

RD Sharma Solutions for Class 9 Maths Chapter 3 Rationalisation

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)

$$\begin{aligned}\text{Using: } \sqrt[n]{a} \times \sqrt[n]{b} &= \sqrt[n]{a \times b} \\ &= \sqrt[3]{4 \times 16} \\ &= \sqrt[3]{64} \\ &= \sqrt[3]{4^3} \\ &= (4^3)^{\frac{1}{3}} \\ &= 4\end{aligned}$$

(ii)

$$\begin{aligned}\text{(Note: } \frac{\sqrt[n]{a}}{\sqrt[n]{b}} &= \sqrt[n]{\frac{a}{b}}) \\ &= \sqrt[4]{\frac{1250}{2}} \\ &= \sqrt[4]{\frac{2 \times 625}{2}} \\ &= \sqrt[4]{625} \\ &= \sqrt[4]{5^4} \\ &= 5^{(4 \times \frac{1}{4})} \\ &= 5\end{aligned}$$

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:

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

$$= 12 + 4\sqrt{2} + 3\sqrt{7} + \sqrt{14}$$

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

$$= 15 - 3\sqrt{2} + 5\sqrt{3} - \sqrt{6}$$

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

$$= \sqrt{15} - \sqrt{25} - 2\sqrt{3} + 2\sqrt{5}$$

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

Question 3: Simplify the following expressions:

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

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

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

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

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

Solution:

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

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

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

$$= 121 - 11$$

$$= 110$$

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

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

$$= 25 - 7 = 18$$

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

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

$$= 8 - 2$$

$$= 6$$

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

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

$$= 9 - 3$$

$$= 6$$

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

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

$$= 5 - 2$$

$$= 3$$

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

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

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

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

Exercise 3.2

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.

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

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

$$= 3\sqrt{5/5}$$

(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.

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

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

$$\begin{aligned}\frac{\sqrt{2}+\sqrt{5}}{\sqrt{3}} &= \frac{(\sqrt{2}+\sqrt{5}) \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} \\ &= \frac{\sqrt{6}+\sqrt{15}}{3}\end{aligned}$$

(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:

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

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

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

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

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

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

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

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

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

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

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

$$\begin{aligned} (vi) \frac{\sqrt{2}-1}{\sqrt{5}} &= \frac{(\sqrt{2}-1) \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}} \\ &= \frac{\sqrt{10}-\sqrt{5}}{5} = \frac{3.162-2.236}{5} \\ &= \frac{0.926}{5} = 0.185 \end{aligned}$$

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

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

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

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

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:

$$\begin{aligned}
 & \text{(i) } \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}} \quad \text{(ii) } \frac{5+2\sqrt{3}}{7+4\sqrt{3}} \quad \text{(iii) } \frac{1+\sqrt{2}}{3-2\sqrt{2}} \\
 & \text{(iv) } \frac{2\sqrt{6}-\sqrt{5}}{3\sqrt{5}-2\sqrt{6}} \quad \text{(v) } \frac{4\sqrt{3}+5\sqrt{2}}{\sqrt{48}+\sqrt{18}} \quad \text{(vi) } \frac{2\sqrt{3}-\sqrt{5}}{2\sqrt{2}+3\sqrt{3}}
 \end{aligned}$$

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.

$$\begin{aligned}
 & \frac{2\sqrt{3}-\sqrt{5}}{2\sqrt{2}+3\sqrt{3}} \\
 &= \frac{(2\sqrt{3}-\sqrt{5})(2\sqrt{2}-3\sqrt{3})}{(2\sqrt{2}+3\sqrt{3})(2\sqrt{2}-3\sqrt{3})} \\
 &= \frac{(2\sqrt{3}-\sqrt{5})(2\sqrt{2}-3\sqrt{3})}{8-27} \\
 &= \frac{(4\sqrt{6}-2\sqrt{10})-18+3\sqrt{15}}{-19} \\
 &= \frac{(18-4\sqrt{6}+2\sqrt{10}-3\sqrt{15})}{19}
 \end{aligned}$$

Exercise VSAQs

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

Solution:

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

[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

$$\begin{aligned}\frac{\sqrt{3}-1}{\sqrt{3}+1} &= \frac{(\sqrt{3}-1)}{(\sqrt{3}+1)} \times \frac{(\sqrt{3}-1)}{(\sqrt{3}-1)} = \frac{(\sqrt{3}-1)^2}{(\sqrt{3})^2 - (1)^2} \\ &= \frac{3+1-2\sqrt{3}}{3-1} = \frac{4-2\sqrt{3}}{2} = 2 - \sqrt{3}\end{aligned}$$

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:

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

[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:

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

$$\begin{aligned}1/a &= 1/(\sqrt{2} + 1) \\&= 1/(\sqrt{2} + 1) \times (\sqrt{2} - 1)/(\sqrt{2} - 1) \\&= (\sqrt{2} - 1)/((\sqrt{2})^2 - (1)^2) \\&= (\sqrt{2} - 1)/1 \\&= \sqrt{2} - 1\end{aligned}$$

Now,

$$\begin{aligned}a - 1/a &= (\sqrt{2} + 1) - (\sqrt{2} - 1) \\&= 2\end{aligned}$$

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

Solution:

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

$$\begin{aligned}1/x &= 1/(2 + \sqrt{3}) \\&= 1/(2 + \sqrt{3}) \times (2 - \sqrt{3})/(2 - \sqrt{3}) \\&= (2 - \sqrt{3})/((2)^2 - (\sqrt{3})^2) \\&= (2 - \sqrt{3})/(4 - 3) \\&= (2 - \sqrt{3})\end{aligned}$$

Now,

$$\begin{aligned}x + 1/x &= (2 + \sqrt{3}) + (2 - \sqrt{3}) \\&= 4\end{aligned}$$

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:

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

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

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

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

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