

# 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  $|x$

(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



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

e.g. 
$$\begin{array}{l} \text{3} \curvearrowright (x - 4) \\ = 3x - 12 \end{array}$$

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."

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

- 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

$$2x + 3y$$
$$= 2(3) + 3(-2)$$
$$= 6 - 6$$
$$= 0$$

WE REPLACE EVERY  $x$  WITH A 3  
AND EVERY  $y$  WITH A -2

PUT THEM IN BRACKETS!

- FOLLOW BIMDAS
  - ① BRACKETS FIRST THEN
  - 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

THIS NUMBER OF TIMES

•  $(2)^3$  MEANS  $2 \times 2 \times 2 = 8$

- $(3) + (-2)$  MEANS ADD -2 TO 3 = 1

# ADDING / SUBTRACTING ALGEBRA

• WE CAN ONLY ADD "LIKE" TERMS.

eg  $3x + 2x = 5x$

KNOW WHEN TO STOP,  
REALISE THAT YOU CAN'T  
DO ANYTHING TO SOMETHING  
LIKE  $3a + 7b$

MAKE SURE YOU FULLY "GET" THIS PAGE. ASK FOR HELP BEFORE PROCEEDING OTHERWISE!

"LIKE" TERMS MEANS THE SAME LETTER WITH THE SAME "POWER"

eg  $4x^2 + 3x$   
 ↙ ↘  
NOT LIKE TERMS

• THE LETTER / POWER DOES NOT CHANGE

eg  $3x + 4x$  IS NOT  $7x^2$

# MULTIPLYING ALGEBRA

3 STEPS.



eg  $(-2x)(3y) = \overset{\textcircled{1}}{-} \overset{\textcircled{2}}{6} \overset{\textcircled{3}}{xy}$

JUST BECAUSE YOU SEE A MINUS SIGN DOES NOT MEAN "TAKE-AWAY"

NOTE

$a \times a = a^2$

$a^2 \times a = a^3$

$a^5 \times a^2 = [a \times a \times a \times a \times a] \times [a \times a]$   
 THIS BIT IS  $a^5$                        $a^2$   
 $= a \times a \times a \times a \times a \times a \times a = a^7$

BEWARE OF THE SIGNS

SAME SIGNS = +  
DIFFERENT SIGNS = -

THIS IS ONLY WHEN MULTIPLYING...

eg  $[-3 - 4 = -7]$

# 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.

eg

$$5 \quad \begin{array}{c} \text{---} \text{---} \\ \text{---} \text{---} \\ \text{---} \text{---} \end{array} \quad (2x - 3)$$

OR

$$\begin{array}{c} \text{---} \text{---} \\ \text{---} \text{---} \\ \text{---} \text{---} \end{array} \quad \begin{array}{c} \text{F} \\ \text{O} \\ \text{I} \\ \text{L} \end{array} \quad \begin{array}{c} (x + 1) \\ (x - 2) \end{array}$$

eg F.O.I.L.

$$(x + 2)(x + 3)$$

$$\begin{aligned} \text{F} &= \text{FIRST} \times \text{FIRST} &= x^2 \\ \text{O} &= \text{OUTER} \times \text{OUTER} &= 3x \\ \text{I} &= \text{INNER} \times \text{INNER} &= 2x \\ \text{L} &= \text{LAST} \times \text{LAST} &= 6 \end{aligned}$$

$$= x^2 + \underline{3x + 2x} + 6$$
$$x^2 + 5x + 6$$

- IF POSSIBLE, TIDY UP WHAT'S IN THE BRACKETS FIRST.