RATIONALISING THE DENOMINATOR

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If the denominator of an expression contains a term with a root, then the process of converting the expression to an equivalent expression whose denominator is a rational number, is called rationalising the denominator.

(1) Rationalise the denominators:-

(a) $\frac{1}{\sqrt{7}} = \frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$

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

(b) $\frac{4}{\sqrt{2}} = \frac{4}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$

$= \frac{4 \times \sqrt{2}}{2}$

$= \frac{\cancel{4}^{2} \times \sqrt{2}}{\cancel{2}_{1}}$

$= 2\sqrt{2}$

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

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

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

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

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

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

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

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

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

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

$$= \frac{8\sqrt{3} - 8\sqrt{5}}{(-2)} \times \frac{(-1)}{(-1)}$$

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

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

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

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

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

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

$$= \frac{(7 + 4\sqrt{3})}{1}$$

$$= 7 + 4\sqrt{3}$$

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

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

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

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

$$= \frac{(4\sqrt{3} \times 4\sqrt{3}) - (4\sqrt{3} \times 3\sqrt{2}) + (5\sqrt{2} \times 4\sqrt{3}) - (5\sqrt{2} \times 3\sqrt{2})}{30}$$

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

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

$$= \frac{18 + 8\sqrt{6}}{30} = \frac{2 \times (9 + 4\sqrt{6})}{30}$$

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

Rough

2 | 48
2 | 24
2 | 12
2 | 6
  3

$\therefore 48 = 2^2 \times 2^2 \times 3$

$\sqrt{48} = \sqrt{2^2 \times 2^2 \times 3}$

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

$= 4\sqrt{3}$

3 | 18
3 | 6
  2

$18 = 3^2 \times 2$

$\sqrt{18} = \sqrt{3^2 \times 2}$

$= 3\sqrt{2}$

$(4\sqrt{3})^2$

$= 4\sqrt{3} \times 4\sqrt{3}$

$= 4 \times 4 \times \sqrt{3} \times \sqrt{3}$

$= 16 \times 3$

$= 48$

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

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

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

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

$= 9 \times 2$

$= 18$