SURDS

A surd is an Irrational number, a number which cannot be expressed as a fraction

SIMPLIFYING

We treat surds a bit like algebra, here are a few rules

① Adding treat the root as you would x

$\sqrt{3} + \sqrt{3} \Rightarrow 2\sqrt{3}$ $\quad 3\sqrt{5} + 5\sqrt{5} = 8\sqrt{5}$

② Multiplying when x two surds they can x inside the $\sqrt{}$

$\sqrt{3} \times \sqrt{3} \Rightarrow \sqrt{3\times3} \Rightarrow \sqrt{9} = 3$

$\sqrt{5} \times \sqrt{5} = 5$

$\sqrt{2} \times \sqrt{3} = \sqrt{2\times3} = \sqrt{6}$

$3\sqrt{5} \times \sqrt{2} = 3\sqrt{5\times2} = 3\sqrt{10}$

③ Simplifying a larger Surd look for a factor of the surd that is a square number

$\sqrt{18} \Rightarrow \sqrt{9\times2} \Rightarrow \sqrt{9} \times \sqrt{2} = 3\sqrt{2}$ (9 as a □ number)

$\sqrt{50} \Rightarrow \sqrt{25\times2} \Rightarrow \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$

④ Brackets multiply out as you would do with algebra brackets

$(1+\sqrt{2})^2 \Rightarrow (1+\sqrt{2})(1+\sqrt{2}) = 1 + \sqrt{2} + \sqrt{2} + 2 = 3 + 2\sqrt{2}$

$(2+3\sqrt{2})^2 \Rightarrow (2+3\sqrt{2})(2+3\sqrt{2}) = 4 + 6\sqrt{2} + 6\sqrt{2} + (9\times2) = 22 + 12\sqrt{2}$

⑤ Rationalising the Denominator ie, getting rid of the surd as the denominator

$\frac{1}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \Rightarrow \frac{\sqrt{5}}{5}$ (times top & bottom by $\sqrt{5}$)

$\frac{6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} \Rightarrow \frac{6\sqrt{3}}{3} \Rightarrow 2\sqrt{3}$

$\frac{1}{1+\sqrt{2}} \times \frac{1-\sqrt{2}}{1-\sqrt{2}} = \frac{1-\sqrt{2}}{(1+\sqrt{2})(1-\sqrt{2})} = \frac{1-\sqrt{2}}{1-\sqrt{2}+\sqrt{2}-2} = \frac{1-\sqrt{2}}{-1} = -1+\sqrt{2}$

Remember difference of squares!

x top & bottom by $1-\sqrt{2}$ to eliminate the surd