Date: ....
Page: ....

Unit - 11
Surds

Laws of Surds

i) $\sqrt[n]{a} = a^{\frac{1}{n}}$ So, $(\sqrt[n]{a})^n = a$.

ii) $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$

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

iv) $\sqrt[n]{a} + \sqrt[n]{a} = 2\sqrt[n]{a}$

v) $\sqrt[m]{\sqrt[n]{a}} = \sqrt[n]{\sqrt[m]{a}} = \sqrt[mn]{a}$

vi) $2\sqrt[n]{a} - \sqrt[n]{a} = \sqrt[n]{a}$

Ex - 11.1

1. Simplify:

a) $\sqrt{2} + 5\sqrt{2} + 2\sqrt{2}$

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

$= 8\sqrt{2}$

b) $5\sqrt{3} + 6\sqrt{3} - \sqrt{3}$

$= (5+6-1)\sqrt{3}$

$= 10\sqrt{3}$

c) $\sqrt{5} - 4\sqrt{5} + 6\sqrt{5}$

$= (1-4+6)\sqrt{5}$

$= 9\sqrt{5}$

d) $8\sqrt[3]{4} - \sqrt[3]{4} - 3\sqrt[3]{4}$

$= (8-1-3)\sqrt[3]{4}$

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

Page:

e) $\sqrt[3]{7} + 4\sqrt[3]{7} - 9\sqrt[3]{7}$

$= (1+4-9)\sqrt[3]{7}$

$= -4\sqrt[3]{7}$

f) $2\sqrt[4]{6} - \sqrt[4]{6} - 3\sqrt[4]{6}$

$= (2-1-3)\sqrt[4]{6}$

$= -2\sqrt[4]{6}$

2. Simplify:

a. $\sqrt{2} \times \sqrt{3} \times \sqrt{5}$

$= \sqrt{30}$

b. $\sqrt{6} \times \sqrt{3} \times 2\sqrt{2}$

$= 2\sqrt{6 \times 3 \times 2} = 2\sqrt{36} =$

c. $\sqrt[3]{9} \times \sqrt[3]{3} \times 3\sqrt[3]{2}$

$= 3\sqrt[3]{9 \times 3 \times 2}$

$= 3\sqrt[3]{54}$

$= 9\sqrt[3]{6}$

d) $5\sqrt{8} \div 2\sqrt{2}$

$= \frac{5\sqrt{8}}{2\sqrt{2}}$

$= \frac{10\sqrt{2}}{2\sqrt{2}}$

$= 5.$

e) $5\sqrt[3]{108} \div 3\sqrt[3]{2}$

$= \frac{5\sqrt[3]{108}}{3\sqrt[3]{2}}$

$= \frac{\cancel{30}\,10\sqrt[3]{3}}{\cancel{3}\sqrt[3]{2}}$

$= 5\sqrt[3]{6}$

f) $4\sqrt{360} \div 3\sqrt{20}$

$= \frac{4\sqrt{360}}{3\sqrt{120}}$

$= \frac{24\sqrt{10}}{6\sqrt{5}}$

$= \cancel{\frac{4\sqrt{3}}{3}}\ 4\sqrt{5}.$

Date: ....

Page: ....

3 Simplify:

a. $\sqrt{32} + \sqrt{8} - \sqrt{72}$

$= \sqrt{2^2 \times 2^2 \times 2} + \sqrt{2^2 \times 2} - \sqrt{2^2 \times 2 \times 3^2}$

$= 2 \times 2\sqrt{2} + 2\sqrt{2} - 2 \times 3\sqrt{2}$

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

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

$= 0.$

b. $\sqrt{27} + \sqrt{75} - 8\sqrt{3}$

$= \cancel{\sqrt{3^2 \times 3} +}$

$= 3\sqrt{3} + 5\sqrt{3} - 8\sqrt{3}$

$= (3+5-8)\sqrt{3}$

$= 0\sqrt{3}$

$= 0$

c. $4\sqrt{45} - 3\sqrt{20} + 8\sqrt{5}$

$= 12\sqrt{5} - 6\sqrt{5} + 8\sqrt{5}$

$= (12-6+8)\sqrt{5}$

$= 14\sqrt{5}$

d) $\sqrt{12} - \sqrt{75} + \sqrt{48}$

$= 2\sqrt{3} - 5\sqrt{3} + 4\sqrt{3}$
$= (2-5+4)\sqrt{3}$
$= 1\sqrt{3}$
$= \sqrt{3}$

e) $\sqrt[3]{16} + \sqrt[3]{54} - \sqrt[3]{250}$

$= 2\sqrt[3]{2} + 3\sqrt[3]{2} - 5\sqrt[3]{2}$
$= 5\sqrt[3]{2} - 5\sqrt[3]{2}$
$= 0$

f) $5\sqrt[3]{81} - 2\sqrt[3]{24} + \sqrt{375}$

$= 5\sqrt[3]{3\times3\times3\times3} - 2\sqrt[3]{2\times2\times2\times3} + \sqrt[3]{3\times5\times5\times5}$
$= 15\sqrt[3]{3} - 4\sqrt[3]{3} + 5\sqrt[3]{3}$
$= 16\sqrt[3]{3}$

g) $4\sqrt[4]{405} - 3\sqrt[4]{80} - 2\sqrt[4]{5}$

$= \cancel{4\sqrt[4]{3x}}$
$= 12\sqrt[4]{5} - 6\sqrt[4]{5} - 2\sqrt[4]{5}$
$= 4\sqrt[4]{5}$

h) $3\sqrt{2} + \sqrt[4]{2500} - \sqrt[4]{64} + 6\sqrt{8}$

$= 3\sqrt{2} + 5\sqrt{2} - 2\sqrt{2} + 12\sqrt{2}$
$= 18\sqrt{2}$

4a $(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})$

$= \sqrt{3}\times\sqrt{3} - \sqrt{3}\times\sqrt{2} + \sqrt{2}\times\sqrt{3} - \sqrt{2}\times\sqrt{2}$

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

$= 1.$

b) $(\sqrt{5}-\sqrt{3})(\sqrt{5}+\sqrt{5})$

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

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

$= 2$

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

$= 2\times 2\sqrt{5}\cdot\sqrt{5} - 2\times 3\sqrt{2}\cdot\sqrt{5} + 3\times 2\sqrt{5}\cdot\sqrt{2} - 3\times 3$
$\sqrt{2}\cdot\sqrt{2}$

$= 20-6\sqrt{10}+6\sqrt{10}-18$

$= 2,,$

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

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

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

$= 2+\sqrt{6}+\sqrt{6}+3$

$= 5+2\sqrt{6}$

Date: ....
Page: ....

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

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

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

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

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

$= 8 - 2\sqrt{15}$

f) $(\sqrt{x+a} - \sqrt{x-a})^2$

$= (\sqrt{x+a} - \sqrt{x-a})(\sqrt{x+a} - \sqrt{x-a})$

$= \sqrt{x+a}\times\sqrt{x+a} - \sqrt{x+a}\times\sqrt{x-a} - \sqrt{x-a}\times\sqrt{x+a} + \sqrt{x-a}\times\sqrt{x-a}$

$= x+a - \sqrt{x^2-a^2} - \sqrt{x^2-a^2} + x-a$

$= 2(x - \sqrt{x^2-a^2})$

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

$= 2\times3\sqrt{2}\times\sqrt{2} + 2\sqrt{2}\cdot\sqrt{3} - \cancel{\sqrt{3}\times}\, 3\sqrt{3}\cdot\sqrt{2} - \sqrt{3}\times\sqrt{3}$

$= 12 + 2\sqrt{6} - 3\sqrt{6} - 3$

$= 9 + 2\cdot3\sqrt{6}$

$= 9\sqrt{6}$

h) $(3\sqrt{5}-4\sqrt{2})(2\sqrt{5}+2\sqrt{3})$

$= 3\cdot 2\sqrt{5}\cdot\sqrt{5} + 3\cdot 2\sqrt{5}\cdot\sqrt{3} - 4\cdot 2\sqrt{5}\cdot\sqrt{2} - 4\cdot 2\sqrt{2}\cdot\sqrt{3}$

$= 30 + 6\sqrt{15} - 8\sqrt{15} - 8\sqrt{6}$

$= \cancel{30+6-8-8\sqrt{15}}$

$= 30+6-8\sqrt{15} - 8\sqrt{6}$

$= 28\sqrt{15} - 8\sqrt{6}$

5. Simplify:

a. $\frac{\sqrt{a^2-b^2}}{\sqrt{a-b}}$

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

$= \sqrt{a+b}$

b) $\frac{\sqrt{x^2-9}}{\sqrt{x-3}}$

$= \frac{\sqrt{x^2-3^2}}{\sqrt{x-3}}$

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

$= \sqrt{x+3}$

c) $\frac{\sqrt[3]{25-x^2}}{\sqrt[3]{x+5}}$

$= \frac{\sqrt[3]{5^2-x^2}}{\sqrt[3]{x+5}}$

Page: ....

$$\frac{\cancel{(\sqrt[3]{5+x})}(\sqrt[3]{5x})}{\cancel{(\sqrt[3]{5+x})}}$$

$$\sqrt[3]{5-x}$$

d. $\dfrac{x-4}{\sqrt{x}+2}$

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

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

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

e) $\dfrac{3x-16}{4+\sqrt{3x}}$

$$= \frac{(\sqrt{3x})^2-(4)^2}{4+\sqrt{3x}}$$

$$= \frac{\cancel{(\sqrt{3x}+4)}(\sqrt{3x}-4)}{\cancel{(4+\sqrt{3x})}}$$

$$= \sqrt{3x}-4.$$

f) $\dfrac{49-5x}{7-\sqrt{5x}}$

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

$$\frac{(7+\sqrt{5x})\cancel{(7-\sqrt{5x})}}{\cancel{(7-\sqrt{5x})}}$$

$$7+\sqrt{5x}$$

6. Simplify.

a. $\dfrac{\sqrt{24}+\sqrt{54}}{10\sqrt{6}}$

$\dfrac{2\sqrt{6}+3\sqrt{6}}{10\sqrt{6}}$

$\dfrac{5\sqrt{6}}{10\sqrt{6}}$

$\dfrac{1}{2}$

b. $\dfrac{4\sqrt[3]{54}-2\sqrt[3]{250}}{6\sqrt[3]{128}}$

$= \dfrac{12\sqrt[3]{6}-10\sqrt[3]{10}}{48\sqrt[3]{2}}$

$= \dfrac{36\sqrt[3]{2}-50\sqrt[3]{2}}{48\sqrt[3]{2}}$

$= \dfrac{-14\sqrt[3]{2}}{48\sqrt[3]{2}}$

$= \dfrac{-7}{24}$

d. $\dfrac{3\sqrt[3]{81}-3\sqrt[3]{24}+2\sqrt[3]{375}}{13\sqrt[3]{192}}$

$\dfrac{3\sqrt[3]{3^3\times 3}-3\sqrt[3]{2^3\times 3}+2\sqrt[3]{5^3\times 3}}{13\sqrt[3]{2^3\times 2^3\times 3}}$

$\dfrac{9\sqrt[3]{3}-6\sqrt[3]{3}+10\sqrt[3]{3}}{\cancel{50}\ 52\sqrt[3]{3}}$

$= \dfrac{13\sqrt[3]{3}}{52\sqrt[3]{3}}$

Date: ....
Page: ....

$= \frac{1}{4}$

Ex-11.2

1. Rationalse the denominators and simplify.

a) $\frac{1}{\sqrt{2}+1}$

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

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

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

$= \sqrt{2}-1$

b) $\frac{1}{\sqrt{3}-2}$

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

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

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

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

$= -\sqrt{3}+2$

Page:

c) $\frac{3}{\sqrt{5}-\sqrt{2}}$

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

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

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

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

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

d) $\frac{4}{2\sqrt{3}-\sqrt{2}}$

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

$= \frac{8\sqrt{3}+\sqrt{2}}{4(\sqrt{3}^2-\sqrt{2}^2)}$

$= \frac{8\sqrt{3}+\sqrt{2}}{4(3-2)}$

$= \frac{8\sqrt{3}+\sqrt{2}}{4}$

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

e) $\frac{8}{3\sqrt{7}+2\sqrt{3}}$

$= \frac{5}{3\sqrt{7}+2\sqrt{3}} \times \frac{3\sqrt{7}+2\sqrt{3}}{3\sqrt{7}-2\sqrt{3}}$

$= \frac{15\sqrt{7}-2\sqrt{3}}{\cancel{9(\sqrt{7}^2} \; 9\sqrt{7}^2-4\sqrt{3}^2}$

$= \frac{15\sqrt{7}-2\sqrt{3}}{63-12}$

$= \frac{15\sqrt{7}-2\sqrt{3}}{51}$ $= \frac{5(\sqrt{7}-2\sqrt{3})}{17}$

$\sqrt{3}$

f) $\dfrac{2\sqrt{2}}{\sqrt{6}+\sqrt{3}}$

$= \dfrac{2\sqrt{2}}{\sqrt{6}+\sqrt{3}} \times \dfrac{\sqrt{6}-\sqrt{3}}{\sqrt{6}-\sqrt{3}}$

$= \dfrac{4\sqrt{3}-2\sqrt{6}}{\sqrt{6}^2-\sqrt{3}^2}$

$= \dfrac{4\sqrt{3}-2\sqrt{6}}{6-3}$

$= \dfrac{2}{3}(2\sqrt{3}-\sqrt{6})$

g) $\dfrac{5\sqrt{3}}{2\sqrt{3}-\sqrt{2}}$

$= \dfrac{5\sqrt{3}}{2\sqrt{3}-\sqrt{2}} \times \dfrac{2\sqrt{3}+\sqrt{2}}{2\sqrt{3}+\sqrt{2}}$

$= \dfrac{30+5\sqrt{6}}{4\sqrt{3}^2-\sqrt{2}^2}$

$= \dfrac{35\sqrt{6}}{10}$

$= \dfrac{7\sqrt{6}}{2}$

h) $\frac{4\sqrt{5}}{2\sqrt{3}+\sqrt{5}}$

$= \frac{4\sqrt{5}}{2\sqrt{3}+\sqrt{5}} \times \frac{2\sqrt{3}-\sqrt{5}}{2\sqrt{3}-\sqrt{5}}$

$= \frac{8\sqrt{15}-20}{4\sqrt{3}^2-\sqrt{5}^2}$

$= \cancel{8\sqrt{15}-20}$

$= \frac{8\sqrt{15}-20}{7}$

$= \frac{4}{7}(2\sqrt{15}-5)$

2. Rationalise the denominators and simplify:

a. $\frac{\sqrt{2}+1}{\sqrt{2}-1}$

$\Rightarrow \frac{\sqrt{2}+1}{\sqrt{2}-1} \times \cancel{\frac{\sqrt{2}+1}{\sqrt{2}-1}}$

$= 3+2\sqrt{2}$

b) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

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

$= 2-\sqrt{3}$

c) $\dfrac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

$= \dfrac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

$= 5-2\sqrt{6}$

d) $\dfrac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$

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

$= 4+\sqrt{15}$

e) $\dfrac{2\sqrt{3}-3\sqrt{2}}{2\sqrt{3}+3\sqrt{2}}$

$= \dfrac{2\sqrt{3}-3\sqrt{2}}{2\sqrt{3}+3\sqrt{2}}$

$= 2\sqrt{6}-5$

f) $\dfrac{3\sqrt{5}-\sqrt{3}}{\sqrt{5}-\sqrt{3}}$

$= \dfrac{3\sqrt{5}-\sqrt{3}}{\sqrt{5}-\sqrt{3}}$

$= 6+\sqrt{15}$

g) $\dfrac{\sqrt{a+b}-\sqrt{a-b}}{\sqrt{a+b}+\sqrt{a-b}}$

$= \dfrac{\sqrt{a+b}-\sqrt{a-b}}{\sqrt{a+b}+\sqrt{a-b}} \times \dfrac{\sqrt{a+b}+\sqrt{a-b}}{\sqrt{a+b}+\sqrt{a-b}}$

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

$\dfrac{(\sqrt{a+b})^2-2\sqrt{a+b}.\sqrt{a-b}+(\sqrt{a-b})^2}{a+b-a+b}$

Date:

Page:

$$\frac{a+\cancel{b}-2\sqrt{a^2-b^2}+a-\cancel{b}}{2b}$$

$$\frac{2a-2\sqrt{a^2-b^2}}{2b}$$

h) $\dfrac{\sqrt{x+1}-\sqrt{x-1}}{\sqrt{x+1}+\sqrt{x-1}}$

$$= \frac{\sqrt{x+1}-\sqrt{x-1}}{\sqrt{x+1}+\sqrt{x-1}} \times \frac{\sqrt{x+1}-\sqrt{x-1}}{\sqrt{x+1}-\sqrt{x-1}}$$

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

$$= \frac{(\sqrt{x+1})^2-2\sqrt{x+1}.\sqrt{x-1}+(\sqrt{x-1})^2}{\cancel{x}+1-\cancel{x}+1}$$

$$\frac{x+\cancel{1}-\sqrt{x^2-1}+x-\cancel{1}}{2}$$

$$= \frac{2x-\sqrt{x^2-1}}{2}\,_{//}$$

k) $\dfrac{\sqrt{2}}{\sqrt{2}+\sqrt{3}-\sqrt{5}}$

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

$$\frac{2+\sqrt{6}+\sqrt{10}}{(\sqrt{2}+\sqrt{5})^2-(\sqrt{5})^2}$$

$$\frac{2+\sqrt{6}+\sqrt{10}}{(\sqrt{2})^2+2\cdot\sqrt{2}\cdot\sqrt{3}+\sqrt{3}^2-5}$$

$$\frac{2+\sqrt{6}+\sqrt{10}}{2+2\sqrt{6}+3-5}$$

$$\frac{2+\sqrt{6}+\sqrt{10}}{2\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}}$$

$$\frac{2\sqrt{6}+6+\sqrt{60}}{2\times 6}$$

$$\frac{6+2\sqrt{6}+\sqrt{6\times 10}}{12}$$

$$\frac{6+2\sqrt{6}+2\sqrt{10}}{12}$$

$$\frac{\cancel{2}(3+\sqrt{6}+\sqrt{10})}{\cancel{10}_5}$$

$$\frac{3+\sqrt{6}+\sqrt{10}}{5}.$$

3. Simplify:

a) $3\sqrt{5} - \frac{1}{\sqrt{5}}$

b) $\frac{7}{\sqrt{3}} + 2\sqrt{3}$

Soln,

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

$= \frac{3\sqrt{5} \times \sqrt{5} - 1}{\sqrt{5}}$

$= \frac{15-1}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$

$= \frac{14\sqrt{5}}{5}$

$= \frac{7+2\sqrt{3} \times \sqrt{3}}{\sqrt{3}}$

$= \frac{7+6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= \frac{13\sqrt{3}}{3}$

Date: ....
Page: ....

c) $\frac{3}{\sqrt{5}} + \frac{\sqrt{5}}{2}$

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

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

$\frac{3\sqrt{5}\cdot 2 + \sqrt{5}\times 5}{10}$

$\frac{6\sqrt{5} + 5\sqrt{5}}{10}$

$\frac{11\sqrt{5}}{10}$

d) $\frac{7}{\sqrt{3}} - \frac{\sqrt{3}}{4}$

$\Rightarrow \frac{7}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} - \frac{\sqrt{3}}{4}$

$\Rightarrow \frac{7\sqrt{3}}{3} - \frac{\sqrt{3}}{4}$

$\Rightarrow \frac{4\cdot 7\sqrt{3} - \sqrt{3}\cdot 3}{12}$

$\Rightarrow \frac{28\sqrt{3} - 3\sqrt{3}}{12}$

$\Rightarrow \frac{28\sqrt{3} - 3\sqrt{3}}{12}$

$\Rightarrow \frac{25\sqrt{3}}{12}$

e) $\frac{\sqrt{2}}{5} + \frac{3}{\sqrt{2}}$

$\Rightarrow \frac{\sqrt{2}}{5} + \frac{3}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$

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

f) $\frac{\sqrt{7}}{3} + \frac{5}{2\sqrt{7}}$

$= \frac{7}{\sqrt{3}} + \frac{5}{2\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$

$= \frac{7}{\sqrt{3}} + \frac{5\sqrt{7}}{14}$

Date: ....
Page: ....

$= \frac{\sqrt{2}\times 2+3\sqrt{2}\times 5}{10}$ $\Rightarrow \frac{\sqrt{7}\times 14+5\sqrt{7}\times 3}{42}$

$\Rightarrow \frac{17\sqrt{2}}{10}$ $= \frac{29\sqrt{7}}{42}$ //

4. Simplify.

a. $\frac{\sqrt{3}+1}{\sqrt{3}-1}+\frac{\sqrt{3}-1}{\sqrt{3}+1}$

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

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

$= \frac{8}{3-1}$

$= 4.$

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

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

$\Rightarrow \frac{5-\sqrt{5}-(5-\sqrt{5})}{1}$

$= \frac{10}{1}$

$= 10$

Date: ....
Page: ....

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

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

$= \frac{10}{1} = 10$

d) $\frac{\sqrt{x}+\sqrt{a}}{\sqrt{x}-\sqrt{a}} - \frac{\sqrt{x}-\sqrt{a}}{\sqrt{x}+\sqrt{a}}$

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

$= \frac{\cancel{x} + 2\sqrt{x}\cdot\sqrt{a} + \cancel{a} - \cancel{x} + \cancel{2a}\, 2\sqrt{x}\cdot\sqrt{a} \cancel{+a}}{x-a}$

$\Rightarrow \frac{4\sqrt{ax}}{x-a}$ //

e) $\frac{x+\sqrt{x^2-1}}{x-\sqrt{x^2-1}} - \frac{x-\sqrt{x^2-1}}{x+\sqrt{x^2-1}}$

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

e) $\dfrac{x^2+2.x\sqrt{x^2-1}+x^2-1-x^2+2.x.\sqrt{x^2-1}-x^2+1}{1}$

$\Rightarrow 4x\sqrt{x^2-1}$

f) $\dfrac{a-\sqrt{a^2-1}}{a+\sqrt{a^2-1}}+\dfrac{a+\sqrt{a^2-1}}{a-\sqrt{a^2-1}}$

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

$\Rightarrow \dfrac{a^2-2a.\sqrt{a^2-1}+a^2-1+a^2+2a.\sqrt{a^2-1}.a^2-1}{1}$

$\Rightarrow 4a^2+2$

$\Rightarrow 2(2a^2+1)$,,

5- Simplify

a) $3\sqrt{20}+\dfrac{4}{\sqrt{5}}+\dfrac{\sqrt{5}+3}{\sqrt{5}-3}$

$= 3\sqrt{2^2\times 5}+\dfrac{4}{\sqrt{5}}\times\dfrac{\sqrt{5}}{\sqrt{5}}+\dfrac{\sqrt{5}+3}{\sqrt{5}-3}\times\dfrac{\sqrt{5}+3}{\sqrt{5}+3}$

$= 3\times 2\sqrt{5}+\dfrac{4\sqrt{5}}{5}+\dfrac{(\sqrt{5}+3)^2}{(\sqrt{5})^2-(3)^2}$

Page: ....

$$6\sqrt{5} + \frac{4\sqrt{5}}{5} + \frac{14+6\sqrt{5}+9}{5-9}$$

$$\frac{30\sqrt{5}+4\sqrt{5}}{5} + \frac{14+6\sqrt{5}}{-4}$$

$$\frac{34\sqrt{5}}{5} - \frac{14+6\sqrt{5}}{4}$$

$$\frac{136\sqrt{5} - 70 - 30\sqrt{5}}{20}$$

$$\frac{106\sqrt{5} - 70}{20}$$

$$\frac{2(53\sqrt{5} - 35)}{10}$$

$$\frac{1}{10}(53\sqrt{5} - 35)$$

b) $\sqrt{72} - \frac{48}{\sqrt{50}} - \frac{45}{\sqrt{128}} + 2\sqrt{98}$

$= 6\sqrt{2} - \frac{48}{5\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} - \frac{45}{8\sqrt{2}} + \frac{\sqrt{2}}{\sqrt{2}}$

Date: ....

Page: ....

e) $\frac{20\sqrt{2}-48\sqrt{2}}{10} - \frac{45\sqrt{2}}{16}$

$\Rightarrow \frac{80\times 20\sqrt{2} - 8\times 48\sqrt{2} - 5\times 45\sqrt{2}}{80}$

$\Rightarrow \frac{1600\sqrt{2} - 384\sqrt{2} - 225\sqrt{2}}{80}$

$= \frac{991\sqrt{2}}{80}.$

c) $\frac{2\sqrt{10}}{\sqrt{3}+1} - \frac{2\sqrt{5}}{\sqrt{6}+2} - \frac{\sqrt{10}}{\sqrt{2}+1}$

$= \frac{2\sqrt{10}}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} - \frac{2\sqrt{5}}{\sqrt{6}+2} \times \frac{\sqrt{6}-2}{\sqrt{6}-2} - \frac{\sqrt{10}}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1}$

$= \frac{2\sqrt{30}-2\sqrt{10}}{\sqrt{3}^2-1^2} - \frac{2\sqrt{30}-4\sqrt{5}}{\sqrt{6}^2-2^2} - \frac{\sqrt{20}-\sqrt{10}}{\sqrt{2}^2-1^2}$

$\Rightarrow \frac{2(\sqrt{30}-\sqrt{10})}{2} - \frac{2(\sqrt{30}-2\sqrt{5})}{2} - \frac{2\sqrt{5}-\sqrt{10}}{1}$

$\Rightarrow \sqrt{30} - \sqrt{10} - \sqrt{30} + 2\sqrt{5} - 2\sqrt{5} + \sqrt{10}$

$\Rightarrow 0.$

Date: ....

Page: ....

6 Simplify.

a) $\dfrac{\sqrt{x+1}+\sqrt{x-1}}{\sqrt{x+1}-\sqrt{x-1}}+\dfrac{\sqrt{x+1}-\sqrt{x-1}}{\sqrt{x-1}+\sqrt{x-1}}$

$\Rightarrow \dfrac{(\sqrt{x+1}+\sqrt{x-1})^2+(\sqrt{x+1}-\sqrt{x-1})^2}{(\sqrt{x+1}+\sqrt{x-1})(\sqrt{x+1}+\sqrt{x-1})}$

$= \dfrac{x+1+2\sqrt{x+1}\cdot\sqrt{x-1}+x-1+x+1-2\sqrt{x+1}\cdot\sqrt{x-1}+x-1}{(\sqrt{x+1})^2-(\sqrt{x-1})^2}$

$\Rightarrow \dfrac{4x}{x+1-x+1}$

$= \dfrac{4x}{2}$

$= 2x.$

b) $\dfrac{\sqrt{a+b}+\sqrt{a-b}}{\sqrt{a+b}-\sqrt{a-b}}+\dfrac{\sqrt{a+b}-\sqrt{a-b}}{\sqrt{a+b}+\sqrt{a-b}}$

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

Date: ....

Page: ....

$$= \frac{a+b+2\cdot\sqrt{a+b}\cdot\sqrt{a-b}+a-b+a+b-2\cdot\sqrt{a+b}\cdot\sqrt{a-b}+a-b}{a+b-a+b}$$

$$= \frac{4a}{2b}$$

$$= \frac{2a}{b}$$

c) $$\frac{\sqrt{2x+3}+\sqrt{2x-3}}{\sqrt{2x+3}-\sqrt{2x-3}} + \frac{\sqrt{2x+3}-\sqrt{2x-3}}{\sqrt{2x+3}+\sqrt{2x-3}}$$

$$\Rightarrow \frac{(\sqrt{2x+3}+\sqrt{2x-3})^2+(\sqrt{2x+3}-\sqrt{2x-3})^2}{2x+3-2x+3}$$

$$\Rightarrow \frac{2x+3+2\cdot\sqrt{2x+3}\cdot\sqrt{2x-3}+2x-3+2x+3-2\cdot\sqrt{2x+3}\cdot\sqrt{2x-3}+2x-3}{2x+3-2x+3}$$

$$= \frac{8x}{6}$$

$$= \frac{4x}{3}$$

Date: ....

Page: ....

d) $\frac{\sqrt{x^2+2}+\sqrt{x^2-2}}{\sqrt{x^2+2}-\sqrt{x^2-2}} + \frac{\sqrt{x^2+2}-\sqrt{x^2-2}}{\sqrt{x^2+2}+\sqrt{x^2-2}}$

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

$= \frac{x^2+2+2.\sqrt{x^2+2}\cdot\sqrt{x^2-2}+x^2-2+x^2+2-2\cdot\sqrt{x^2+2}\cdot\sqrt{x^2-2}+x^2-2}{4}$

$= \frac{4x^2}{4}$

$= x^2$

Ex-11.3

1. Solve

a) $\sqrt{x+1} = 5$

Squaring both sides.

$(\sqrt{x+1})^2 = 5^2$

$x+1 = 25$

$\therefore x = 24$

Date: ....
Page: ....

- Checking for $x = 24$

$\sqrt{24+1} = 5$

$\sqrt{25} = 5$

$5 = 5$ (True)

b) $\sqrt{2x-5} = 7$

Squaring both sides.

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

$2x-5 = 49$

$2x = 27$

checking for $x = 27$

or $\sqrt{2x-5} = 7$

or $\sqrt{2 \times 27 - 5} = 7$

or $\sqrt{49} = 7$

$\therefore$ $7 = 7$ (True)

d) $\sqrt{2x+3} - 3 = 0$

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

Squaring both sides.

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

$2x+3 = 9$

$2x = 6$

$x = 3$

Page:

Checking for $x = 3$

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

or, $\sqrt{9} = 3$

$\therefore$ $3 = 3$ (True)

f) $\sqrt[3]{x+5} - 1 = 2$

or, $\sqrt[3]{x+5} = 3$

Cubing both sides

$(\sqrt[3]{x+5})^3 = 3^3$

$x+5 = 27$

$x = 22$

Checking for $x = 22$

or, $\sqrt[3]{22+5} - 1 = 2$

or, $\sqrt[3]{27} - 1 = 2$

or, $3 - 1 = 2$

$\therefore$ $2 = 2$ (True)

g) $\sqrt[4]{2x-1} - 2 = 1$

or, $\sqrt[4]{2x-1} = 3$

Raising 4 on both sides

$(\sqrt[4]{2x-1})^4 = 3^4$

$2x - 1 = 81$

$2x = 82$

$\therefore x = 41$

h) $\sqrt{x+5} = \sqrt{2x-3}$

Squaring both side.

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

or $x+5 = 2x-3$

$x = 8$

Checking for $x=8$

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

$\sqrt{8+5} = \sqrt{2\times 8-3}$

$\sqrt{13} = \sqrt{13}$ (True)

$\therefore x = 8.$

Page: ....

Ex-11.3

3. Solve:

i) $\frac{\sqrt{x}+\sqrt{7}}{\sqrt{x}-\sqrt{7}} = 3$

$\sqrt{x}+\sqrt{7} = 3\sqrt{x} - 3\sqrt{7}$

$\sqrt{x} - 3\sqrt{x} = -3\sqrt{7} - \sqrt{7}$

$-2\sqrt{x} = -4\sqrt{7}$ $\therefore \sqrt{x} = 2\sqrt{7}$

Sq both sides

$(\sqrt{x})^2 = (2\sqrt{7})^2$

$x = 4\times 7$

$\therefore x = 28$

Checking for $x = 28$

$\frac{\sqrt{28}+\sqrt{7}}{\sqrt{28}-\sqrt{7}} = 3$

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

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

$3 = 3$ True

$x = 28$

Date: ....
Page: ....

h) $\frac{\sqrt{y}+\sqrt{5}}{\sqrt{y}-\sqrt{5}} = 3$

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

$\sqrt{y}-3\sqrt{y} = -3\sqrt{5}-\sqrt{5}$

$-2\sqrt{y} = -4\sqrt{5}$

$\sqrt{y} = 2\sqrt{5}$

Sq both sides

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

$y = 4 \times 5$

$\therefore y = 20$

Checking for $y = 20$

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

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

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

$3 = 3$ True.

$y = 20$

4c) $2x+1 = \sqrt{4x^2+3x+6}$

Sq both sides.

$(2x+1)^2 = (\sqrt{4x^2+3x+6})^2$

or, $(2x)^2 + 2\cdot 2x\cdot 1 + 1^2 = 4x^2+3x+6$

or, $4x^2+4x+1-4x^2-3x-6=0$

or, $x-5=0$

$\therefore x=5$

Checking for $x=5$

$2\times 5+1 = \sqrt{4\times 5^2+3\times 5+6}$

$10+1 = \sqrt{100+15+6}$

$11 = \sqrt{121}$

$11 = 11$ True

$\therefore x = 5$.

5f.) $\sqrt{x} + \sqrt{x-\sqrt{1-x}} = 1$

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

Sq. both sides.

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

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

Sq. both sides

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

Date: ....
Page: ....

$$1-x = 1-4\sqrt{x}+4x$$
$$1-x-1+4\sqrt{x}-4x=0$$
$$4\sqrt{x}-5x=0$$
$$4\sqrt{5}=5x$$

Sq. both Sides

$$(4\sqrt{x})^2=(5x)^2$$
$$16x=25x^2$$
$$16x=25x^2$$
$$25x^2-16x=0$$
$$x(25x-16)=0$$

Either $\qquad$ OR

$x=0$ $\qquad$ $25x-16=0$

$$2\sqrt{x}=16$$
$$\therefore x=\frac{16}{25}$$

Checking for $x=0$

$$\sqrt{0}+\sqrt{0-\sqrt{1-0}}=1$$
$$0+\sqrt{0-\sqrt{1}}=1$$
$$0+\sqrt{0-1}=1$$
$$\sqrt{-1}=1 \text{ False}$$

Checking for $x=\frac{16}{25}$

$$\sqrt{\frac{16}{25}}+\sqrt{\frac{16}{25}-\sqrt{1-\frac{16}{25}}}=1$$

$$\frac{4}{5} + \sqrt{\frac{16}{5} - \sqrt{\frac{25-16}{25}}} = 1$$

$$\frac{4}{5} + \sqrt{\frac{16}{5} - \sqrt{\frac{9}{25}}} = 1$$

$$\frac{4}{5} + \sqrt{\frac{16}{25} - \frac{3}{5}} = 1$$

$$\frac{4}{5} + \sqrt{\frac{16-15}{25}} = 1$$

$$\frac{4}{5} + \frac{1}{5} = 1$$

$$\frac{5}{5} = 1$$

$1 = 1$ True.

$$x = \frac{16}{25}$$

6f $$\frac{7x-36}{6+\sqrt{7x}} = 9 - \frac{5\sqrt{7x-11}}{3}$$

$$\frac{(\sqrt{7x})^2 - 6^2}{6+\sqrt{7x}} = \frac{27 - 5\sqrt{7x-11}}{3}$$

Date: ....
Page: ....

$$\frac{(\sqrt{7x}+6)(\sqrt{7x}-6)}{(\sqrt{7x}+6)} = \frac{38-5\sqrt{7x}}{3}$$

$3\sqrt{7x} - 18 = 38 - 5\sqrt{7x}$

$3\sqrt{7x} + 5\sqrt{7x} = 38 + 18$

$8\sqrt{7x} = 56$

$\sqrt{7x} = 7$

Sq. both sides.

$7x = 49$

$x = 7$

Checking for $x = 7$

$$\frac{7\times7-36}{6+\sqrt{7\times7}} = \frac{9-5\sqrt{7\times7}-11}{3}$$

$$\frac{13}{6+7} = 9 - \frac{5\times7-11}{3}$$

$$\frac{13}{13} = 9 - \frac{24}{3}$$

$1 = 1$ True

$\therefore x = 7$

Page: ....

7(f) $\dfrac{\sqrt{x}+\sqrt{a}}{\sqrt{x}-\sqrt{a}} + \dfrac{\sqrt{x}-\sqrt{a}}{\sqrt{x}+\sqrt{a}} = 6$

$\dfrac{(\sqrt{x}+\sqrt{a})^2+(\sqrt{x}-\sqrt{a})^2}{(\sqrt{x}-\sqrt{a})(\sqrt{x}+\sqrt{a})} = 6$

$\dfrac{x+2\sqrt{x}\cdot\sqrt{a}+a+x-2\sqrt{x}\cdot\sqrt{a}+a}{x-a}$

$2x+2a = 6x-6a$

$2x-6x = -6a-2a$

$-4x = -8a$

$x = 2a.$

Checking for $x = 2a$

$\dfrac{\sqrt{2a}+\sqrt{a}}{\sqrt{2a}-\sqrt{a}} + \dfrac{\sqrt{2a}-\sqrt{a}}{\sqrt{2a}+\sqrt{a}} = 6$

$\dfrac{(\sqrt{2a}+\sqrt{a})^2+(\sqrt{2a}-\sqrt{a})^2}{(\sqrt{2a}-\sqrt{a})(\sqrt{2a}+\sqrt{a})} = 6$

$\dfrac{2a+\cancel{2\sqrt{2a}\cdot\sqrt{a}}+a+2a-\cancel{2\sqrt{2a}\cdot\sqrt{a}}+a}{2a-a} = 6$

$\dfrac{6a}{a} = 6$

$6 = 6$.

Ime

$x = 2a$

Date: ....
Page: ....

Checking for $x = 16$

$\sqrt{x-7} = \sqrt{x} - 1$
$\sqrt{16-7} = \sqrt{16} - 1$
$3 = 3$ (True)

c) $\sqrt{x+8} - 2 = \sqrt{x}$

$= \sqrt{x+8} - 2 = \sqrt{x}$
or $\sqrt{x+8} = 2 + \sqrt{x}$

Squaring both sides of the equation, we get,

$(\sqrt{x+8})^2 = (2+\sqrt{x})^2$
$x+8 = 2^2 + 2 \cdot 2\sqrt{x} + (\sqrt{x})^2$
$x+8 = 4 + 4\sqrt{x} + x$
$4\sqrt{x} = 4$
$\sqrt{x} = 1$
$x = 1$

Checking for $x = 1$

$\sqrt{x+8} - 2 = \sqrt{x}$
$\sqrt{1+8} - 2 = \sqrt{1}$
$3-2 = 1$
$1 = 1$ (True)

e) $\sqrt{x} = 6 - \sqrt{x-24}$

Soln,

$\sqrt{x-24} = 6 - \sqrt{x}$

Squaring both sides of the equation, we get

$(\sqrt{x-24})^2 = (6-\sqrt{x})^2$

$x - 24 = 6^2 + 2.6\sqrt{x} + (\sqrt{x})^2$

$x - 24 = 36 + 12\sqrt{x} - x$

$12\sqrt{x} = 60$.

$\sqrt{x} = 5$

$x = 25$

Checking for $x = 25$

$\sqrt{25-24} = 6 - \sqrt{25}$

$\sqrt{1} = 1$

$1 = 1$ (True).

g) $x + \sqrt{x^2 - 20} = 10$

Soln,

$(x + \sqrt{x^2 - 20}) + (-x) = 10 + (-x)$

$x + \sqrt{x^2 - 20} - x = 10 - x$

$x - x + \sqrt{x^2 - 20} = -x + 10$

$\sqrt{x^2 - 20} = -x + 10$

Date:
Page:

Squaring both sides

$(\sqrt{x^2-20})^2 = (-x+10)^2$

$x^2-20 = (-x)^2+2(-x)10+10^2$

$x^2-20 = x^2-2x\cdot10+100$

$x^2-20 = x^2-20x+100$

$-20 = -20x+100$

$-120 = -20x$

$x = 6$

Checking for $x=6$

$6+\sqrt{6^2-20} = 10$

$10 = 10$ (True)

3. Solve.

a) $\frac{x-1}{\sqrt{x}+1} = 1$

Soln,

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

$\frac{\cancel{(x-1)}(\sqrt{x}-1)}{\cancel{(x-1)}} = 1$

(v) $\sqrt{x}-1=1$

$\Rightarrow \sqrt{x}=2$

$\therefore x=4$

(i) $\frac{x-9}{\sqrt{x}+3}=1$

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

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

$= \sqrt{x}-3=1$

$\Rightarrow \sqrt{x}=4$

$\therefore x=2$

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

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

$$\sqrt{5x-2} + \frac{\sqrt{5x+2}}{2} = 2$$

$$2\sqrt{5x-4} + \sqrt{5x+2} = 4$$

Date: ....
Page: ....

$3\sqrt{5x} = 6$

$\sqrt{5x} = 2$

$x = 4/5$

f) $\dfrac{\sqrt{x} - 3}{\sqrt{x}} = \dfrac{2}{5}$

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

$= 5\sqrt{x} - 15 = 2\sqrt{x}$

$= 5\sqrt{x} - 2\sqrt{x} = 15$

$= 3\sqrt{x} = 15$

$= \sqrt{x} = 5$

$x = 5^2$

$x = 25$

4. Solve:

a) $\sqrt{2x+7} = x+2$

⇒ Squaring both sides of the equation, we get

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

$2x+7 = x^2 + 4x - 4$

$x^2 - 2x = 11$

$x(x-2) = 11$

Either $x = 11$ or $x - 2 = 11$

$x = 13$

Date: ....

Page: ....

b) $\sqrt{2x+9} = 13 - x.$

Soln,

Squaring both sides.

$(\sqrt{2x+9})^2 = (13-x)^2$

$2x+9 = 13^2 - 2\cdot13\cdot x + x^2$

$2x+9 = 169 - 26x + x^2$

$x^2 + 160 - 28x = 0$

$x^2 - 20x - 8x + 160 = 0$

$(x-20)(x-8) = 0$

∴ $\cancel{x=20}$

Either, OR.

$x - 20 = 0$ $x - 8 = 0$

$x = 20$ $x = 8.$

Substituting $x = 20$ in the original equation, we get

$\sqrt{2\times20+9} = 13 - 20$

$7 = -7$ which is false.

Substituting $x = 8$ in the given equation, we get

$\sqrt{2\times8+9} = 13 - 8$

$5 = 5$ which is True.

So, the required value of x is 5

Date:

Page:

d) $3x - \sqrt{7x+2} = 2$

Soln,

$-\sqrt{7x+2} = -3x+2$

Squaring both sides.

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

$7x+2 = (3x)^2 + 2(-3x)2 + 2^2$

$7x+2 = 9x^2 - 12x + 4$

$7x+2 - (9x^2 - 12x + 4) = 0$

$\cancel{7x}\ 19x - 9x^2 - 2 = 0$

$9x^2 - 19x + 2 = 0$

$9x^2 - 18x - x + 2 = 0$

$9x(x-2) - 1(x-2) = 0$

$(x-2)(9x-1) = 0$

Either or

$x - 2 = 0$ $9x - 1 = 0$

$x = 2$ $9x = 1$

$x = 1/9$

Substituting $x = 2$ in the Original eqn. we get.

$3\times2 - \sqrt{7\times2+2} = 2$

$6 - \sqrt{14+2} = 2$

$2 = 2$ which is Tru.

$\therefore$ So. the required value of x is 2.

Date: ....

Page: ....

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

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

Squaring both sides.

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

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

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

$3x+1 = x + 4 \cdot \sqrt{x-1} - 1 + 4$

$\cancel{3x+1} =$

$2x - 2 = 4 \cdot \sqrt{x-1}$

Again,

Squaring the both Sides

$(2x-2)^2 = (4\sqrt{x-1})^2$

$4x^2 - 8x + 4 = 16x - 16$

$4x^2 - 8x + 4 - 16x + 16 = 0$

$4x^2 - 24x + 20 = 0$

$2^2(x^2 - (6x) + 5) = 0$

$x^2 - 6x + 5 = 0$

$x^2 - 5x - x + 5 = 0$

$(x-5)(x-1) = 0$

Either $x - 5 = 0$, $x = 5$

or $x - 1 = 0$, $x = 1$

Date: ....
Page: ....

Substituting $x=5$ in original eqn, we get;

$$\sqrt{3\times5+1} - \sqrt{5-1} = 2$$

$2 = 2$ which is True

Substituting $x=1$ in original eqn we get

$$\sqrt{3\times1+1} - \sqrt{1-1} = 2$$

$2 = 2$ Which is True.

$\therefore$ So the required value is (5, 1).

5. Solve :

a) $\sqrt{x} + \sqrt{5+x} = \dfrac{15}{\sqrt{5+x}}$

Soln,

$$\sqrt{x} = \frac{15}{\sqrt{5+x}} - \sqrt{5+x}$$

or $\sqrt{x} = \dfrac{15-(\sqrt{5+x})(\sqrt{5+x})}{(\sqrt{5+x})}$

or $\sqrt{x}(\sqrt{5+x}) = 15 - \sqrt{(5+x)}^2$

or $\sqrt{x(5+x)} = 15-5-x$

or $\sqrt{x(5+x)} = 10-x$

Date: ....

Page: ....

Squaring both sides

or $\left(\sqrt{x(5+x)}\right)^2 = (10-x)^2$

or $x(5+x) = 10^2 - 2\times10\times x + x^2$

or $5x + x^2 = 100 - 20x + x^2$

or $x^2 - x^2 + 5x + 20x = 100$

or $x = \frac{100}{25}$

$\therefore$ $x = 4$

c) $2\sqrt{x} - \sqrt{4x-3} = \frac{1}{\sqrt{4x-3}}$

Soln,

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

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

$\cancel{2\sqrt{x}\sqrt{4x-3}}$

$2\sqrt{x(4x-3)} = 1 + \sqrt{(4x-3)(4x-3)}$

$2\sqrt{x(4x-3)} = 1 + \sqrt{(4x-3)^2}$

$2\sqrt{x(4x-3)} = 1 + 4x - 3$

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

$2\sqrt{x(4x-3)} = 2(2x-1)$

$\sqrt{x(4x-3)} = 2x-1$

Date: ....
Page: ....

Squaring both sides.

$(\sqrt{x(4x-3)})^2 = (2x-1)^2$

$x(4x-3) = (2x)^2 - 2\cdot 2x\cdot 1 + 1^2$

$x(4x-3) = 4x^2 - 4x + 1$

$4x^2 - 3x - 4x^2 + 4x - 1 = 0$

$x = 1$

d) $\cancel{\dfrac{5\sqrt{x}-3}{\sqrt{x}+2} = \dfrac{3+5\sqrt{x}}{\sqrt{x}+5}}$

6. Solve:-

a) $\dfrac{x-1}{\sqrt{x}+1} = 4 + \dfrac{\sqrt{x}-1}{2}$

Soln,

or $\dfrac{(\sqrt{x})^2 - (1)^2}{\sqrt{x}+1} = 4 + \dfrac{\sqrt{x}-1}{2}$

or $\sqrt{x} - 1 = 4 + \dfrac{\sqrt{x}-1}{2}$

or $\sqrt{x} - 1 - \dfrac{\sqrt{x}-1}{2} = 4$

or $\dfrac{2(\sqrt{x}-1) - (\sqrt{x}-1)}{2} = 4$

Date: ....

Page: ....

or $\sqrt{x}-1=8$

or $\sqrt{x}=8+1$

or $\sqrt{x}=9$

Squaring both sides.

$$(\sqrt{x})^2=9^2$$

$$x=81.$$

c) $\dfrac{y-25}{5+\sqrt{y}}=4+\dfrac{\sqrt{y}-5}{5}$

• Soln,

$$\frac{(\sqrt{y})^2-5^2}{\sqrt{y}+5}=4+\frac{\sqrt{y}-5}{5}$$

$$\frac{(\sqrt{y}+5)(\sqrt{\cancel{5}y}-5)}{\sqrt{y}+5}=4+\frac{\sqrt{y}-5}{5}$$

$$\sqrt{y}-5=4+\frac{\sqrt{y}-5}{5}$$

$$\sqrt{y}-5-\frac{\sqrt{y}-5}{5}=4$$

$$\frac{5(\sqrt{y}-5)-(\sqrt{y}-5)}{5}=4$$

Date: ....
Page: ....

or $5\sqrt{y} - 25 - \sqrt{y} + 5 = 20$

or $4\sqrt{y} - 20 = 20$

or $4\sqrt{y} = 40$

or $\sqrt{y} = 10$

Squaring both sides.

or, $(\sqrt{y})^2 = 10^2$

$\therefore y = 100$

e) $\frac{3x-4}{2+\sqrt{3x}} - \frac{\sqrt{3x}-2}{2} = 2$

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

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

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

$\sqrt{3x} - 2 = 4$

$\sqrt{3x} = 6$

Squaring both sides

$(\sqrt{3x})^2 = 6^2$

$3x = 36$

$x = 12.$