15 - Counting, accuracy, powers and surds

Reciprocals

- We just flip the fraction to get the reciprocal

$5 = \frac{5}{1}$ $\frac{5}{1} \longrightarrow \frac{1}{5}$

- If we need the negative reciprocal, switch the sign and flip the fraction

$-\frac{1}{2} \longrightarrow \frac{2}{1}$ $\frac{2}{6} \longrightarrow -\frac{6}{2}$

Surds

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$
$C\sqrt{a} \times D\sqrt{b} = CD\sqrt{ab}$
$\sqrt{a} \div \sqrt{b} = \sqrt{a/b}$
$C\sqrt{a} \div D\sqrt{b} = C/D\sqrt{a/b}$
$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{a/b}$

- When adding, treat it like algebra, you can only add together the same surd, so change the √'s to <u>like terms.</u>
- Do this by leaving the <u>same irrational</u> number.

Simplifying Surds

e.g. $\sqrt{12}$

1. Find 2 numbers that are factors, one must be a **square** number
   $4 \times 3 = 12$
2. Simplify ⟶ Root of square number goes outside, other number goes inside
   $2\sqrt{3}$
   ↗ ↖

Root of 4 Other factor

You want the **biggest** possible root as a in — $a\sqrt{b}$

Expanding surds

- Square a — ^2a
- Mulitply $a^2 \times b$
- $\sqrt{a^2} \times \sqrt{b} = \sqrt{a^2b}$

Simplifying Surd x Surd

1. Times outside numbers together
2. Times irrational numbers together
3. Simplify further, want biggest possible number outside. Recognise <u>square factors</u>, root then multiply them to the outside number.

$C\sqrt{a} \times D\sqrt{b} = CD\sqrt{ab} = 2\sqrt{45} \times 3\sqrt{2}$
$2x6\sqrt{45x2} = 6\sqrt{90}$
$6\sqrt{9x\sqrt{10}}$
$6 \times 3 \times \sqrt{10} = 18\sqrt{10}$

Rationalising

Getting rid of surd from the denominator

For normal rationalising, just multiply the surd by itself:

- $\frac{5}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{3}$

For rationalising when there is more than just the surd as the denominator, multiply by the opposite ±:

- $\frac{b}{2+\sqrt{a}} \times \frac{2-\sqrt{a}}{2-\sqrt{a}} = \frac{b(2-\sqrt{a})}{(2+\sqrt{a})(2-\sqrt{a})} = \frac{2b-b\sqrt{a}}{4-a}$

Limits of accuracy

Degree of rounding
e.g.
1100 = 2 s.f.
Find the values that would round to 1100 for 2sf
$1050 \leq 1100 < 1150$

Max speed = greatest distance/shortest time
Population density = total population/total area

Choices and outcomes

Permutation	Combination
Order/position does matter	Order does not matter
With repetition = nR	With repetition = nR
Without repetition = nPr	Without repetition = nCr