

SUMMARY OF Y9 ALGEBRA

COMBINING TERMS

Adding (or subtracting) terms	<p>Eg : $3x - 5 - 8x = -5 - 5x$ It cannot be simplified further</p> <p>Eg : $4x - 12x^2$ cannot be simplified further</p>	<p>You can <u>add only</u> like terms : Eg $3x + 5$ cannot be simplified further.</p> <p>Addition ‘works like money’ : For $3x - 8x$, think « <i>I won 3 dollars and lost 8 dollars so, all in all, I lost 5 dollars</i> therefore $3x - 8x = -5x$ ». Note that adding x's gives x's, not x^2.</p>
Multiplying (or dividing)	Eg : $4x \times (-5x^2) = -20x^3$	<ol style="list-style-type: none"> 1. Take care of the sign: <i>A positive times a positive...etc</i> 2. Multiply the numbers 3. Multiply the pronumerals

FRACTIONS

Adding (or subtracting) fractions	<p>Eg : $\frac{3}{x} - \frac{5}{2x} = \frac{3 \times 2}{x \times 2} - \frac{5}{2x}$</p> $= \frac{6}{2x} - \frac{5}{2x} = \frac{1}{2x}$	<ol style="list-style-type: none"> 1. Do same denominator, 2. then keep denominator, and add or subtract numerators
Multiplying fractions	<p>Eg : $\frac{4x}{15y} \times \frac{3y^5}{-8x^2}$</p> $= -\frac{4 \times 3 \times x \times y^5}{3 \times 5 \times 4 \times 2 \times x^2 y} = -\frac{y^4}{10x}$	Multiply numerators together and denominators together (and then simplify)
Dividing fractions	Eg : $\frac{4x}{15y} \div \frac{2x}{3y} = \frac{4x}{15y} \times \frac{3y}{2x} = \frac{2}{5}$	Keep me, Change me, Flip me
Simplifying Fractions	<p>In $\frac{4x \times 3}{15x \times 3}$ you CAN cancel the 3's.</p> $\therefore \frac{4x \times 3}{15x \times 3} = \frac{4x}{15x} = \frac{4 \times x}{15 \times x} = \frac{4}{15}$ <p>In $\frac{4x+3}{15x+3}$ you CANNOT cancel the 3's because you have a sum, not a product.</p>	<p>Rule : $\frac{k \times a}{k \times b} = \frac{a}{b}$</p> <p>Note the <i>product</i> : It is $k \times a$, you cannot cancel if it is $k + a$.</p> <p>\therefore To simplify fractions:</p> <ol style="list-style-type: none"> 1. Factorise the numerator and the denominator. 2. If there are common factors, cancel them.

EXPANDING EXPRESSIONS

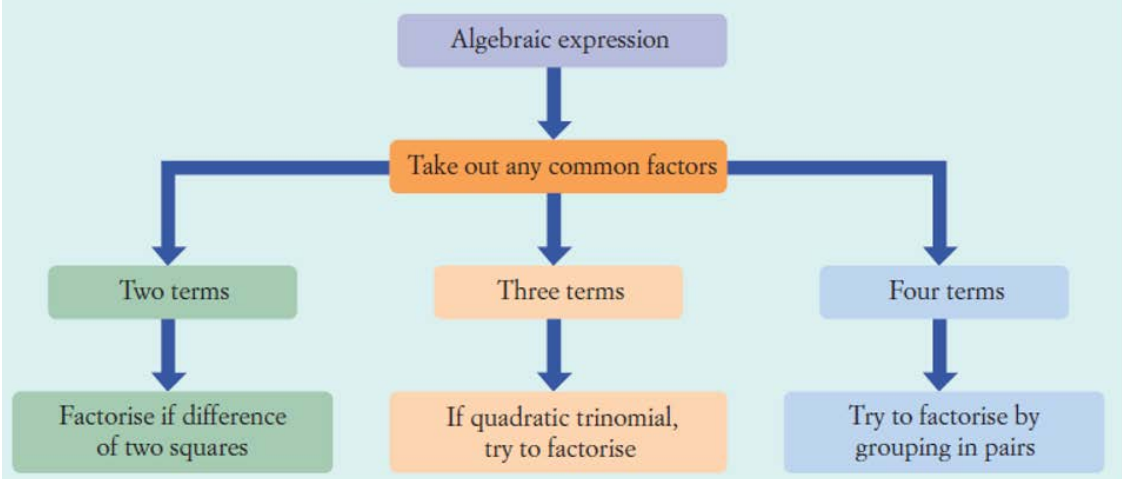
<ul style="list-style-type: none"> Distributivity Law (Rainbow) 	Eg : $4x(5 - 12x^2) = 20x - 48x^3$
<ul style="list-style-type: none"> Expanding the product of two binomials (FOIL) <i>Rainbow works but uses an intermediate step</i> 	Eg : Expand $(7x - 5)(2 - 3x)$ $= 14x - 21x^2 - 10 + 15x$ $= -21x^2 + 29x - 10$
<ul style="list-style-type: none"> Particular case of FOIL : Difference of Squares $(A + B)(A - B) = A^2 - B^2$ 	Eg : $(3x - 5)(3x + 5) = 9x^2 - 25$ (use formula with $A = 3x$ and $B = 5$)
<ul style="list-style-type: none"> Particular case of FOIL : Perfect Squares Square of a sum : $(A + B)^2 = A^2 + 2AB + B^2$ Square of a difference : $(A - B)^2 = A^2 - 2AB + B^2$	Eg : Expand $(x + 3)^2 = x^2 + 6x + 9$ (use <i>Square of a sum</i> formula with $A = x$ and $B = 3$) $(3x - 7)^2 = 9x^2 - 42x + 49$ (use <i>Square of a difference</i> formula with $A = 3x$ and $B = 7$)

FACTORISING EXPRESSIONS

Summary

Factorisation strategies

- Look for any common factors and factorise first
- If there are two terms, try factorising using the difference of two squares
- If there are three terms, try factorising as a quadratic trinomial
- If there are four terms, try factorising by grouping in pairs



How do we do this?

<ul style="list-style-type: none"> • Common factor 	Eg : $20x - 12x^2 = 5 \times 4x - 3x \times 4x = 4x(5 - 3x)$
<ul style="list-style-type: none"> • Grouping in pairs 	Eg : Factorize $7x - 21 + x^2 - 3x$ $= 7(x - 3) + x(x - 3) = (7 + x)(x - 3)$
<ul style="list-style-type: none"> • PSF (Product, Sum Factors) for expressions of the form $ax^2 + bx + c$ 	<p><i>Rewrite the coefficient of x as a sum of two numbers. How to find these numbers?</i></p> <ul style="list-style-type: none"> • Their Product = P = Coefficient of $x^2 \times$ <i>constant term</i> (i. e. the one with no x) • Their Sum =S = Coefficient of x <p>Eg : Factorize $2x^2 + 7x - 15$ <i>Product</i> = $2 \times -15 = -30$ <i>Sum</i> = 7 <i>Factors (must guess) : -10 and 3</i></p> $2x^2 + 7x - 15 = 2x^2 - 10x + 3x - 15$ $= 2x(x - 5) + 3(x - 5)$ $= (2x + 3)(x - 5)$
<ul style="list-style-type: none"> • Difference of squares $A^2 - B^2 = (A + B)(A - B)$	Eg : $x^2 - 16 = (x + 4)(x - 4)$ Eg : $49x^2 - 25y^2 = (7x + 5y)(7x - 5y)$