SURDS

Learn these rules of surds

1. $\sqrt{a}\times\sqrt{b}=\sqrt{ab}$

2. $\dfrac{\sqrt{a}}{\sqrt{b}}=\sqrt{\dfrac{a}{b}}$

3. $m\sqrt{a}+n\sqrt{a}=(m+n)\sqrt{a}$

Examples for discussion

1. Write $\sqrt{63}$ as the simplest possible surd.

2. Simplify $\sqrt{50}+\sqrt{2}-2\sqrt{18}+\sqrt{8}$

3. Simplify $(3+\sqrt{2})(3-\sqrt{2})$

Rationalising a surd

Sometimes surds can appear as denominators in a fraction and are best avoided. The process of clearing surds is called **rationalisation**.

Examples

Rationalise the denominators of (a) $\dfrac{1}{\sqrt{2}}$ (b) $\dfrac{9}{\sqrt{3}}$ (c) $\dfrac{1}{2+\sqrt{2}}$

(a) $\dfrac{1}{\sqrt{2}}=\dfrac{\sqrt{2}}{2}$ (multiply top and bottom by $\sqrt{2}$)

(b) $\dfrac{9}{\sqrt{3}}=\dfrac{9\sqrt{3}}{3}=3\sqrt{3}$

(c) $\dfrac{1}{2+\sqrt{2}}=\dfrac{1(2-\sqrt{2})}{(2+\sqrt{2})(2-\sqrt{2})}=\dfrac{2-\sqrt{2}}{4-2}=\dfrac{2-\sqrt{2}}{2}=1-\dfrac{1}{2}\sqrt{2}$

Questions to work through

1. Express these in the form A + B$\sqrt{C}$ where A, B and C are rational.

(i) $\left(\sqrt{3}-1\right)^2$ (ii) $\sqrt{\frac{1}{2}}+\sqrt{\frac{1}{4}}+\sqrt{\frac{1}{8}}$

2. Rationalise the denominator of the following fraction :

$$\frac{\sqrt{6}+\sqrt{3}}{\sqrt{6}-\sqrt{3}}$$

3. A rectangle has sides of length $2\sqrt{3}$ cm and $3\sqrt{3}$ cm.

Find in surd form,

(i) The perimeter

(ii) The area

(iii) The diagonal length.

4. Find the height of an equilateral triangle of side $4\sqrt{2}$ cm, in surd form.

5. Solve the equation, giving x in the form A + B$\sqrt{C}$

(i) $\left(\sqrt{2}-1\right)x=4$ (ii) $\sqrt{3}x=x+\sqrt{3}$

REMEMBER THAT ALL SURDS QUESTIONS SHOULD BE TACKLED WITHOUT THE USE OF A CALCULATOR.

INDICES

Learn these rules of indices

1. $a^m \times a^n = a^{m+n}$

2. $a^m \div a^n = a^{m-n}$

3. $(a^m)^n = a^{mn}$

4. $a^{\frac{1}{2}} = \sqrt{a}$ and $a^{\frac{1}{n}} = \sqrt[n]{a}$ and $a^{\frac{m}{n}} = (\sqrt[n]{a})^m$

5. $a^0 = 1$

6. $a^{-n} = \frac{1}{a^n}$

Examples to discuss

(i) Evaluate the following:

(a) $64^{\frac{1}{2}}$ (b) 2^{-3} (c) $27^{-\frac{2}{3}}$ (d) $\left(\frac{1}{8}\right)^{-\frac{2}{3}}$

.....

.....

.....

(ii) Simply the following:

(a) $(2x^3)^2$ (b) $\left(\sqrt{x}\right)^{\frac{2}{3}}$ (c) $\frac{6x^2y^{-3}}{2x^5y^4}$

.....

.....

.....

EQUATIONS WITH INDICES

Many equations in maths will contain indices of a rational type. It is important that you can manipulate the algebra by employing the rules of indices where necessary.

Examples for discussion

Solve these equations involving indices :

(a) $x^{\frac{1}{2}} = 6$

.....

(b) $2x^3 = -54$

.....

(c) $2^{2x-6} = 16^x$ Tip : Equate powers

.....

.....

(d) $x^{\frac{3}{4}} = 8$

.....

.....