ALGEBRA

INTRODUCTION

- ALGEBRA IS BRILLIANT! (+ VERY USEFUL)
- IT IS WHERE WE USE LETTERS TO REPRESENT UNKNOWN NUMBERS
- DON'T SWITCH OFF JUST BECAUSE IT LOOKS WEIRD
- IT OBEYS ALL THE RULES OF NORMAL NUMBERS

Let's just outline some rules about \( x \) (or, actually, any letter):

1. \( x \) is a number
2. \( x \) could be any number
3. \( x \) is the same thing as \( 1x \)
4. \( x \) obeys all the usual rules of numbers
5. A number outside a bracket means:
   - Multiply everything inside the bracket by the number outside

ALGEBRA IS USED IN ALMOST EVERY AREA OF MATHS, SO MAKE SURE YOU LEARN AND PRACTISE THIS TOPIC VERY WELL.
Algebra Rules

1. $x$ is a number

2. $x$ could be any number

3. $x$ follows all the rules of every other number

4. You can only add “like” terms
   
   e.g. We can add: $3x + 2x = 5x$
   
   But we can’t add: $4a + 3b$
   
   And we can’t add: $5x^2 + 3x$

5. $5x$ means “5 multiplied by $x$”

6. $x$ is the same as $1x$

7. To Multiply Algebra: Use 3 steps

   ![Diagram](image)

8. A number outside a bracket means multiply everything inside the bracket by the number outside.

   e.g. $3(x - 4) = 3x - 12$

9. To multiply out Double Brackets, we need to multiply everything in the first bracket by everything in the second bracket. Use the arrows as shown in the diagram, or use “F.O.I.L.”

   F. means First x First
   O. means Outer x Outer
   I. means Inner x Inner
   L. means Last x Last
ALGEBRA

SUBSTITUTION

- REPLACE A LETTER WITH A NUMBER

eg if \( x = 3 \) and \( y = -2 \), calculate the value of \( 2x + 3y \)

ANS \( 2x + 3y \)

\( = 2(3) + 3(-2) \)

\( = 6 - 6 \)

\( = 0 \)

- FOLLOW BIMDAS

1. BRACKETS FIRST
2. INDICES / POWERS
3. MULTIPLICATION / DIVISION
4. ADDITION / SUBTRACTION

DON'T FORGET: IF YOU PUT IT INTO YOUR CALCULATOR CORRECTLY, YOU WILL GET THE ANSWER!

SOME CONFUSION:

- \((2)(-2)\) MEANS \(2\) MULTIPLIED BY \(-2\)

- \(3(-1)\) MEANS \(3\) MULTIPLIED BY \(-1\)

- \(3(2 + 5)\) MEANS \(3\) MULTIPLIED BY \((2+5)\)
  
  SO

  \(3\) MULTIPLIED BY \(7\)

- \((2)^3\) MEANS \(2 \times 2 \times 2 = 8\)

- \((3)+(\text{-}2)\) MEANS ADD \(-2\) TO \(3 = 1\)
Adding/Subtracting Algebra

- We can only add "like" terms.
  
  \( 3a + 2a = 5a \)

Know when to stop, realise that you can't do anything to something-like \(3a + 7b\)

"Like" terms mean the same letter with the same power

- The letter/power does not change.
  
  \( 4x^2 + 3x \)  

\( \rightarrow \) Not like terms

Multiplying Algebra

3 Steps.

- Signs (1)
- Numbers (2)
- Letters (3)

IN THAT ORDER!

\( (-2x)(3y) = 6xy\)

Note

- \( \color{red}{a \times a} = a^2 \)
- \( a^2 \times a = a^3 \)

This line is \( a^5 \)

\( a \times a = \left( \color{red}{a \times a \times a \times a \times a} \right) \times \left( \color{red}{a \times a} \right) \)

\( = a \times a \times a \times a \times a \times a \times a \times a = a \)

Beware of the signs

Same signs = +
Different signs = -

This is only when multiplying...

\( \color{red}{\text{eg}} \) \( \left( -3 - 4 \right) = -7 \)
**Brackets**

**Single Brackets** → Multiply everything inside the bracket by the number/letter outside.

**Double Brackets** → Multiply everything in the first bracket by everything in the second bracket.

* It might help to draw arrows/lines linking what needs to be multiplied.

**Example:**

\[(x + 2)(x + 3)\]

- **F** (First × First) = \(x^2\)
- **O** (Outer × Outer) = 3\(x\)
- **I** (Inner × Inner) = 2\(x\)
- **L** (Last × Last) = 6

= \(x^2 + 3x + 2x + 6\)
= \(x^2 + 5x + 6\)

* If possible, tidy up what's in the brackets first.