

Exercise 4.3

Q.1 Express each of the following surd in the simplest form:

(i) $\sqrt{180}$

Solution: $\sqrt{180}$

$$= (180)^{\frac{1}{2}}$$

$$= (2 \times 2 \times 3 \times 3 \times 5)^{\frac{1}{2}}$$

$$= (2^2 \times 3^2 \times 5)^{\frac{1}{2}}$$

$$= 2^{2 \times \frac{1}{2}} \times 3^{2 \times \frac{1}{2}} \times 5^{\frac{1}{2}}$$

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

$$= 6\sqrt{5} \text{ Ans}$$

(ii) $3\sqrt{162}$

Solution: $3\sqrt{162}$

$$3(\sqrt{81 \times 2})$$

$$= 3(\sqrt{9^2 \times 2})$$

$$= 3 \times 9(\sqrt{2})$$

$$= 27\sqrt{2} \text{ Ans}$$

(iii) $\frac{3}{4}\sqrt[3]{128}$

Solution: $\frac{3}{4}\sqrt[3]{128}$

$$= \frac{3}{4}(\sqrt[3]{64 \times 2})$$

$$= \frac{3}{4}(\sqrt[3]{4^3 \times 2})$$

$$= \frac{3}{4}[{}^3\sqrt{4^3} \times {}^3\sqrt{2}]$$

$$= \frac{3}{4} \times 4 \times {}^3\sqrt{2}$$

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

$$= 3{}^3\sqrt{2} \text{ Ans}$$

(iv) $\sqrt[5]{96x^6y^7z^8}$

Solution: $\sqrt[5]{96x^6y^7z^8}$

$$= \sqrt[5]{32 \times 3 \times x^5y^5z^5 \times x^1y^2z^3}$$

$$= \sqrt[5]{2^5 \times 3 \times x^5y^5z^5 \times xy^2z^3}$$

$$= \sqrt[5]{2^5x^5y^5z^5} \times \sqrt[5]{3xy^2z^3}$$

$$= \sqrt[5]{2^5} \times \sqrt[5]{x^5} \times \sqrt[5]{y^5} \times \sqrt[5]{z^5} \times \sqrt[5]{3xy^2z^3}$$

$$= 2xyz\sqrt[5]{3xy^2z^3} \text{ Ans}$$

Q.2 Simplify

(i) $\frac{\sqrt{18}}{\sqrt{3}\sqrt{2}}$

Solution: $\frac{\sqrt{18}}{\sqrt{3}\sqrt{2}}$

$$= \frac{\sqrt{9 \times 2}}{\sqrt{3} \times \sqrt{2}}$$

$$= \frac{\sqrt{3^2 \times 2}}{\sqrt{3} \times \sqrt{2}}$$

$$= \frac{\sqrt{3^2} \times \cancel{\sqrt{2}}}{\sqrt{3} \times \cancel{\sqrt{2}}}$$

$$= \frac{3}{\sqrt{3}}$$

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

$$= \frac{3\sqrt{3}}{(\sqrt{3})^2}$$

$$= \frac{\cancel{3}\sqrt{3}}{\cancel{3}}$$

$$= \sqrt{3} \text{ Ans}$$

(ii) $\frac{\sqrt{21}\sqrt{9}}{\sqrt{63}}$

Solution: $\frac{\sqrt{21}\sqrt{9}}{\sqrt{63}}$
 $= \frac{\sqrt{21}\sqrt{3^2}}{\sqrt{9 \times 7}}$
 $= \frac{\sqrt{21} \times 3}{\sqrt{3^2} \times \sqrt{7}}$
 $= \frac{\sqrt{21} \times 3}{3\sqrt{7}}$
 $= \frac{\cancel{3}\sqrt{21}}{\cancel{3}\sqrt{7}}$
 $= \frac{\sqrt{21}}{\sqrt{7}}$
 $= \frac{\sqrt{7 \times 3}}{\sqrt{7}}$
 $= \frac{\cancel{\sqrt{7}} \times \sqrt{3}}{\cancel{\sqrt{7}}}$
 $= \sqrt{3} \text{ Ans}$

(iii) $= \sqrt[5]{243x^5y^{10}z^{15}}$

Solution: $= \sqrt[5]{243x^5y^{10}z^{15}}$
 $= \sqrt[5]{3^5x^5(y^2)^5(z^3)^5}$
 $= \sqrt[5]{3^5} \times \sqrt[5]{x^5} \times \sqrt[5]{(y^2)^5} \times \sqrt[5]{(z^3)^5}$
 $= 3 \times x \times y^2 \times z^3$
 $= 3xy^2z^3 \text{ Ans}$

(iv) $\frac{4}{5}\sqrt[3]{125}$

Solution: $\frac{4}{5}\sqrt[3]{125}$
 $= \frac{4}{5}\sqrt[3]{5 \times 5 \times 5}$
 $= \frac{4}{5}\sqrt[3]{5^3}$

$$= \frac{4}{\cancel{5}} \times \cancel{5}$$

= 4 Ans

(v) $\sqrt{21} \times \sqrt{7} \times \sqrt{3}$

Solution: $\sqrt{21} \times \sqrt{7} \times \sqrt{3}$
 $= \sqrt{7 \times 3} \times \sqrt{7} \times \sqrt{3}$
 $= \sqrt{7 \times 3 \times 7 \times 3}$
 $= \sqrt{7 \times 7 \times 3 \times 3}$
 $= \sqrt{7^2} \times \sqrt{3^2}$
 $= 7 \times 3$
 $= 21 \text{ Ans}$

Q.3 Simplify by combining similar terms.

(i) $\sqrt{45} - 3\sqrt{20} + 4\sqrt{5}$

Solution: $\sqrt{45} - 3\sqrt{20} + 4\sqrt{5}$
 $= \sqrt{9 \times 5} - 3\sqrt{5 \times 4} + 4\sqrt{5}$
 $= \sqrt{3^2} \times \sqrt{5} - 3\sqrt{2^2} \times \sqrt{5} + 4\sqrt{5}$
 $= 3\sqrt{5} - 3 \times 2\sqrt{5} + 4\sqrt{5}$
 $= 3\sqrt{5} - 6\sqrt{5} + 4\sqrt{5}$
 $= \sqrt{5}(3 - 6 + 4)$
 $= \sqrt{5}(3 - 2)$
 $= \sqrt{5}(1)$
 $= \sqrt{5} \text{ Ans}$

(ii) $4\sqrt{12} + 5\sqrt{27} - 3\sqrt{75} + \sqrt{300}$

Solution: $4\sqrt{12} + 5\sqrt{27} - 3\sqrt{75} + \sqrt{300}$
 $= 4\sqrt{4 \times 3} + 5\sqrt{9 \times 3} - 3\sqrt{25 \times 3} + \sqrt{100 \times 3}$
 $= 4 \times 2\sqrt{3} + 5 \times 3\sqrt{3} - 3 \times 5\sqrt{3} + 10\sqrt{3}$
 $= 8\sqrt{3} + 15\sqrt{3} - 15\sqrt{3} + 10\sqrt{3}$
 $= 8\sqrt{3} + 15\sqrt{3} - 15\sqrt{3} + 10\sqrt{3}$

$$\begin{aligned}
 &= \sqrt{3}(8 + 15 - 15 + 10) \\
 &= \sqrt{3}(8 + 10) \\
 &= \sqrt{3}(18) \\
 &= 18\sqrt{3} \text{ Ans}
 \end{aligned}$$

(iii) $\sqrt{3}(2\sqrt{3} + 3\sqrt{3})$

Solution: $\sqrt{3}(2\sqrt{3} + 3\sqrt{3})$

$$\begin{aligned}
 &= \sqrt{3} \times \sqrt{3}(2 + 3) \\
 &= (\sqrt{3})^2 \times (5) \\
 &= 3(5) \\
 &= 15 \text{ Ans}
 \end{aligned}$$

(iv) $2(6\sqrt{5} - 3\sqrt{5})$

Solution: $2(6\sqrt{5} - 3\sqrt{5})$

$$\begin{aligned}
 &= 2 \times \sqrt{5}(6 - 3) \\
 &= 2 \times \sqrt{5}(3) \\
 &= 6\sqrt{5} \text{ Ans}
 \end{aligned}$$

Q.4 Simplify

(i) $(3 + \sqrt{3})(3 - \sqrt{3})$

Solution: $(3 + \sqrt{3})(3 - \sqrt{3})$

$$\begin{aligned}
 &= (3)^2 - (\sqrt{3})^2 \\
 &= 9 - 3 \\
 &= 6 \text{ Ans}
 \end{aligned}$$

(ii) $(\sqrt{5} + \sqrt{3})^2$

Solution: $(\sqrt{5} + \sqrt{3})^2$

$$\begin{aligned}
 &= (\sqrt{5})^2 + 2(\sqrt{5})(\sqrt{3}) + (\sqrt{3})^2 \\
 &= 5 + 2\sqrt{5 \times 3} + 3 \\
 &= 8 + 2\sqrt{15} \text{ Ans}
 \end{aligned}$$

(iii) $(\sqrt{5} + \sqrt{3})(\sqrt{5} - \sqrt{3})$

Solution: $(\sqrt{5} + \sqrt{3})(\sqrt{5} - \sqrt{3})$

$$\begin{aligned}
 &= (\sqrt{5})^2 - (\sqrt{3})^2 \\
 &= 5 - 3 \\
 &= 2 \text{ Ans}
 \end{aligned}$$

(iv) $\left(\sqrt{2} + \frac{1}{\sqrt{3}}\right)\left(\sqrt{2} - \frac{1}{\sqrt{3}}\right)$

Solution: $\left(\sqrt{2} + \frac{1}{\sqrt{3}}\right)\left(\sqrt{2} - \frac{1}{\sqrt{3}}\right)$

$$\begin{aligned}
 &= (\sqrt{2})^2 - \left(\frac{1}{\sqrt{3}}\right)^2 \\
 &= 2 - \frac{(1)^2}{(\sqrt{3})^2} \\
 &= 2 - \frac{1}{3} \\
 &= \frac{6-1}{3} \\
 &= \frac{5}{3} \text{ Ans}
 \end{aligned}$$

(v) $(\sqrt{x} + \sqrt{y})(\sqrt{x} - \sqrt{y})(x + y)(x^2 + y^2)$

Solution:

$$\begin{aligned}
 &(\sqrt{x} + \sqrt{y})(\sqrt{x} - \sqrt{y})(x + y)(x^2 + y^2) \\
 &= [(\sqrt{x})^2 - (\sqrt{y})^2](x + y)(x^2 + y^2) \\
 &= (x - y)(x + y)(x^2 + y^2) \\
 &= [(x)^2 - (y)^2](x^2 + y^2) \\
 &= (x^2 - y^2)(x^2 + y^2)
 \end{aligned}$$

$$\begin{aligned} &= \left[(x^2)^2 - (y^2)^2 \right] \\ &= x^4 - y^4 \text{ Ans} \end{aligned}$$

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Report any mistake at freeilm786@gmail.com

