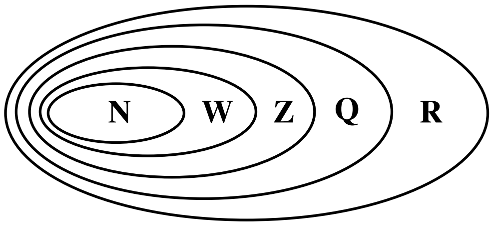
CHAPTER 3: SURDS

NUMBER SETS:

Natural numbers N = {1, 2, 3...}
Whole numbers W = {0, 1, 2, 3...}
Integers Z = {... -3, -2, -1, 0, 1, 2, 3...}



Rational numbers, Q , can be written as a division of two integers.
Irrational numbers **cannot** be written as a division of two integers.

Real numbers, R , are all rational and irrational numbers.

SURDS ARE IRRATIONAL ROOTS.

For example, $\sqrt{2}$, $\sqrt{\frac{5}{9}}$, $\sqrt[3]{16}$ are surds.

whereas $\sqrt{25}$, $\sqrt{\frac{4}{9}}$, $\sqrt[3]{-8}$ are **not** surds as they are 5 , $\frac{2}{3}$ and -2 respectively.

SIMPLIFYING ROOTS:

RULES: $\sqrt{mn} = \sqrt{m} \times \sqrt{n}$ $\sqrt{\frac{m}{n}} = \frac{\sqrt{m}}{\sqrt{n}}$

(1) Simplify $\sqrt{24} \times \sqrt{3}$

$\sqrt{24} \times \sqrt{3}$
$= \sqrt{72}$

$= \sqrt{36} \times \sqrt{2}$ 36 *is the largest square number which is a factor of* 72

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

(2) Simplify $\sqrt{72} + \sqrt{48} - \sqrt{50}$

$\sqrt{72} + \sqrt{48} - \sqrt{50}$
$= \sqrt{36} \times \sqrt{2} + \sqrt{16} \times \sqrt{3} - \sqrt{25} \times \sqrt{2}$
$= 6\sqrt{2} + 4\sqrt{3} - 5\sqrt{2}$
$= 6\sqrt{2} - 5\sqrt{2} + 4\sqrt{3}$
$= \sqrt{2} + 4\sqrt{3}$

(3) Remove the brackets and fully simplify:

(a) $\left(\sqrt{3}-\sqrt{2}\right)^2$

$= \left(\sqrt{3}-\sqrt{2}\right)\left(\sqrt{3}-\sqrt{2}\right)$

$= \sqrt{3}\left(\sqrt{3}-\sqrt{2}\right) - \sqrt{2}\left(\sqrt{3}-\sqrt{2}\right)$

$= \sqrt{9}-\sqrt{6} - \sqrt{6}+\sqrt{4}$

$= 3-\sqrt{6} - \sqrt{6}+2$

$= 5-2\sqrt{6}$

(b) $\left(3\sqrt{2}+2\right)\left(3\sqrt{2}-2\right)$

$= \left(3\sqrt{2}+2\right)\left(3\sqrt{2}-2\right)$

$= 3\sqrt{2}\left(3\sqrt{2}-2\right) + 2\left(3\sqrt{2}-2\right)$

$= 9\sqrt{4}-6\sqrt{2} + 6\sqrt{2} - 4$

$= 18-6\sqrt{2} + 6\sqrt{2} - 4$

$= 14$

RATIONALISING DENOMINATORS:

Removing surds from the denominator.

Express with a rational denominator:

(1) $\dfrac{4}{\sqrt{6}}$

$\dfrac{4}{\sqrt{6}}$

$= \dfrac{4 \times \sqrt{6}}{\sqrt{6} \times \sqrt{6}}$ *multiply the 'top' and 'bottom' by the surd on the denominator*

$= \dfrac{4\sqrt{6}}{6}$

$= \dfrac{2\sqrt{6}}{3}$

(2) $\dfrac{\sqrt{3}}{3\sqrt{2}}$

$\dfrac{\sqrt{3}}{3\sqrt{2}}$

$= \dfrac{\sqrt{3} \times \sqrt{2}}{3\sqrt{2} \times \sqrt{2}}$

$= \dfrac{\sqrt{6}}{3 \times \sqrt{4}}$

$= \dfrac{\sqrt{6}}{6}$