

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

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

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

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

$$= 121 - 11$$

$$= 110$$

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

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

$$= 25 - 7 = 18$$

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

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

$$= 8 - 2$$

$$= 6$$

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

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

$$= 9 - 3$$

$$= 6$$

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

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

$$= 5 - 2$$

$$= 3$$

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

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

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

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

Exercise 3.2

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Question 1: Rationalise the denominators of each of the following (i – vii):

- (i) $3/\sqrt{5}$ (ii) $3/(2\sqrt{5})$ (iii) $1/\sqrt{12}$ (iv) $\sqrt{2}/\sqrt{5}$
(v) $(\sqrt{3}+1)/\sqrt{2}$ (vi) $(\sqrt{2}+\sqrt{5})/\sqrt{3}$ (vii) $3\sqrt{2}/\sqrt{5}$

Solution:

- (i) Multiply both numerator and denominator to with same number to rationalise the denominator.

$$\begin{aligned} &= \frac{3 \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}} \\ &= \frac{3 \times \sqrt{5}}{5} \\ &= 3/5\sqrt{5} \end{aligned}$$

- (ii) Multiply both numerator and denominator to with same number to rationalise the denominator.

$$\begin{aligned} \frac{3}{2\sqrt{5}} &= \frac{3 \times \sqrt{5}}{2 \times \sqrt{5} \times \sqrt{5}} \\ &= \frac{3\sqrt{5}}{2 \times 5} = \frac{3\sqrt{5}}{10} = \frac{3}{10} \sqrt{5} \end{aligned}$$

- (iii) Multiply both numerator and denominator to with same number to rationalise the denominator.

$$\begin{aligned} \frac{1}{\sqrt{12}} &= \frac{1}{\sqrt{4 \times 3}} = \frac{1}{2\sqrt{3}} \\ &= \frac{1 \times \sqrt{3}}{2\sqrt{3} \times \sqrt{3}} = \frac{\sqrt{3}}{2 \times 3} = \frac{\sqrt{3}}{6} \end{aligned}$$

- (iv) Multiply both numerator and denominator to with same number to rationalise the denominator.

$$\frac{\sqrt{2}}{\sqrt{5}} = \frac{\sqrt{2} \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}} = \frac{\sqrt{10}}{5} = \frac{1}{5} \sqrt{10}$$

- (v) Multiply both numerator and denominator to with same number to rationalise the denominator.

$$\frac{\sqrt{3}+1}{\sqrt{2}} = \frac{(\sqrt{3}+1)\sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{\sqrt{6}+\sqrt{2}}{2}$$

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(vi) Multiply both numerator and denominator to with same number to rationalise the denominator.

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

$$= \frac{\sqrt{6} + \sqrt{15}}{3}$$

(vii) Multiply both numerator and denominator to with same number to rationalise the denominator.

$$\frac{3\sqrt{2}}{\sqrt{5}} = \frac{3\sqrt{2} \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}} = \frac{3 \times \sqrt{10}}{5}$$

$$= \frac{3}{5} \sqrt{10}$$

Question 2: Find the value to three places of decimals of each of the following. It is given that $\sqrt{2} = 1.414$, $\sqrt{3} = 1.732$, $\sqrt{5} = 2.236$ and $\sqrt{10} = 3.162$

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

(ii) $\frac{3}{\sqrt{10}}$

(iii) $\frac{\sqrt{5} + 1}{\sqrt{2}}$

(iv) $\frac{\sqrt{10} + \sqrt{15}}{\sqrt{2}}$

(v) $\frac{2 + \sqrt{3}}{3}$

(vi) $\frac{\sqrt{2} - 1}{\sqrt{5}}$

Solution:

(i) $\frac{2}{\sqrt{3}} = \frac{2 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}}$

$$= \frac{2\sqrt{3}}{3} = \frac{2 \times 1.732}{3} = \frac{3.464}{3} = 1.154$$

(ii) $\frac{3}{\sqrt{10}} = \frac{3 \times \sqrt{10}}{\sqrt{10} \times \sqrt{10}} = \frac{3\sqrt{10}}{10}$

$$= \frac{3(3.162)}{10} = \frac{9.486}{10} = 0.9486$$

$$(iii) \frac{\sqrt{5}+1}{\sqrt{2}} = \frac{(\sqrt{5}+1) \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}}$$

$$= \frac{\sqrt{10}+\sqrt{2}}{2} = \frac{3.162+1.414}{2}$$

$$= \frac{4.576}{2} = 2.288$$

$$(iv) \frac{\sqrt{10}+\sqrt{15}}{\sqrt{2}} = \frac{(\sqrt{10}+\sqrt{15})\sqrt{2}}{\sqrt{2} \times \sqrt{2}}$$

$$= \frac{\sqrt{20}+\sqrt{30}}{2} = \frac{2\sqrt{5}+\sqrt{10} \times \sqrt{3}}{2}$$

$$= \frac{2(2.236)+3.162 \times 1.732}{2} = 4.974$$

$$(v) \frac{2+\sqrt{3}}{3} = \frac{2+1.732}{3} = \frac{3.732}{3} = 1.244$$

$$(vi) \frac{\sqrt{2}-1}{\sqrt{5}} = \frac{(\sqrt{2}-1) \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}}$$

$$= \frac{\sqrt{10}-\sqrt{5}}{5} = \frac{3.162-2.236}{5}$$

$$= \frac{0.926}{5} = 0.185$$

Question 3: Express each one of the following with rational denominator:

$$(i) \frac{1}{3+\sqrt{2}} \quad (ii) \frac{1}{\sqrt{6}-\sqrt{5}} \quad (iii) \frac{16}{\sqrt{41}-5}$$

$$(iv) \frac{30}{5\sqrt{3}-3\sqrt{5}} \quad (v) \frac{1}{2\sqrt{5}-\sqrt{3}} \quad (vi) \frac{\sqrt{3}+1}{2\sqrt{2}-\sqrt{3}}$$

$$(vii) \frac{6-4\sqrt{2}}{6+4\sqrt{2}} \quad (viii) \frac{3\sqrt{2}+1}{2\sqrt{5}-3} \quad (ix) \frac{b^2}{\sqrt{a^2+b^2}+a}$$

$$(vii) \frac{6-4\sqrt{2}}{6+4\sqrt{2}} \quad (viii) \frac{3\sqrt{2}+1}{2\sqrt{5}-3} \quad (ix) \frac{b^2}{\sqrt{a^2+b^2}+a}$$

Solution:

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

(i) Multiply and divide given number by $3 - \sqrt{2}$

$$\begin{aligned} & \frac{1}{3 + \sqrt{2}} \\ &= \frac{3 - \sqrt{2}}{(3 + \sqrt{2})(3 - \sqrt{2})} \\ &= \frac{3 - \sqrt{2}}{9 - 2} \\ &= \frac{3 - \sqrt{2}}{7} \end{aligned}$$

(ii) Multiply and divide given number by $\sqrt{6} + \sqrt{5}$

$$\begin{aligned} & \frac{1}{\sqrt{6} - \sqrt{5}} \\ &= \frac{\sqrt{6} + \sqrt{5}}{(\sqrt{6} - \sqrt{5})(\sqrt{6} + \sqrt{5})} \\ &= \frac{\sqrt{6} + \sqrt{5}}{6 - 5} \\ &= \sqrt{6} + \sqrt{5} \end{aligned}$$

(iii) Multiply and divide given number by $\sqrt{41} + 5$

$$\begin{aligned}& \frac{16}{\sqrt{41}-5} \\&= \frac{16 \times (\sqrt{41}+5)}{(\sqrt{41}-5)(\sqrt{41}+5)} \\&= \frac{16\sqrt{41}+80}{41-25} \\&= \frac{16\sqrt{41}+80}{16} \\&= \frac{16(\sqrt{41}+5)}{16} \\&= \sqrt{41} + 5\end{aligned}$$

(iv) Multiply and divide given number by $5\sqrt{3} + 3\sqrt{5}$

$$\begin{aligned}& \frac{30}{5\sqrt{3}-3\sqrt{5}} \\&= \frac{30 \times (5\sqrt{3}+3\sqrt{5})}{(5\sqrt{3}-3\sqrt{5})(5\sqrt{3}+3\sqrt{5})} \\&= \frac{30 \times (5\sqrt{3}+3\sqrt{5})}{75-45} \\&= \frac{30 \times (5\sqrt{3}+3\sqrt{5})}{30} \\&= 5\sqrt{3} + 3\sqrt{5}\end{aligned}$$

(v) Multiply and divide given number by $2\sqrt{5} + \sqrt{3}$

$$\begin{aligned}& \frac{1}{2\sqrt{5}-\sqrt{3}} \\&= \frac{2\sqrt{5}+\sqrt{3}}{(2\sqrt{5}-\sqrt{3})(2\sqrt{5}+\sqrt{3})} \\&= \frac{2\sqrt{5}+\sqrt{3}}{20-3} \\&= \frac{2\sqrt{5}+\sqrt{3}}{17}\end{aligned}$$

(vi) Multiply and divide given number by $2\sqrt{2} + \sqrt{3}$

$$\begin{aligned}& \frac{\sqrt{3}+1}{2\sqrt{2}-\sqrt{3}} \\&= \frac{(\sqrt{3}+1)(2\sqrt{2}+\sqrt{3})}{(2\sqrt{2}+\sqrt{3})(2\sqrt{2}-\sqrt{3})} \\&= \frac{(2\sqrt{6}+3+2\sqrt{2}+\sqrt{3})}{8-3} \\&= \frac{(2\sqrt{6}+3+2\sqrt{2}+\sqrt{3})}{5}\end{aligned}$$

(vii) Multiply and divide given number by $6 - 4\sqrt{2}$

$$\begin{aligned}& \frac{6-4\sqrt{2}}{6+4\sqrt{2}} \\&= \frac{(6-4\sqrt{2})(6-4\sqrt{2})}{(6+4\sqrt{2})(6-4\sqrt{2})} \\&= \frac{(6-4\sqrt{2})^2}{36-32} \\&= \frac{36-48\sqrt{2}+32}{4} \\&= \frac{68-48\sqrt{2}}{4} \\&= \frac{4(17-12\sqrt{2})}{4} \\&= 17 - 12\sqrt{2}\end{aligned}$$

(viii) Multiply and divide given number by $2\sqrt{5} + 3$

$$\begin{aligned}
 & \frac{3\sqrt{2}+1}{2\sqrt{5}-3} \\
 &= \frac{(3\sqrt{2}+1) \times (2\sqrt{5}+3)}{(2\sqrt{5}-3)(2\sqrt{5}+3)} \\
 &= \frac{6\sqrt{10}+9\sqrt{2}+2\sqrt{5}+3}{(20-9)} \\
 &= \frac{6\sqrt{10}+9\sqrt{2}+2\sqrt{5}+3}{11}
 \end{aligned}$$

(ix) Multiply and divide given number by $\sqrt{a^2+b^2} - a$

$$\begin{aligned}
 & \frac{b^2}{\sqrt{a^2+b^2}+a} \\
 &= \frac{b^2(\sqrt{a^2+b^2}-a)}{(\sqrt{a^2+b^2}+a)(\sqrt{a^2+b^2}-a)} \\
 &= \frac{b^2(\sqrt{a^2+b^2}-a)}{(a^2+b^2)-a^2} \\
 &= \frac{b^2(\sqrt{a^2+b^2}-a)}{b^2}
 \end{aligned}$$

Question 4: Rationalise the denominator and simplify:

(i) $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ (ii) $\frac{5+2\sqrt{3}}{7+4\sqrt{3}}$ (iii) $\frac{1+\sqrt{2}}{3-2\sqrt{2}}$

(iv) $\frac{2\sqrt{6}-\sqrt{5}}{3\sqrt{5}-2\sqrt{6}}$ (v) $\frac{4\sqrt{3}+5\sqrt{2}}{\sqrt{48}+\sqrt{18}}$ (vi) $\frac{2\sqrt{3}-\sqrt{5}}{2\sqrt{2}+3\sqrt{3}}$

Solution:

[Use identities: $(a+b)(a-b) = a^2 - b^2$; $(a+b)^2 = (a^2 + 2ab + b^2)$ and $(a-b)^2 = (a^2 - 2ab + b^2)$]

(i) Multiply both numerator and denominator by $\sqrt{3}-\sqrt{2}$ to rationalise the denominator.

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

(ii) Multiply both numerator and denominator by $7-4\sqrt{3}$ to rationalise the denominator.

$$\begin{aligned}& \frac{5+2\sqrt{3}}{7+4\sqrt{3}} \\&= \frac{(5+2\sqrt{3})(7-4\sqrt{3})}{(7+4\sqrt{3})(7-4\sqrt{3})} \\&= \frac{(5+2\sqrt{3})(7-4\sqrt{3})}{49-48} \\&= 35 - 20\sqrt{3} + 14\sqrt{3} - 24 \\&= 11 - 6\sqrt{3}\end{aligned}$$

(iii) Multiply both numerator and denominator by $3+2\sqrt{2}$ to rationalise the denominator.

$$\begin{aligned}& \frac{1+\sqrt{2}}{3-2\sqrt{2}} \\&= \frac{(1+\sqrt{2})(3+2\sqrt{2})}{(3-2\sqrt{2})(3+2\sqrt{2})} \\&= \frac{(1+\sqrt{2})(3+2\sqrt{2})}{9-8} \\&= 3 + 2\sqrt{2} + 3\sqrt{2} + 4 \\&= 7 + 5\sqrt{2}\end{aligned}$$

(iv) Multiply both numerator and denominator by $3\sqrt{5}+2\sqrt{6}$ to rationalise the denominator.

$$\begin{aligned}& \frac{2\sqrt{6}-\sqrt{5}}{3\sqrt{5}-2\sqrt{6}} \\&= \frac{(2\sqrt{6}-\sqrt{5})(3\sqrt{5}+2\sqrt{6})}{(3\sqrt{5}-2\sqrt{6})(3\sqrt{5}+2\sqrt{6})} \\&= \frac{(2\sqrt{6}-\sqrt{5})(3\sqrt{5}+2\sqrt{6})}{45-24} \\&= \frac{(2\sqrt{6}-\sqrt{5})(3\sqrt{5}+2\sqrt{6})}{21} \\&= \frac{6\sqrt{30}+24-15-2\sqrt{30}}{21} \\&= \frac{4\sqrt{30}+9}{21}\end{aligned}$$

(v) Multiply both numerator and denominator by $\sqrt{48}-\sqrt{18}$ to rationalise the denominator.

$$\begin{aligned}& \frac{4\sqrt{3}+5\sqrt{2}}{\sqrt{48}+\sqrt{18}} \\&= \frac{(4\sqrt{3}+5\sqrt{2})(\sqrt{48}-\sqrt{18})}{(\sqrt{48}+\sqrt{18})(\sqrt{48}-\sqrt{18})} \\&= \frac{(4\sqrt{3}+5\sqrt{2})(\sqrt{48}-\sqrt{18})}{48-18} \\&= \frac{48-12\sqrt{6}+20\sqrt{6}-30}{30} \\&= \frac{18+8\sqrt{6}}{30} \\&= \frac{9+4\sqrt{6}}{15}\end{aligned}$$

(vi) Multiply both numerator and denominator by $2\sqrt{2}-3\sqrt{3}$ to rationalise the denominator.

$$\frac{2\sqrt{3}-\sqrt{5}}{2\sqrt{2}+3\sqrt{3}}$$

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

$$= \frac{(2\sqrt{3}-\sqrt{5})(2\sqrt{2}-3\sqrt{3})}{8-27}$$

$$= \frac{(4\sqrt{6}-2\sqrt{10})-18+3\sqrt{15}}{-19}$$

$$= \frac{(18-4\sqrt{6}+2\sqrt{10}-3\sqrt{15})}{19}$$

Exercise VSAQs

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Question 1: Write the value of $(2 + \sqrt{3})(2 - \sqrt{3})$.**Solution:**

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

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

$$[\text{Using identity : } (a + b)(a - b) = a^2 - b^2]$$

$$= 4 - 3$$

$$= 1$$

Question 2: Write the reciprocal of $5 + \sqrt{2}$.**Solution:**

$$\text{Reciprocal of } 5 + \sqrt{2} = \frac{1}{5 + \sqrt{2}}$$

Rationalisation of fraction**Multiply and divide given fraction by $5 - \sqrt{2}$**

$$\begin{aligned} &= \frac{5 - \sqrt{2}}{(5 + \sqrt{2})(5 - \sqrt{2})} \\ &= \frac{5 - \sqrt{2}}{(5)^2 - (\sqrt{2})^2} \\ &= \frac{5 - \sqrt{2}}{25 - 2} \\ &= \frac{5 - \sqrt{2}}{23} \end{aligned}$$

Question 3: Write the rationalisation factor of $7 - 3\sqrt{5}$.**Solution:**Rationalisation factor of $7 - 3\sqrt{5}$ is $7 + 3\sqrt{5}$ **Question 4: If**

$$\frac{\sqrt{3} - 1}{\sqrt{3} + 1} = x + y\sqrt{3}$$

Find the values of x and y.

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

Rationalising Denominator

$$\frac{\sqrt{3} - 1}{\sqrt{3} + 1} = \frac{(\sqrt{3} - 1)}{(\sqrt{3} + 1)} \times \frac{(\sqrt{3} - 1)}{(\sqrt{3} - 1)} = \frac{(\sqrt{3} - 1)^2}{(\sqrt{3})^2 - (1)^2}$$

$$= \frac{3 + 1 - 2\sqrt{3}}{3 - 1} = \frac{4 - 2\sqrt{3}}{2} = 2 - \sqrt{3}$$

Now,

$$2 - \sqrt{3} = x + y\sqrt{3}$$

On comparing,

$$x = 2, y = -1$$

Question 5: If $x = \sqrt{2} - 1$, then write the value of $1/x$.**Solution:**

$$x = \sqrt{2} - 1$$

$$\text{or } 1/x = 1/(\sqrt{2} - 1)$$

Rationalising denominator, we have

$$= 1/(\sqrt{2} - 1) \times (\sqrt{2} + 1)/(\sqrt{2} + 1)$$

$$= (\sqrt{2} + 1)/(2 - 1)$$

$$= \sqrt{2} + 1$$

Question 6: Simplify

$$\sqrt{3 + 2\sqrt{2}}$$

Solution:

$$\sqrt{3 + 2\sqrt{2}}$$

$$= \sqrt{2 + 1 + 2\sqrt{2}}$$

$$= \sqrt{(\sqrt{2})^2 + (1)^2 + 2 \times \sqrt{2} \times 1}$$

$$= \sqrt{(\sqrt{2} + 1)^2} = \sqrt{2} + 1$$

[Because: $(a + b)^2 = a^2 + b^2 + 2ab$]

Question 7: Simplify

$$\sqrt{3 - 2\sqrt{2}}$$

Solution:

$$\sqrt{3 - 2\sqrt{2}}$$

$$= \sqrt{2+1-2\sqrt{2}}$$

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

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

$$[\text{Because: } (a - b)^2 = a^2 + b^2 - 2ab]$$

Question 8: If $a = \sqrt{2} + 1$, then find the value of $a - 1/a$.

Solution:

$$\text{Given: } a = \sqrt{2} + 1$$

$$1/a = 1/(\sqrt{2} + 1)$$

$$= 1/(\sqrt{2} + 1) \times (\sqrt{2} - 1)/(\sqrt{2} - 1)$$

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

$$= (\sqrt{2} - 1)/1$$

$$= \sqrt{2} - 1$$

Now,

$$a - 1/a = (\sqrt{2} + 1) - (\sqrt{2} - 1)$$

$$= 2$$

Question 9: If $x = 2 + \sqrt{3}$, find the value of $x + 1/x$.

Solution:

$$\text{Given: } x = 2 + \sqrt{3}$$

$$1/a = 1/(2 + \sqrt{3})$$

$$= 1/(2 + \sqrt{3}) \times (2 - \sqrt{3})/(2 - \sqrt{3})$$

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

$$= (2 - \sqrt{3}) / (4 - 3)$$

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

Now,

$$x + 1/x = (2 + \sqrt{3}) + (2 - \sqrt{3})$$

$$= 4$$

Question 10: Write the rationalisation factor of $\sqrt{5} - 2$.

Solution:

Rationalisation factor of $\sqrt{5} - 2$ is $\sqrt{5} + 2$

Question 11: If $x = 3 + 2\sqrt{2}$, then find the value of $\sqrt{x} - 1/\sqrt{x}$.

Solution:

$$x = 3 + 2\sqrt{2}$$

$$\begin{aligned} \frac{1}{x} &= \frac{1}{3 + 2\sqrt{2}} = \frac{(3 - 2\sqrt{2})}{(3 + 2\sqrt{2})(3 - 2\sqrt{2})} \\ &= \frac{3 - 2\sqrt{2}}{(3)^2 - (2\sqrt{2})^2} = \frac{3 - 2\sqrt{2}}{9 - 8} = \frac{3 - 2\sqrt{2}}{1} \end{aligned}$$

$$x + \frac{1}{x} = 3 + 2\sqrt{2} + 3 - 2\sqrt{2} = 6$$

$$\begin{aligned} \text{Now, } \left(\sqrt{x} - \frac{1}{\sqrt{x}} \right)^2 &= x + \frac{1}{x} - 2 \\ &= 6 - 2 = 4 = (2)^2 \end{aligned}$$

$$\left(\sqrt{x} - \frac{1}{\sqrt{x}} \right) = 2$$