

Surds Basic

Rational numbers: $\frac{p}{q}, q \neq 0$ e.g. $\frac{1}{2}, \frac{5}{7}, \frac{3}{4}$

irrational numbers: $\sqrt{2}, \sqrt{3}, \pi, e$

$$\pi = 3.14159 \dots$$

$$e = 2.71828 \dots$$

Surds: special type of irrational number

but it can be simplified to

a rational number.

" $\sqrt{\quad}$ " $\sqrt{3}, \sqrt{5}, \sqrt{6}, \sqrt{7}, \sqrt{8}$

$$\sqrt{4} = \sqrt{2 \times 2} = \sqrt{2^2} = 2$$

$$\sqrt{9} = \sqrt{3^2} = 3$$

$$\begin{array}{l} 2 = 4 \\ 3 = 9 \\ 4 = 16 \\ 5 = 25 \\ \vdots \end{array}$$

$$\begin{array}{l} \sqrt{4} \rightarrow \text{Rational} \\ \sqrt{9} \rightarrow \text{Rational} \\ \sqrt{16} \rightarrow \text{Rational} \\ \sqrt{25} \rightarrow \text{Rational} \end{array}$$

$$\begin{array}{l} \sqrt{2}, \sqrt{3}, \sqrt{5} \\ \sqrt{6}, \sqrt{7}, \sqrt{8} \\ \dots \end{array}$$

Q.1 simplify $2\sqrt{3} + 3\sqrt{3}$

$$\begin{aligned} \text{sol} \quad & \sqrt{3}(2+3) = \sqrt{3}(5) \\ & = 5\sqrt{3} \end{aligned}$$

Q.2: $(2\sqrt{5})^2$

$$\begin{aligned} \text{sol} \quad & 2\sqrt{5} \times 2\sqrt{5} \\ & = (2 \times 2)(\sqrt{5} \times \sqrt{5}) \\ & = 4\sqrt{25} \\ & = 4\sqrt{5^2} \\ & = 4(5) \Rightarrow 20 \end{aligned}$$

Q.3 $8\sqrt{3} \times 4\sqrt{3}$

$$\begin{aligned} \text{sol} \quad & (8 \times 4)(\sqrt{3} \times \sqrt{3}) \\ & = 32(\sqrt{3 \times 3}) \\ & = 32\sqrt{9} \\ & = 32\sqrt{3^2} \\ & = 32 \times 3 \\ & = 96 \end{aligned}$$

$$\begin{array}{r} 32 \\ \times 3 \\ \hline 96 \end{array}$$

Q.4 $4\sqrt{7} \div \sqrt{7}$

$$\begin{aligned} \text{sol} \quad & \frac{4\sqrt{7}}{\sqrt{7}} \\ & = \frac{4}{1} = 4 \end{aligned}$$

Q.5 $4\sqrt{63} - \sqrt{28} + 3\sqrt{112} \rightarrow ①$

$$\begin{aligned} \text{sol} \quad 4\sqrt{63} &= 4\sqrt{3 \times 3 \times 7} \\ &= 4\sqrt{3^2 \times 7} \\ &= 4(\sqrt{3^2} \times \sqrt{7}) \\ &= 4(3\sqrt{7}) \\ &= 12\sqrt{7} \end{aligned}$$

$$\begin{array}{r} 3 \overline{) 63} \\ 3 \overline{) 21} \\ 7 \overline{) 7} \\ \hline 1 \end{array} = 3 \times 3 \times 7$$

$$\begin{aligned} \sqrt{28} &= \sqrt{2 \times 2 \times 7} = \sqrt{2^2} \times \sqrt{7} \\ &= 2 \times \sqrt{7} \Rightarrow 2\sqrt{7} \end{aligned}$$

$$\begin{array}{r} 2 \overline{) 28} \\ 2 \overline{) 14} \\ 7 \overline{) 7} \\ \hline 1 \end{array}$$

$$\sqrt{28} = 2\sqrt{7}$$

$$\begin{aligned} 3\sqrt{112} &= 3\sqrt{2 \times 2 \times 2 \times 2 \times 7} \\ &= 3\sqrt{2^2 \times 2^2 \times 7} \\ &= 3(\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{7}) \\ &= 3(2 \times 2 \times \sqrt{7}) \\ &= 3(4\sqrt{7}) \\ &= 12\sqrt{7} \end{aligned}$$

$$\begin{array}{r} 2 \overline{) 112} \\ 2 \overline{) 56} \\ 2 \overline{) 28} \\ 2 \overline{) 14} \\ 7 \overline{) 7} \\ \hline 1 \end{array}$$

$$4\sqrt{63} - \sqrt{28} + 3\sqrt{112}$$

$$12\sqrt{7} - 2\sqrt{7} + 12\sqrt{7}$$

$$\sqrt{7}(12 - 2 + 12)$$

$$\sqrt{7}(10 + 12) \Rightarrow \sqrt{7}(22)$$

$$= \boxed{22\sqrt{7}} \text{ Ans.}$$