Examples of **conjugates**

$4+\sqrt{3}$ and $4-\sqrt{3}$
$11-2\sqrt{7}$ and $11+2\sqrt{7}$
$\sqrt{5}+\sqrt{14}$ and $\sqrt{5}-\sqrt{14}$
$9\sqrt{2}-3\sqrt{5}$ and $9\sqrt{2}+3\sqrt{5}$

When we multiply these **conjugates**, the result is an integer (no radicals).

$$(4+\sqrt{3})(4-\sqrt{3}) = 16-4\sqrt{3}+4\sqrt{3}-3 = \boxed{13}$$

$$(11-2\sqrt{7})(11+2\sqrt{7}) = 121+22\sqrt{7}-22\sqrt{7}-28 = \boxed{93}$$

$$(\sqrt{5}+\sqrt{14})(\sqrt{5}-\sqrt{14}) = 5-\sqrt{70}+\sqrt{70}-14 = \boxed{-9}$$

$$(9\sqrt{2}-3\sqrt{5})(9\sqrt{2}+3\sqrt{5}) = 162+27\sqrt{10}-27\sqrt{10}-45 = \boxed{117}$$

Since you know the middle terms will always disappear (add to zero), you can skip writing them.

$$(4+\sqrt{3})(4-\sqrt{3}) = 16-3 = \boxed{13}$$

$$(11-2\sqrt{7})(11+2\sqrt{7}) = 121-28 = \boxed{93}$$

$$(\sqrt{5}+\sqrt{14})(\sqrt{5}-\sqrt{14}) = 5-14 = \boxed{-9}$$

$$(9\sqrt{2}-3\sqrt{5})(9\sqrt{2}+3\sqrt{5}) = 162-45 = \boxed{117}$$

We will use **conjugates** to simplify fractions with radicals getting added/subtracted in the denominator.

Example 1

Simplify $\frac{1}{6+\sqrt{3}}$

The denominator is $\mathbf{6+\sqrt{3}}$.

The conjugate of the denominator is $\mathbf{6-\sqrt{3}}$. We will multiply the numerator and the denominator by $\mathbf{6-\sqrt{3}}$.

$$\frac{1}{6+\sqrt{3}} \bullet \frac{\mathbf{6-\sqrt{3}}}{\mathbf{6-\sqrt{3}}} = \frac{6-\sqrt{3}}{36-3} = \boxed{\frac{\mathbf{6-\sqrt{3}}}{\mathbf{33}}}$$