

Rationalisation Ex 3.2 Q6

Answer:

(i) We know that rationalization factor for $\sqrt{3}+1$ is $\sqrt{3}-1$. We will multiply numerator and denominator of the given expression $\frac{\sqrt{3}-1}{\sqrt{3}+1}$ by $\sqrt{3}-1$, to get

$$\frac{\sqrt{3}-1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} = \frac{\left(\sqrt{3}\right)^2 + \left(1\right)^2 - 2 \times \sqrt{3} \times 1}{\left(\sqrt{3}\right)^2 - \left(1\right)^2}$$
$$= \frac{3+1-2\sqrt{3}}{3-1}$$
$$= \frac{4-2\sqrt{3}}{2}$$
$$= 2-\sqrt{3}$$

On equating rational and irrational terms, we get

$$a - b\sqrt{3} = 2 - \sqrt{3}$$

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

 $= 2 - 1\sqrt{3}$ Hence, we get a = 2, b = 1

(ii) We know that rationalization factor for $2+\sqrt{2}$ is $2-\sqrt{2}$. We will multiply numerator and denominator of the given expression $\frac{4+\sqrt{2}}{2+\sqrt{2}}$ by $2-\sqrt{2}$, to get

$$\frac{4+\sqrt{2}}{2+\sqrt{2}} \times \frac{2-\sqrt{2}}{2-\sqrt{2}} = \frac{4\times 2 - 4\times \sqrt{2} + 2\times \sqrt{2} - \left(\sqrt{2}\right)^{2}}{\left(2\right)^{2} - \left(\sqrt{2}\right)^{2}}$$

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

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

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

On equating rational and irrational terms, we get

$$a - \sqrt{b} = 3 - \sqrt{2}$$

Hence, we get a = 3, b = 2

(iii) We know that rationalization factor for $3-\sqrt{2}$ is $3+\sqrt{2}$. We will multiply numerator and denominator of the given expression $\frac{3+\sqrt{2}}{3-\sqrt{2}}$ by $3+\sqrt{2}$, to get

$$\begin{aligned} \frac{3+\sqrt{2}}{3-\sqrt{2}} \times \frac{3+\sqrt{2}}{3+\sqrt{2}} &= \frac{\left(3\right)^2 + \left(\sqrt{2}\right)^2 + 2 \times 3 \times \sqrt{2}}{\left(3\right)^2 - \left(\sqrt{2}\right)^2} \\ &= \frac{9+2+6\sqrt{2}}{9-2} \\ &= \frac{11+6\sqrt{2}}{7} \\ &= \frac{11}{7} + \frac{6}{7}\sqrt{2} \end{aligned}$$

On equating rational and irrational terms, we get

$$a + b\sqrt{2} = \frac{11}{7} + \frac{6}{7}\sqrt{2}$$

Hence, we get
$$a = \frac{11}{7}, b = \frac{6}{7}$$

(iv) We know that rationalization factor for $7+4\sqrt{3}$ is $7-4\sqrt{3}$. We will multiply numerator and denominator of the given expression $\frac{5+3\sqrt{3}}{7+4\sqrt{3}}$ by $7-4\sqrt{3}$, to get

$$\begin{split} \frac{5+3\sqrt{3}}{7+4\sqrt{3}} \times \frac{7-4\sqrt{3}}{7-4\sqrt{3}} &= \frac{5\times7-5\times4\times\sqrt{3}+3\times7\times\sqrt{3}-3\times4\times\left(\sqrt{3}\right)^2}{\left(7\right)^2-\left(4\sqrt{3}\right)^2} \\ &= \frac{35-20\sqrt{3}+21\sqrt{3}-36}{49-48} \\ &= \frac{\sqrt{3}-1}{1} \\ &= \sqrt{3}-1 \end{split}$$

On equating rational and irrational terms, we get

$$a+b\sqrt{3}=\sqrt{3}-1$$

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

Hence, we get a = -1, b = 1

(v) We know that rationalization factor for $\sqrt{11}+\sqrt{7}$ is $\sqrt{11}-\sqrt{7}$. We will multiply numerator and denominator of the given expression $\frac{\sqrt{11}-\sqrt{7}}{\sqrt{11}+\sqrt{7}}$ by $\sqrt{11}-\sqrt{7}$, to get

$$\begin{split} \frac{\sqrt{11} - \sqrt{7}}{\sqrt{11} + \sqrt{7}} \times \frac{\sqrt{11} - \sqrt{7}}{\sqrt{11} - \sqrt{7}} &= \frac{\left(\sqrt{11}\right)^2 + \left(\sqrt{7}\right)^2 - 2 \times \sqrt{11} \times \sqrt{7}}{\left(\sqrt{11}\right)^2 - \left(\sqrt{7}\right)^2} \\ &= \frac{11 + 7 - 2\sqrt{77}}{11 - 7} \\ &= \frac{18 - 2\sqrt{77}}{4} \\ &= \frac{9}{2} - \frac{1}{2}\sqrt{77} \end{split}$$

On equating rational and irrational terms, we get

$$a - b\sqrt{77} = \frac{9}{2} - \frac{1}{2}\sqrt{77}$$

Hence, we get $a = \frac{9}{2}, b = \frac{1}{2}$

(vi) We know that rationalization factor for $4-3\sqrt{5}$ is $4+3\sqrt{5}$. We will multiply numerator and denominator of the given expression $\frac{4+3\sqrt{5}}{4-3\sqrt{5}}$ by $4+3\sqrt{5}$, to get

$$\frac{4+3\sqrt{5}}{4-3\sqrt{5}} \times \frac{4+3\sqrt{5}}{4+3\sqrt{5}} = \frac{(4)^2 + (3\sqrt{5})^2 + 2\times 4\times 3\sqrt{5}}{(4)^2 - (3\sqrt{5})^2}$$
$$= \frac{16+45+24\sqrt{5}}{16-45}$$
$$= \frac{61+24\sqrt{5}}{-29}$$
$$= -\frac{61}{29} - \frac{24}{29}\sqrt{5}$$

On equating rational and irrational terms, we get

$$a + b\sqrt{5} = -\frac{61}{29} - \frac{24}{29}\sqrt{5}$$

Hence, we get
$$a = -\frac{61}{29}, b = -\frac{24}{29}$$

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