Exercise 3.1 Page No: 3.2

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

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

$= \sqrt[4]{\frac{2\times625}{2}}$

$= \sqrt[4]{625}$

$= \sqrt[4]{5^4}$

$= 5^{(4 \times \frac{1}{4})}$

$= 5$

Question 2: Simplify the following expressions:

(i) (4 + √7) (3 + √2)

(ii) (3 + √3)(5- √2)

(iii) (√5 -2)(√3 – √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 Page No: 3.13

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

(i) 3/ √5 (ii) 3/(2 √5) (iii) 1/ √12 (iv) √2/ √5
(v) (√3 + 1)/ √2 (vi) (√2 + √5)/ √3 (vii) 3 √2/ √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√5/5

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

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

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

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

$$\frac{1}{\sqrt{12}} = \frac{1}{\sqrt{4\times 3}} = \frac{1}{2\sqrt{3}}$$

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

(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.

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

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

(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 √2 = 1.414, √3 = 1.732, √5 = 2.236 and √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) $\frac{1}{3+\sqrt{2}}$ (ii) $\frac{1}{\sqrt{6}-\sqrt{5}}$ (iii) $\frac{16}{\sqrt{41}-5}$

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

(vii) $\frac{6-4\sqrt{2}}{6+4\sqrt{2}}$ (viii) $\frac{3\sqrt{2}+1}{2\sqrt{5}-3}$ (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−√2

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

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

$$= \frac{3-\sqrt{2}}{9-2}$$

$$= \frac{3-\sqrt{2}}{7}$$

(ii) Multiply and divide given number by √6 + √5

$$\frac{1}{\sqrt{6}-\sqrt{5}}$$

$$= \frac{\sqrt{6}+\sqrt{5}}{(\sqrt{6}-\sqrt{5})(\sqrt{6}+\sqrt{5})}$$

$$= \frac{\sqrt{6}+\sqrt{5}}{6-5}$$

$$= \sqrt{6}+\sqrt{5}$$

(iii) Multiply and divide given number by √41 + 5

$\frac{16}{\sqrt{41}-5}$

$= \frac{16\times(\sqrt{41}+5)}{(\sqrt{41}-5)(\sqrt{41}+5)}$

$= \frac{16\sqrt{41}+80}{41-25}$

$= \frac{16\sqrt{41}+80}{16}$

$= \frac{16(\sqrt{41}+5)}{16}$

$= \sqrt{41}+5$

(iv) Multiply and divide given number by 5√3 + 3√5

$\frac{30}{5\sqrt{3}-3\sqrt{5}}$

$= \frac{30\times(5\sqrt{3}+3\sqrt{5})}{(5\sqrt{3}-3\sqrt{5})(5\sqrt{3}+3\sqrt{5})}$

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

$= \frac{30\times(5\sqrt{3}+3\sqrt{5})}{30}$

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

(v) Multiply and divide given number by 2√5 + √3

$\frac{1}{2\sqrt{5}-\sqrt{3}}$

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

$= \frac{2\sqrt{5}+\sqrt{3}}{20-3}$

$= \frac{2\sqrt{5}+\sqrt{3}}{17}$

(vi) Multiply and divide given number by 2√2 + √3

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

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

$$= \frac{(2\sqrt{6}+3+2\sqrt{2}+\sqrt{3})}{8-3}$$

$$= \frac{(2\sqrt{6}+3+2\sqrt{2}+\sqrt{3})}{5}$$

(vii) Multiply and divide given number by 6 - 4√2

$$\frac{6-4\sqrt{2}}{6+4\sqrt{2}}$$

$$= \frac{(6-4\sqrt{2})(6-4\sqrt{2})}{(6+4\sqrt{2})(6-4\sqrt{2})}$$

$$= \frac{(6-4\sqrt{2})^2}{36-32}$$

$$= \frac{36-48\sqrt{2}+32}{4}$$

$$= \frac{68-48\sqrt{2}}{4}$$

$$= \frac{4(17-12\sqrt{2})}{4}$$

$$= 17 - 12\sqrt{2}$$

(viii) Multiply and divide given number by 2√5 + 3

$$\frac{3\sqrt{2}+1}{2\sqrt{5}-3}$$

$$= \frac{(3\sqrt{2}+1)\times(2\sqrt{5}+3)}{(2\sqrt{5}-3)(2\sqrt{5}+3)}$$

$$= \frac{6\sqrt{10}+9\sqrt{2}+2\sqrt{5}+3}{(20-9)}$$

$$= \frac{6\sqrt{10}+9\sqrt{2}+2\sqrt{5}+3}{11}$$

(ix) Multiply and divide given number by √(a^2+b^2) - a

$$\frac{b^2}{\sqrt{(a^2+b^2)}+a}$$

$$= \frac{b^2(\sqrt{(a^2+b^2)}-a)}{(\sqrt{(a^2+b^2)}+a)(\sqrt{(a^2+b^2)}-a)}$$

$$= \frac{b^2(\sqrt{(a^2+b^2)}-a)}{(a^2+b^2)-a^2)}$$

$$= \frac{b^2(\sqrt{(a^2+b^2)}-a)}{b^2}$$

Question 4: Rationales 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 √3–√2 to rationalise the denominator.

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

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

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

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

$$= 5 - 2\sqrt{6}$$

(ii) Multiply both numerator and denominator by 7–4√3 to rationalise the denominator.

$$\frac{5+2\sqrt{3}}{7+4\sqrt{3}}$$

$$= \frac{(5+2\sqrt{3})(7-4\sqrt{3})}{(7+4\sqrt{3})(7-4\sqrt{3})}$$

$$= \frac{(5+2\sqrt{3})(7-4\sqrt{3})}{49-48}$$

$$= 35 - 20\sqrt{3} + 14\sqrt{3} - 24$$

$$= 11 - 6\sqrt{3}$$

(iii) Multiply both numerator and denominator by 3+2√2 to rationalise the denominator.

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

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

$$= \frac{(1+\sqrt{2})(3+2\sqrt{2})}{9-8}$$

$$= 3 + 2\sqrt{2} + 3\sqrt{2} + 4$$

$$= 7 + 5\sqrt{2}$$

(iv) Multiply both numerator and denominator by 3√5+2√6 to rationalise the denominator.

$$\frac{2\sqrt{6}-\sqrt{5}}{3\sqrt{5}-2\sqrt{6}}$$

$$= \frac{(2\sqrt{6}-\sqrt{5})(3\sqrt{5}+2\sqrt{6})}{(3\sqrt{5}-2\sqrt{6})(3\sqrt{5}+2\sqrt{6})}$$

$$= \frac{(2\sqrt{6}-\sqrt{5})(3\sqrt{5}+2\sqrt{6})}{45-24}$$

$$= \frac{(2\sqrt{6}-\sqrt{5})(3\sqrt{5}+2\sqrt{6})}{21}$$

$$= \frac{6\sqrt{30}+24-15-2\sqrt{30}}{21}$$

$$= \frac{4\sqrt{30}+9}{21}$$

(v) Multiply both numerator and denominator by √48–√18 to rationalise the denominator.

$$\frac{4\sqrt{3}+5\sqrt{2}}{\sqrt{48}+\sqrt{18}}$$

$$= \frac{(4\sqrt{3}+5\sqrt{2})(\sqrt{48}-\sqrt{18})}{(\sqrt{48}+\sqrt{18})(\sqrt{48}-\sqrt{18})}$$

$$= \frac{(4\sqrt{3}+5\sqrt{2})(\sqrt{48}-\sqrt{18})}{48-18}$$

$$= \frac{48-12\sqrt{6}+20\sqrt{6}-30}{30}$$

$$= \frac{18+8\sqrt{6}}{30}$$

$$= \frac{9+4\sqrt{6}}{15}$$

(vi) Multiply both numerator and denominator by 2√2 – 3√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

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

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

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

$= 4 - 3$

$= 1$

Question 2: Write the reciprocal of $5 + \sqrt{2}$.
Solution:
Reciprocal of $5+\sqrt{2} = \frac{1}{5+\sqrt{2}}$

Rationalisation of fraction

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

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

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 = √2 – 1, then write the value of 1/x.
Solution:
x = √2 – 1

or 1/x = 1/(√2 – 1)

Rationalising denominator, we have

= 1/(√2 – 1) x (√2 + 1)/(√2 + 1)

= (√2 + 1)/(2-1)

= √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:

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

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

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

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

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

Question 8: If a = √2 +1, then find the value of a – 1/a.
Solution:

Given: a = √2 + 1

1/a = 1/(√2 + 1)

= 1/(√2 + 1) x (√2 - 1)/(√2 - 1)

= (√2 - 1)/ ((√2)^2 - (1)^2)

= (√2 - 1)/1

= √2 - 1

Now,

a - 1/a = (√2 + 1) - (√2 - 1)

= 2

Question 9: If x = 2 + √3, find the value of x + 1/x.
Solution:
Given: x = 2 + √3

1/x = 1/(2 + √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 √5 – 2.
Solution:
Rationalisation factor of $\sqrt{5} - 2$ is $\sqrt{5} + 2$

Question 11: If x = 3 + 2√2, then find the value of √x – 1/√x.

Solution:

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

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

$$= \frac{3-2\sqrt{2}}{(3)^2-(2\sqrt{2})^2} = \frac{3-2\sqrt{2}}{9-8} = \frac{3-2\sqrt{2}}{1}$$

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

Now, $$\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2 = x + \frac{1}{x} - 2$$

$$= 6 - 2 = 4 = (2)^2$$

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