

Solutions to Revision Sheet on Surds

1. Simplify the following surds:

- a. $\sqrt{12} = \sqrt{4 \times 3} = \sqrt{4}\sqrt{3} = 2\sqrt{3}$
- b. $\sqrt{20} = \sqrt{4 \times 5} = \sqrt{4}\sqrt{5} = 2\sqrt{5}$
- c. $\sqrt{18} = \sqrt{9 \times 2} = \sqrt{9}\sqrt{2} = 3\sqrt{2}$
- d. $\sqrt{27} = \sqrt{9 \times 3} = \sqrt{9}\sqrt{3} = 3\sqrt{3}$
- e. $\sqrt{8} = \sqrt{4 \times 2} = \sqrt{4}\sqrt{2} = 2\sqrt{2}$
- f. $\sqrt{24} = \sqrt{4 \times 6} = \sqrt{4}\sqrt{6} = 2\sqrt{6}$
- g. $\sqrt{28} = \sqrt{4 \times 7} = \sqrt{4}\sqrt{7} = 2\sqrt{7}$
- h. $\sqrt{32} = \sqrt{16 \times 2} = \sqrt{16}\sqrt{2} = 4\sqrt{2}$
- i. $\sqrt{45} = \sqrt{9 \times 5} = \sqrt{9}\sqrt{5} = 3\sqrt{5}$
- j. $\sqrt{48} = \sqrt{16 \times 3} = \sqrt{16}\sqrt{3} = 4\sqrt{3}$
- k. $\sqrt{44} = \sqrt{4 \times 11} = \sqrt{4}\sqrt{11} = 2\sqrt{11}$
- l. $\sqrt{63} = \sqrt{9 \times 7} = \sqrt{9}\sqrt{7} = 3\sqrt{7}$
- m. $\sqrt{50} = \sqrt{25 \times 2} = \sqrt{25}\sqrt{2} = 5\sqrt{2}$
- n. $\sqrt{54} = \sqrt{9 \times 6} = \sqrt{9}\sqrt{6} = 3\sqrt{6}$
- o. $\sqrt{200} = \sqrt{100 \times 2} = \sqrt{100}\sqrt{2} = 10\sqrt{2}$

2. Add or subtract these surds

- a. $4\sqrt{2} + 3\sqrt{2} = 7\sqrt{2}$
- b. $5\sqrt{2} - 3\sqrt{2} = 2\sqrt{2}$
- c. $6\sqrt{3} + 2\sqrt{3} = 8\sqrt{3}$
- d. $6\sqrt{3} - 2\sqrt{3} = 4\sqrt{3}$
- e. $\sqrt{5} + \sqrt{5} = 2\sqrt{5}$
- f. $\sqrt{5} - \sqrt{5} = 0$

g. $8\sqrt{2} + 2\sqrt{2} = 10\sqrt{2}$

h. $2\sqrt{3} - \sqrt{3} = \sqrt{3}$

i. $3\sqrt{3} + 3\sqrt{3} = 6\sqrt{3}$

3. Simplify:

a. $\sqrt{8} + \sqrt{2} = 2\sqrt{2} + \sqrt{2} = 3\sqrt{2}$

b. $\sqrt{18} - \sqrt{2} = 3\sqrt{2} - \sqrt{2} = 2\sqrt{2}$

c. $\sqrt{125} - 5\sqrt{5} = 5\sqrt{5} - 5\sqrt{5} = 0$

d. $\sqrt{48} - \sqrt{12} = 4\sqrt{3} - 2\sqrt{3} = 2\sqrt{3}$

e. $\sqrt{32} + \sqrt{18} = 4\sqrt{2} - 3\sqrt{2} = \sqrt{2}$

f. $\sqrt{75} - \sqrt{12} = 5\sqrt{3} - 2\sqrt{3} = 3\sqrt{3}$

g. $\sqrt{45} - \sqrt{20} = 3\sqrt{5} - 2\sqrt{5} = \sqrt{5}$

h. $\sqrt{63} - \sqrt{28} = 3\sqrt{7} - 2\sqrt{7} = \sqrt{7}$

4. a) $\sqrt{2} \times \sqrt{2} = \sqrt{2 \times 2} = \sqrt{4} = 2$

b) $\sqrt{6} \times \sqrt{6} = \sqrt{6 \times 6} = \sqrt{36} = 6$

c) $\sqrt{2} \times \sqrt{50} = \sqrt{2 \times 50} = \sqrt{100} = 10$

d) $\sqrt{3} \times \sqrt{12} = \sqrt{3 \times 12} = \sqrt{36} = 6$

e) $\sqrt{3} \times \sqrt{27} = \sqrt{3 \times 27} = \sqrt{81} = 9$

f) $\sqrt{10} \times \sqrt{2} = \sqrt{10 \times 2} = \sqrt{20} = 2\sqrt{5}$

g) $\sqrt{3} \times \sqrt{15} = \sqrt{3 \times 15} = \sqrt{45} = 3\sqrt{5}$

h) $\sqrt{5} \times \sqrt{10} = \sqrt{5 \times 10} = \sqrt{50} = 5\sqrt{2}$

5. a) $(2 + \sqrt{2})(3 + \sqrt{2})$
 $\rightarrow 6 + 2\sqrt{2} + 3\sqrt{2} + 2 \rightarrow 8 + 5\sqrt{2}$

Solutions to Surds (Continued)

$$\begin{aligned} \text{b) } & (2+\sqrt{2})(3-\sqrt{2}) \\ & \rightarrow 6-2\sqrt{2}+3\sqrt{2}-2 \rightarrow 4+\sqrt{2} \end{aligned}$$

$$\begin{aligned} \text{c) } & (5-\sqrt{3})(5+\sqrt{3}) \\ & \rightarrow 25+5\sqrt{3}-5\sqrt{3}-3 \rightarrow 22 \end{aligned}$$

$$\begin{aligned} \text{d) } & (\sqrt{3}-\sqrt{2})(\sqrt{3}-\sqrt{2}) \\ & \rightarrow 3-\sqrt{3}\sqrt{2}-\sqrt{2}\sqrt{3}+2 \rightarrow 5-2\sqrt{6} \end{aligned}$$

$$\begin{aligned} & \left(\frac{1}{\sqrt{2}}+\sqrt{2}\right)\left(\frac{1}{\sqrt{2}}-\sqrt{2}\right) \\ \text{e) } & \rightarrow \frac{1}{\sqrt{2}} \cdot \frac{1}{\sqrt{2}} - \sqrt{2} \cdot \frac{1}{\sqrt{2}} + \sqrt{2} \cdot \frac{1}{\sqrt{2}} - \sqrt{2}\sqrt{2} \\ & \rightarrow \frac{1}{2} - 1 + 1 - 2 \rightarrow -1\frac{1}{2} \end{aligned}$$

$$\begin{aligned} \text{f) } & \frac{2}{\sqrt{3}}\left(\frac{1}{\sqrt{3}}-\frac{\sqrt{3}}{2}\right) \rightarrow \frac{2}{\sqrt{3}} \cdot \frac{1}{\sqrt{3}} - \frac{2\sqrt{3}}{2\sqrt{3}} \\ & \rightarrow \frac{2}{3} - 1 \rightarrow -\frac{1}{3} \end{aligned}$$

$$\text{6 a) } \frac{1}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} \rightarrow \frac{\sqrt{6}}{6}$$

$$\text{b) } \frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} \rightarrow \frac{\sqrt{7}}{7}$$

$$\text{c) } \frac{2}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} \rightarrow \frac{2\sqrt{6}}{6} \rightarrow \frac{\sqrt{6}}{3}$$

$$\text{d) } \frac{3}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} \rightarrow \frac{3\sqrt{3}}{3} \rightarrow \sqrt{3}$$

$$\text{e) } \frac{5}{\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}} \rightarrow \frac{5\sqrt{10}}{10} \rightarrow \frac{\sqrt{10}}{2}$$

$$\text{f) } \frac{1}{\sqrt{11}} \times \frac{\sqrt{11}}{\sqrt{11}} \rightarrow \frac{\sqrt{11}}{11}$$

$$\text{g) } \frac{4}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} \rightarrow \frac{4\sqrt{2}}{2} \rightarrow 2\sqrt{2}$$

$$\text{h) } \frac{20}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \rightarrow \frac{20\sqrt{5}}{5} \rightarrow 4\sqrt{5}$$

$$\text{i) } \frac{6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} \rightarrow \frac{6\sqrt{3}}{3} \rightarrow 2\sqrt{3}$$

$$\text{j) } \frac{12}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} \rightarrow \frac{12\sqrt{6}}{6} \rightarrow 2\sqrt{6}$$

7.

$$\frac{1}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}}$$

$$\begin{aligned} \text{a) } & \rightarrow \frac{2-\sqrt{3}}{4+2\sqrt{3}-2\sqrt{3}-3} \rightarrow \frac{2-\sqrt{3}}{1} \\ & \rightarrow 2-\sqrt{3} \end{aligned}$$

$$\text{b) } \frac{1}{\sqrt{5}-1} \times \frac{\sqrt{5}+1}{\sqrt{5}+1} \rightarrow \frac{\sqrt{5}+1}{5-1} \rightarrow \frac{\sqrt{5}+1}{4}$$

$$\text{c) } \frac{1}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1} \rightarrow \frac{\sqrt{2}-1}{2-1} \rightarrow \sqrt{2}-1$$

$$\begin{aligned} \text{d) } & \frac{1}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}} \rightarrow \frac{2-\sqrt{3}}{4+2\sqrt{3}-2\sqrt{3}-3} \\ & \rightarrow \frac{2-\sqrt{3}}{1} \rightarrow 2-\sqrt{3} \end{aligned}$$

$$\text{e) } \frac{1}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} \rightarrow \frac{\sqrt{2}+1}{2-1} \rightarrow \sqrt{2}+1$$

$$\text{f) } \frac{1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} \rightarrow \frac{\sqrt{3}-1}{3-1} \rightarrow \frac{\sqrt{3}-1}{2}$$

$$\text{g) } \frac{4}{\sqrt{5}-1} \times \frac{\sqrt{5}+1}{\sqrt{5}+1} \rightarrow \frac{4(\sqrt{5}+1)}{4} \rightarrow \sqrt{5}+1$$