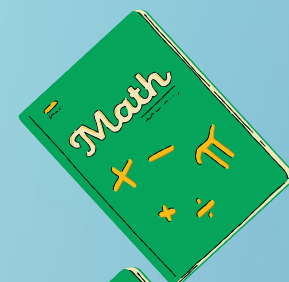
3+2



3+2



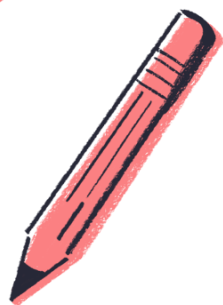
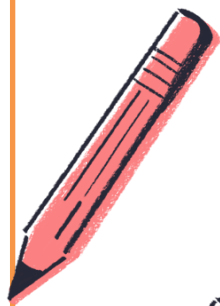
3+2



$$x^2 + 8x + 15 =$$

$$x^2 + 14x + 24 =$$

1. What are the two numbers with a product of 15 and a sum of 8?
2. What are the two numbers with a product of 24 and a sum of 14?



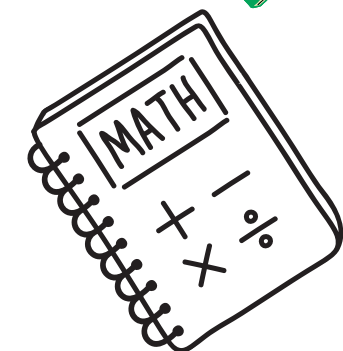
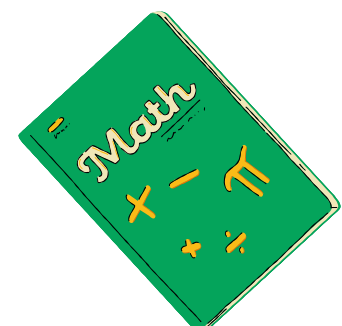
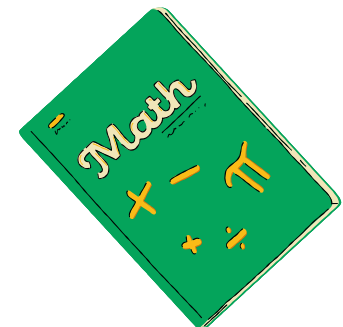
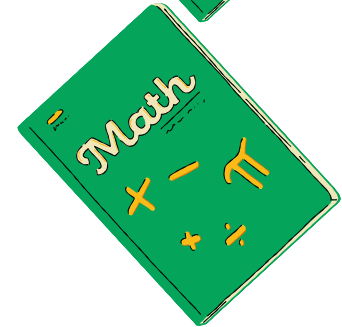
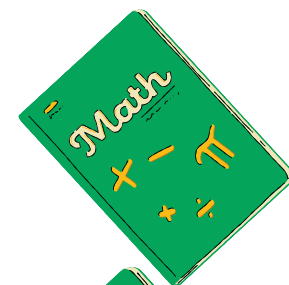
3+2



3+2



3+2



Factor:

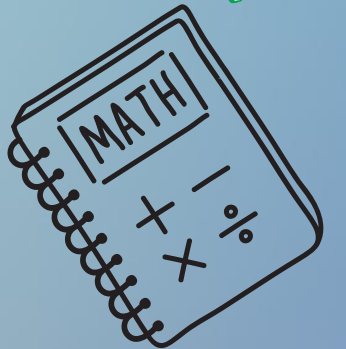
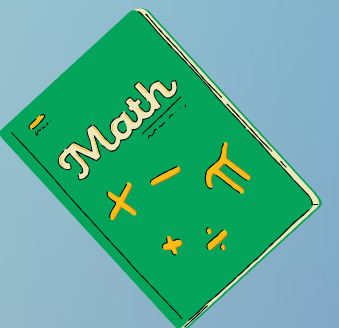
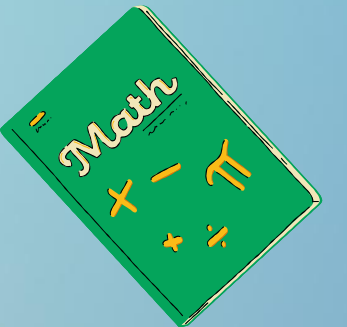
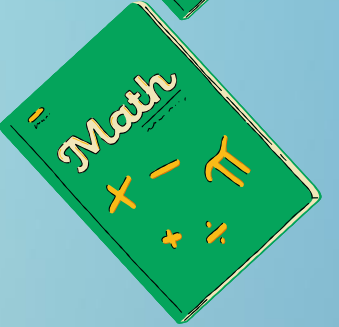
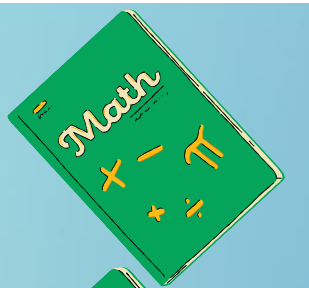
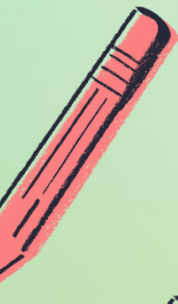
$$x^2 + 6x + 5 =$$

$$x^2 - 5x - 14 =$$

$$x^2 + 6x - 27 =$$

$$x^2 - 20x + 36 =$$

8. Combined Factoring



$$3+2$$



$$3+2$$



$$3+2$$





Some expressions require more than one factoring method. Begin by checking for a GCF, and then examine the remaining expression for another pattern.

$$3x^3 - 27x$$

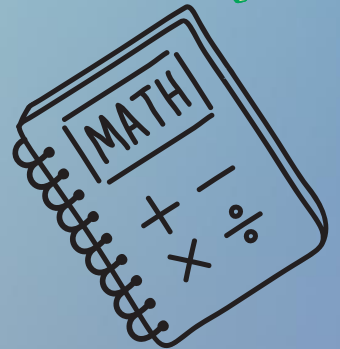
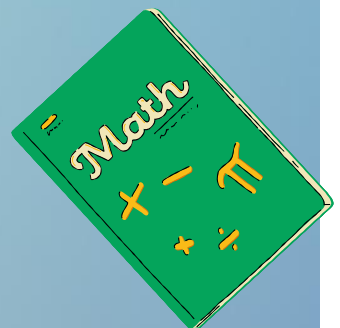
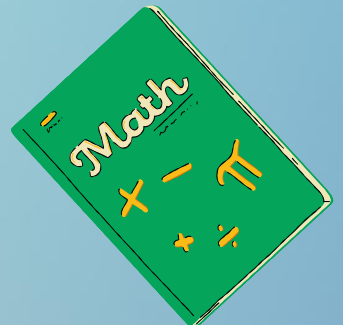
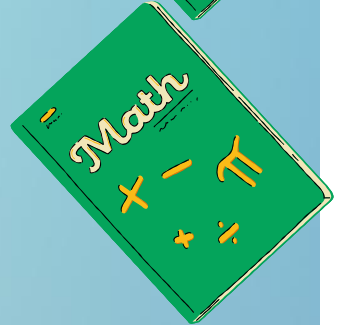
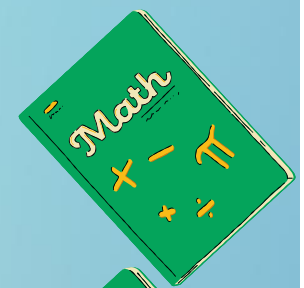
First, factor out the GCF $3x$:

$$3x(x^2 - 9)$$

Next, factor the difference of two squares:

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

Always continue factoring until every factor is completely factored.





Factor: $2x^2 - 22x + 48 = 2(x^2 - 11x + 24)$
 $= 2(x - 8)(x - 3)$

Factor: $7x^4 - 56x^3 - 63x^2 = 7x^2(x^2 - 8x - 9)$
 $= 7x^2(x - 9)(x + 1)$



Factor: $-3x^9 + 48xy^4 = 48xy^4 - 3x^9$
 $= 3x(16y^4 - x^8)$
 $= 3x(4y^2 + x^4)(4y^2 - x^4)$



3+2



3+2



3+2

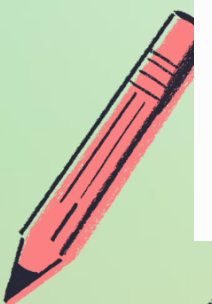


9.
Advanced Numerical Factoring


$$3+2$$


$$3+2$$


$$3+2$$



Advanced numerical factoring involves breaking larger numbers into **prime factors**. Prime factorization can help students find the GCF, least common multiple, and factors of algebraic coefficients.

Example:

Factor 180 completely:

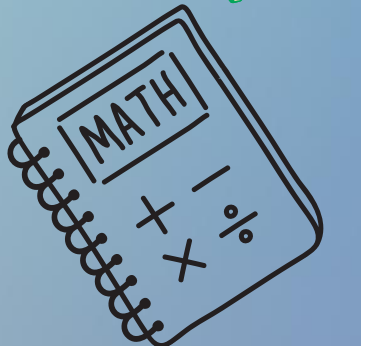
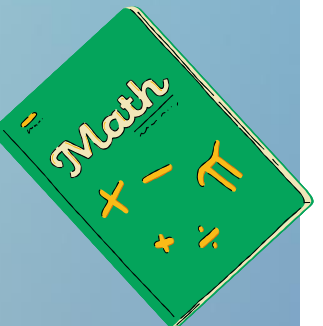
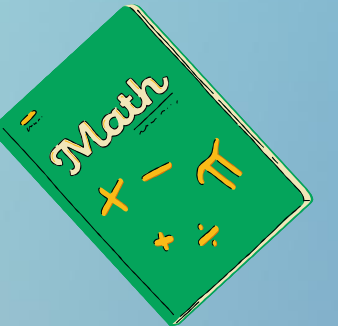
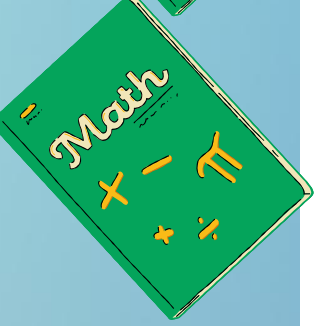
$$180 = 2 \times 90$$

$$= 2 \times 2 \times 45$$

$$= 2^2 \times 3^2 \times 5$$

Therefore, the prime factorisation is:

$$180 = 2^2 \cdot 3^2 \cdot 5$$





It can also involve factoring expressions with larger coefficients.

Example:

$$12x^2 + 11x - 5$$
$$= (3x - 1)(4x + 5)$$

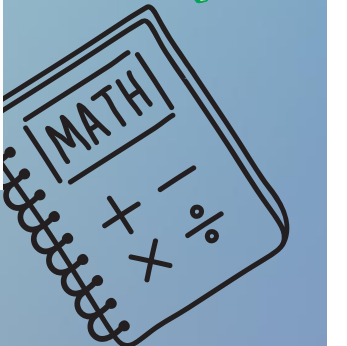
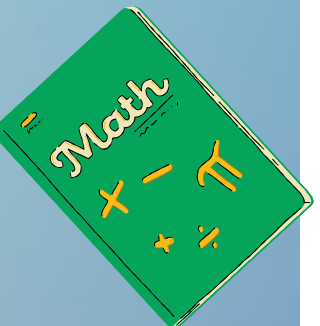
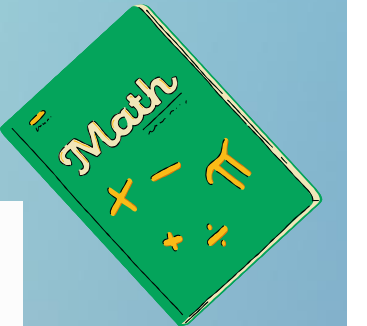
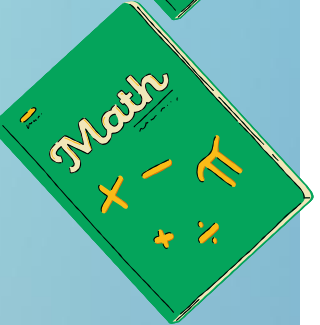
Check:

$$(3x - 1)(4x + 5) = 12x^2 + 15x - 4x - 5$$
$$= 12x^2 + 11x - 5$$



3+2

3+2



Advanced Numerical Factoring

Example 1

Find the prime factorization of 1599.

Notice that :

$$\begin{aligned} 1599 &= 1600 - 1 = (40^2) - (1^2) \\ &= (40+1)(40-1) \\ &= (41)(39) \\ &= (41)(3*13) \\ &= 41*3*13 \end{aligned}$$

Example 2

Find the prime factorization of 2491.

Notice that :

$$\begin{aligned} 2491 &= 2500 - 9 = (50^2) - (3^2) \\ &= (50 - 3)(50 + 3) \\ &= 47*53 \end{aligned}$$

10.

Factoring Rational Expressions



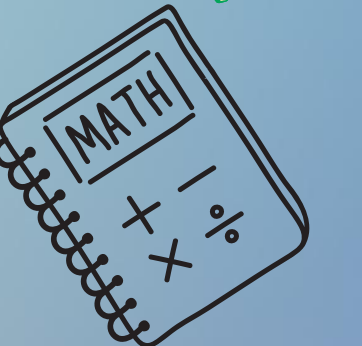
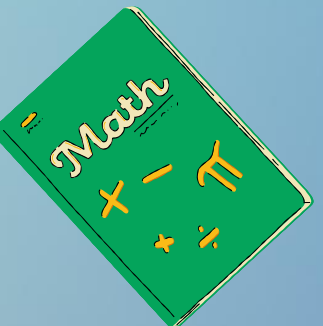
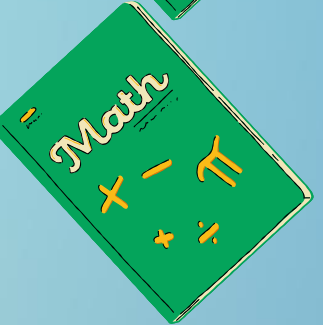
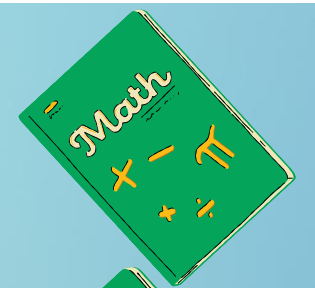
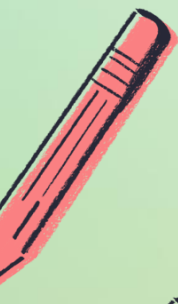
$$3+2$$

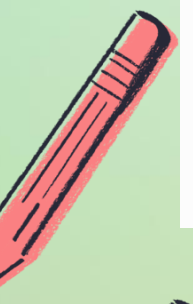


$$3+2$$



$$3+2$$





A **rational expression** is a fraction containing polynomials.
To simplify it, factor the numerator and denominator and
then cancel common factors.

Example:

$$\frac{x^2 - 9}{x^2 + 5x + 6}$$

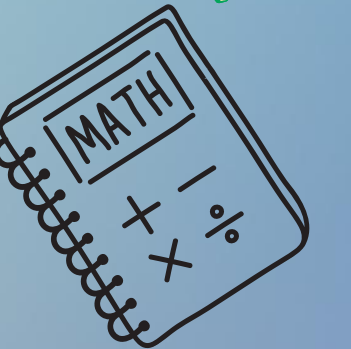
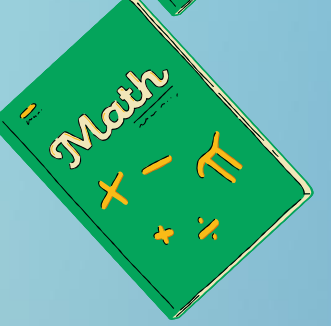
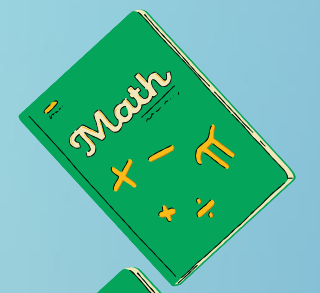
Factor both parts:

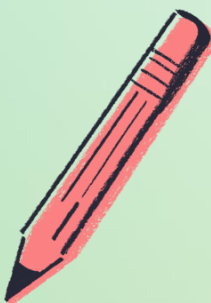
$$\frac{(x - 3)(x + 3)}{(x + 2)(x + 3)}$$

Cancel the common factor $x + 3$:

Only **common factors** can be cancelled. Individual terms separated by addition or subtraction cannot be cancelled.

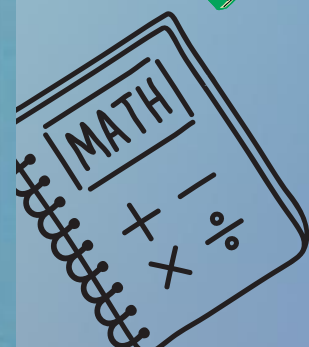
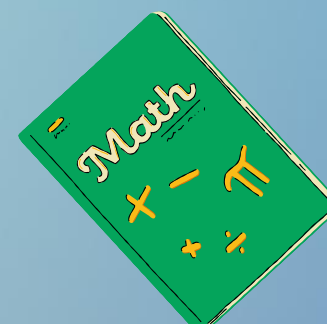
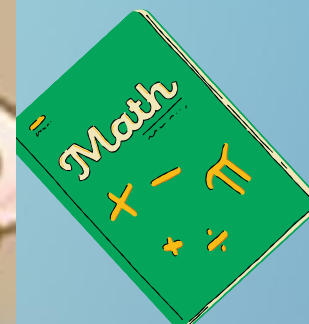
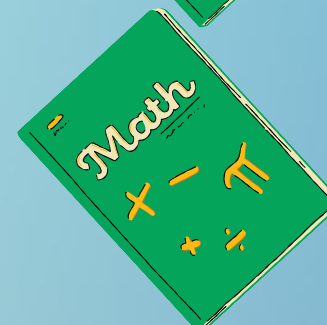
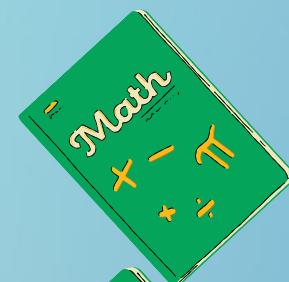
$$\frac{x - 3}{x + 2}$$





3+2

3+2



Simplify:

$$\frac{x^2 + 4x - 21}{x^2 - 6x + 9} = \frac{\cancel{(x-3)}(x+7)}{(x-3)^{\cancel{2}}} = \frac{(x+7)}{(x-3)}$$



Simplify:


$$\frac{x^2 + 4x - 21}{x^2 - 6x + 9} =$$




3+2

3+2





Factoring - Rational Expressions

Practice question

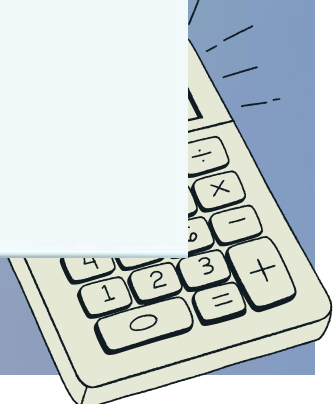


$$\frac{x^2 + 12x - 45}{x + 15} = 22, \text{ then } x = ?$$



$$\frac{4P + 3Q - 4R}{P - R} = 19, \text{ then } \frac{Q}{P - R} = ?$$

Handwritten purple arrows point from the Q in the numerator and the $P - R$ in the denominator of the second fraction to a 5 written to the right.



Factoring - Rational Expressions

Practice question

$$\frac{(x+15)(x-3)}{x+15} = 22$$

$$x - 3 = 22$$

$$x = 25$$

$$\frac{x^2 + 12x - 45}{x + 15} = 22, \text{ then } x = ?$$

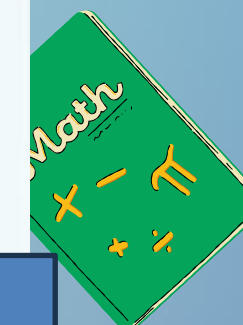
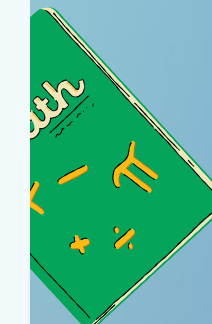
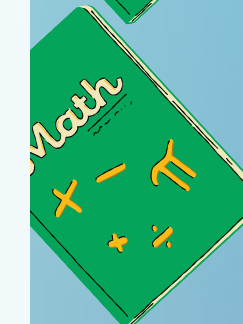
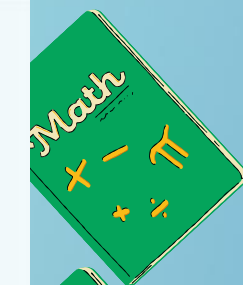


$$\frac{4P + 3Q - 4R}{P - R} = 19, \text{ then } \frac{Q}{P - R} = ?$$



$$\begin{aligned} 4p + 3Q - 4R &= 19P - 4R \\ 4p + 3Q + 19R &= 19P - 4P \\ 15R + 3Q &= 15P \\ 3Q + 15R &= 15P \end{aligned}$$

$$\begin{aligned} Q + 5R &= 5P \\ Q &= 5P - 5R \\ Q &= 5(P - R) \\ \frac{Q}{P - R} &= 5 \end{aligned}$$



Thank You