Simplifying Surds

We ALWAYS have to leave expressions in the simplest form. Any expression involving a root is called a surd, and we often have to write an answer in surd form which implicitly means simplified surd form: $\frac{a}{b}\sqrt{\frac{c}{d}}$ or $a+b\sqrt{c}$ where a, b, c, d are whole numbers or fractions and c and d are as small as possible.

For example:

Simplify $\sqrt{(75)}$

We can write 75 as the product of a number, 3, and a perfect square, 25. Then we take the 25 outside the square root but then we have to square root it:

$$\sqrt{(75)}=\sqrt{(25*3)}=5\sqrt{(3)}$$

This is the general procedure. We take out the largest perfect square which is a factor of the number to be rooted. The perfect square can be either a whole number or a fraction.

Example:

Simplify $\sqrt{\frac{40}{9}}$

$$\sqrt{\frac{40}{9}}=\sqrt{\frac{4}{9}10}=\frac{2}{3}\sqrt{10}$$

Example

Simplify

$$\sqrt{\frac{32}{27}}$$

$$\sqrt{\frac{32}{27}}=\sqrt{\frac{16}{9}\frac{2}{3}}=\frac{4}{3}\sqrt{\frac{2}{3}}$$

Example: Expand and simplify $(2+3\sqrt{5})(3+2\sqrt{5})$.

$$2*3=6$$

$$2*:2\sqrt{5}=4\sqrt{5}$$

$$3\sqrt{5}*3=9\sqrt{5}$$

$3\sqrt{5} * 2\sqrt{5} = 6\sqrt{25} = 6 * 5 = 30$

Now add up all the terms to obtain $36 + 13\sqrt{5}$.