

### Exercise 3.1

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Question 1: Simplify each of the following:

(i)  $\sqrt[3]{4} \times \sqrt[3]{16}$

(ii)  $\frac{\sqrt[4]{1250}}{\sqrt[4]{2}}$

Solution:

(i)

Using:  $\sqrt[n]{a} \times \sqrt[n]{b} = \sqrt[n]{a \times b}$

$$= \sqrt[3]{4 \times 16}$$

$$= \sqrt[3]{64}$$

$$= \sqrt[3]{4^3}$$

$$= (4^3)^{\frac{1}{3}}$$

$$= 4$$

(ii)

(Note:  $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$ )

$$= \sqrt[4]{\frac{1250}{2}}$$

$$= \sqrt[4]{\frac{2 \times 625}{2}}$$

$$= \sqrt[4]{625}$$

$$= \sqrt[4]{15^4}$$

$$= 15(4 \times \frac{1}{4})$$

$$= 15$$

Question 2: Simplify the following expressions:

(i)  $(4 + \sqrt{7})(3 + \sqrt{2})$

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

(iii)  $(\sqrt{5} - 2)(\sqrt{3} - \sqrt{5})$

**Solution:**

$$\begin{aligned} \text{(i)} & (4 + \sqrt{7})(3 + \sqrt{2}) \\ & = 12 + 4\sqrt{2} + 3\sqrt{7} + \sqrt{14} \end{aligned}$$

$$\begin{aligned} \text{(ii)} & (3 + \sqrt{3})(5 - \sqrt{2}) \\ & = 15 - 3\sqrt{2} + 5\sqrt{3} - \sqrt{6} \end{aligned}$$

$$\begin{aligned} \text{(iii)} & (\sqrt{5} - 2)(\sqrt{3} - \sqrt{5}) \\ & = \sqrt{15} - \sqrt{25} - 2\sqrt{3} + 2\sqrt{5} \\ & = \sqrt{15} - 5 - 2\sqrt{3} + 2\sqrt{5} \end{aligned}$$

**Question 3: Simplify the following expressions:**

$$\text{(i)} (11 + \sqrt{11})(11 - \sqrt{11})$$

$$\text{(ii)} (5 + \sqrt{7})(5 - \sqrt{7})$$

$$\text{(iii)} (\sqrt{8} - \sqrt{2})(\sqrt{8} + \sqrt{2})$$

$$\text{(iv)} (3 + \sqrt{3})(3 - \sqrt{3})$$

$$\text{(v)} (\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2})$$

**Solution:**

Using Identity:  $(a - b)(a + b) = a^2 - b^2$

$$\text{(i)} (11 + \sqrt{11})(11 - \sqrt{11})$$

$$= 11^2 - (\sqrt{11})^2$$

$$= 121 - 11$$

$$= 110$$

$$\text{(ii)} (5 + \sqrt{7})(5 - \sqrt{7})$$

$$= (5^2 - (\sqrt{7})^2)$$

$$= 25 - 7 = 18$$

$$\text{(iii)} (\sqrt{8} - \sqrt{2})(\sqrt{8} + \sqrt{2})$$

$$= (\sqrt{8})^2 - (\sqrt{2})^2$$

$$= 8 - 2$$

$$= 6$$

$$\text{(iv)} (3 + \sqrt{3})(3 - \sqrt{3})$$

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

$$= 9 - 3$$

$$= 6$$

$$\text{(v)} (\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2})$$

$$= (\sqrt{5})^2 - (\sqrt{2})^2$$

$$= 5 - 2$$

$$= 3$$

**Question 4: Simplify the following expressions:**

**(i)**  $(\sqrt{3} + \sqrt{7})^2$

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

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

**Solution:**

Using identities:  $(a - b)^2 = a^2 + b^2 - 2ab$  and  $(a + b)^2 = a^2 + b^2 + 2ab$

**(i)**  $(\sqrt{3} + \sqrt{7})^2$

$$= (\sqrt{3})^2 + (\sqrt{7})^2 + 2(\sqrt{3})(\sqrt{7})$$

$$= 3 + 7 + 2\sqrt{21}$$

$$= 10 + 2\sqrt{21}$$

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

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

$$= 5 + 3 - 2\sqrt{15}$$

$$= 8 - 2\sqrt{15}$$

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

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

$$= 20 + 18 + 12\sqrt{10}$$

$$= 38 + 12\sqrt{10}$$