Rules: $\qquad \sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$

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

WARNING!!

$$\sqrt{a} + \sqrt{b} \neq \sqrt{a+b}$$

$$\sqrt{a} - \sqrt{b} \neq \sqrt{a-b}$$

Simplifying Surds

Ex1 $\qquad \sqrt{50} + \sqrt{2}$

$$= \sqrt{25 \times 2} + \sqrt{2}$$

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

$$= 6\sqrt{2}$$

1 4 9 16 25 36

Ex2 $\qquad \sqrt{12} + \sqrt{27} - \sqrt{48}$

$$\sqrt{4 \times 3} + \sqrt{9 \times 3} - \sqrt{16 \times 3}$$

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

$$= \sqrt{3}$$

Exercise $\qquad$ Simplify

1) $\sqrt{5} + \sqrt{20} = \sqrt{5} + \sqrt{4 \times 5}$
$= \sqrt{5} + 2\sqrt{5} \qquad = 3\sqrt{5}$

2) $\sqrt{28} - \sqrt{7} = \sqrt{4 \times 7} - \sqrt{7}$
$= 2\sqrt{7} - \sqrt{7} \qquad = \sqrt{7}$

3) $\sqrt{72} - \sqrt{50} = \sqrt{36 \times 2} - \sqrt{25 \times 2}$
$= 6\sqrt{2} - 5\sqrt{2} \qquad = \sqrt{2}$

4) $\sqrt{12} + \sqrt{300} = \sqrt{4 \times 3} + \sqrt{100 \times 3}$
$= 2\sqrt{3} + 10\sqrt{3} \qquad = 12\sqrt{3}$

Expand and Simplify

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

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

$= 13 + 2\sqrt{2}$

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

$= 8 + 6\sqrt{3} + 20\sqrt{3} + 45$

$= 53 + 26\sqrt{3}$

$3 \times \sqrt{3} \times 5 \times \sqrt{3}$
$= 3 \times 5 \times 3$
$= 45$

Exercice

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

$= 10 + 2\sqrt{5} + 5\sqrt{5} + 5$

$= 15 + 7\sqrt{5}$

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

$= 12 - 3\sqrt{2} + 4\sqrt{2} - 2$

$= 10 + \sqrt{2}$

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

$= 8 - 2\sqrt{3} + 20\sqrt{3} - 15$

$= -7 + 18\sqrt{3}$

Rationalising Denominators

1) Simplify $\dfrac{12}{\sqrt{3}} = \dfrac{12}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}}$

$= \dfrac{12\sqrt{3}}{3} = 4\sqrt{3}$

2) $\dfrac{15}{\sqrt{7}} = \dfrac{15}{\sqrt{7}} \times \dfrac{\sqrt{7}}{\sqrt{7}} = \dfrac{15\sqrt{7}}{7}$

Exercice

1) $\dfrac{10}{\sqrt{5}} = \dfrac{10}{\sqrt{5}} \times \dfrac{\sqrt{5}}{\sqrt{5}} = \dfrac{10\sqrt{5}}{5} = 2\sqrt{5}$

2) $\dfrac{14}{\sqrt{2}} = \dfrac{14}{\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{14\sqrt{2}}{2} = 7\sqrt{2}$

Ex 3 $\quad \dfrac{7}{4-\sqrt{3}}$

$a^2 - b^2$
$= (a+b)(a-b)$

$= \dfrac{7}{4-\sqrt{3}} \times \dfrac{4+\sqrt{3}}{4+\sqrt{3}} = \dfrac{7(4+\sqrt{3})}{4^2 - \sqrt{3}^2}$

$= \dfrac{28 + 7\sqrt{3}}{16 - 3}$

$= \dfrac{28 + 7\sqrt{3}}{13}$