Rules of Surds

Rule	Example
1. (a) $\sqrt{8} = \sqrt{\mathbf{2} \times \mathbf{2} \times 2} = 2\sqrt{2}$ (c) $\sqrt{32} = \sqrt{\mathbf{4} \times 4 \times 3} = 4\sqrt{2}$	(b) $\sqrt{34} = \sqrt{\mathbf{2} \times \mathbf{2} \times 2 \times 3} = 2\sqrt{6}$ (d) $\sqrt{1250} = \sqrt{2 \times \mathbf{5} \times \mathbf{5} \times \mathbf{5} \times \mathbf{5}} = 25\sqrt{2}$
2. $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$	$\sqrt{3} \times \sqrt{2} = \sqrt{6}$ $\sqrt{16 \times 4} = \sqrt{16} \times \sqrt{4} = 8$
3. $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$	$\sqrt{\frac{36}{9}} = \frac{\sqrt{36}}{\sqrt{9}} = \frac{6}{3} = 2$
4. $\sqrt{a} \times \sqrt{a} = a$	$\sqrt{5} \times \sqrt{5} = 5$ $2\sqrt{3} \times 5\sqrt{3} = 2 \times 5 \times 3 = 30$
5. $\sqrt{a} + \sqrt{a} = 2\sqrt{a}$ $\sqrt{a} + \sqrt{b}$ can't simplify	$\sqrt{5} + \sqrt{5} = 2\sqrt{5}$ $2\sqrt{2} + 5\sqrt{2} = 7\sqrt{2}$ $\sqrt{3} - 5\sqrt{3} = -4\sqrt{3}$ $\sqrt{5} + \sqrt{4}$ can't simplify
6. $(a + \sqrt{b})^2 = a^2 + 2a\sqrt{b} + b$	$(3\sqrt{2})^2 = 18$ $(2 + \sqrt{3})^2 = 7+4\sqrt{3}$ $(2+2\sqrt{3})^2 = 16 + 8\sqrt{3}$ $(3\sqrt{2} - 2\sqrt{3})^2 = 30-12\sqrt{6}$
7. $(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$ (Product of conjugate surds a is a rational number)	$(3 + \sqrt{5})(3 - \sqrt{5}) = 3^2 - 5 = 4$
8. $\frac{a}{\sqrt{b}} = \frac{a}{\sqrt{b}} \times \frac{\sqrt{b}}{\sqrt{b}} = \frac{a\sqrt{b}}{b}$	$\frac{5}{\sqrt{2}} = \frac{5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{2}}{2}$
9. $\frac{a}{b + \sqrt{c}} = \frac{a}{b + \sqrt{c}} \times \frac{b - \sqrt{c}}{b - \sqrt{c}} = \frac{a(b - \sqrt{c})}{b^2 - c}$	$\frac{2+2\sqrt{2}}{1-\sqrt{2}} = \frac{(2+2\sqrt{2})(1+\sqrt{2})}{(1-\sqrt{2})(1+\sqrt{2})} = -6 - 4\sqrt{2}$