

SURDS

Calculate and simplify:

a) $7\sqrt{2} + 3\sqrt{8} - \sqrt{80} + 4\sqrt{20} =$

b) $2\sqrt{45} - 3\sqrt{5} + 4\sqrt{20} =$

c) $2\sqrt{8} + 5\sqrt{72} - 7\sqrt{18} - \sqrt{50} =$

d) $\sqrt{4} \cdot \sqrt{12} \cdot \sqrt{3} =$

e) $\sqrt[4]{2^3} \cdot \sqrt{2} \cdot \sqrt[3]{2^5} =$

f) $3\sqrt{72} \div 2\sqrt{9} =$

g) $\sqrt[6]{\frac{2}{3}} \cdot \sqrt[3]{\frac{3}{2}} =$

h) $\frac{1}{3} \sqrt[3]{15} \cdot 5 \sqrt[3]{18} =$

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

j) $(2\sqrt[3]{5})^3 =$

k) $(1 - \sqrt{2})^2 =$

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

m) $\sqrt[3]{\sqrt{4\sqrt{2^3}}} =$

n) $\sqrt{1 + \sqrt{6 + \sqrt{5 + \sqrt{16}}}} =$

o) $(4\sqrt{18} - 6\sqrt{8} + 8\sqrt{72}) \div \sqrt{2} =$

SOLUTION

$$\begin{aligned} \text{a) } 7\sqrt{2} + 3\sqrt{8} - \sqrt{80} + 4\sqrt{20} &= 7\sqrt{2} + 3\sqrt{2^3} - \sqrt{2^4 \cdot 5} + 4\sqrt{2^2 \cdot 5} = \\ &= 7\sqrt{2} + 6\sqrt{2} - 4\sqrt{5} + 8\sqrt{5} = 13\sqrt{2} + 4\sqrt{5} \end{aligned}$$

$$\text{b) } 2\sqrt{45} - 3\sqrt{5} + 4\sqrt{20} = 2\sqrt{3^2 \cdot 5} - 3\sqrt{5} + 4\sqrt{2^2 \cdot 5} = 6\sqrt{5} - 3\sqrt{5} + 8\sqrt{5} = 11\sqrt{5}$$

$$\begin{aligned} \text{c) } 2\sqrt{8} + 5\sqrt{72} - 7\sqrt{18} - \sqrt{50} &= 2\sqrt{2^3} + 5\sqrt{2^3 \cdot 3^2} - 7\sqrt{2 \cdot 3^2} - \sqrt{2 \cdot 5^2} = \\ &= 4\sqrt{2} + 30\sqrt{2} - 21\sqrt{2} - 5\sqrt{2} = 8\sqrt{2} \end{aligned}$$

$$\text{d) } \sqrt{4} \cdot \sqrt{12} \cdot \sqrt{3} = \sqrt{2^2} \cdot \sqrt{2^2 \cdot 3} \cdot \sqrt{3} = \sqrt{2^2 \cdot 2^2 \cdot 3^2} = 2 \cdot 2 \cdot 3 = 12$$

$$\text{e) } \sqrt[4]{2^3} \cdot \sqrt{2} \cdot \sqrt[3]{2^5} = \sqrt[12]{2^9} \cdot \sqrt[12]{2^6} \cdot \sqrt[12]{2^{20}} = \sqrt[12]{2^{35}} = 2^{2\frac{12}{12}} \sqrt[12]{2^{11}} = 4\sqrt[12]{2^{11}}$$

$$\text{f) } 3\sqrt{72} \div 2\sqrt{9} = \frac{3\sqrt{2^3 \cdot 3^2}}{2\sqrt{3^2}} = \frac{3 \cdot 2 \cdot 3\sqrt{2}}{2 \cdot 3} = 3\sqrt{2}$$

$$\text{g) } \sqrt[6]{\frac{2}{3}} \cdot \sqrt[3]{\frac{3}{2}} = \sqrt[6]{\frac{2}{3}} \cdot \sqrt[6]{\frac{3^2}{2^2}} = \sqrt[6]{\frac{2 \cdot 3^2}{3 \cdot 2^2}} = \sqrt[6]{\frac{3}{2}}$$

$$\text{h) } \frac{1}{3} \sqrt[3]{15} \cdot 5\sqrt[3]{18} = \frac{5}{3} \sqrt[3]{3 \cdot 5} \cdot \sqrt[3]{2 \cdot 3^2} = \frac{5}{3} \sqrt[3]{3^3 \cdot 2 \cdot 5} = \frac{5}{3} \cdot 3\sqrt[3]{10} = 5\sqrt[3]{10}$$

$$\text{i) } (2\sqrt{3})^2 = 2^2 \cdot \sqrt{3^2} = 4 \cdot 3 = 12$$

$$\text{j) } (2\sqrt[3]{5})^3 = 2^3 \cdot \sqrt[3]{5^3} = 8 \cdot 5 = 40$$

$$\text{k) } (1 - \sqrt{2})^2 = 1^2 - 2\sqrt{2} + (\sqrt{2})^2 = 1 - 2\sqrt{2} + 2 = 3 - 2\sqrt{2}$$

$$\text{l) } (\sqrt{2} + \sqrt{3})(\sqrt{2} - \sqrt{3}) = (\sqrt{2})^2 - (\sqrt{3})^2 = 2 - 3 = -1$$

$$\text{m) } \sqrt[3]{\sqrt[4]{2^3}} = \sqrt[24]{2^3} = \sqrt[8]{2}$$

$$\begin{aligned} \text{n) } \sqrt{1 + \sqrt{6 + \sqrt{5 + \sqrt{16}}}} &= \sqrt{1 + \sqrt{6 + \sqrt{5 + 4}}} = \sqrt{1 + \sqrt{6 + \sqrt{9}}} = \sqrt{1 + \sqrt{6 + 3}} = \\ &= \sqrt{1 + \sqrt{9}} = \sqrt{1 + 3} = 2 \end{aligned}$$

$$\begin{aligned} \text{o) } (4\sqrt{18} - 6\sqrt{8} + 8\sqrt{72}) \div \sqrt{2} &= (4\sqrt{2 \cdot 3^2} - 6\sqrt{2^3} + 8\sqrt{2^3 \cdot 3^2}) \div \sqrt{2} = \\ &= (4 \cdot 3\sqrt{2} - 6 \cdot 2\sqrt{2} + 8 \cdot 2 \cdot 3\sqrt{2}) \div \sqrt{2} = (12\sqrt{2} - 12\sqrt{2} + 48\sqrt{2}) \div \sqrt{2} = 48 \end{aligned}$$