**BASIC QUADRATIC EQUATIONS**

**The logical, thinking method is obviously as follows:**

***The BASIC IDEA: If a × b = 0***

 ***then a = 0 or b = 0***

***so if (x – 5)(x + 8) = 0***

***then x – 5 = 0 or x + 8 = 0***

***so x = 5 or x = –8***

**But of course, most people soon start to “miss out” the middle step and just write:**

***(x – 5)(x + 8) = 0***

***so x = 5 or x = –8***

**Unfortunately, many students forget the logical reasoning behind this idea and start to make up their own “rule”.**

**Basically, they say *“The answers are the numbers in the brackets with the sign changed”*!**

**This of course works for cases like the above.**

**eg *x2 – x – 12 = 0***

 ***(x – 4)(x + 3) = 0***

 ***x = 4 or x = – 3***

***ie just by using the numbers in the bracket with the signs changed.***

**Then as soon as they meet questions like the following, everything goes wrong!**

 ***If (3x – 12)(2x + 10) = 0***

 ***then 3x – 12 = 0 or 2x + 10 = 0***

 ***3x = 12 or 2x = – 10***

 ***x = 4 or x = – 5***

**We then go back to using:**

 ***If a × b = 0 then a = 0 or b = 0***

**Another problem arises when we solve equations such as:**

***2x2 + 2x – 24 = 0* which factorises into *2(x – 3)(x + 4) = 0***

**Some students cannot deal with what the “2” means!**

**They often put *x = 3 or – 4 or 2*!**

**Again, we have to go back to basics to explain the following:**

***If a × b × c = 0 then a = 0 or b = 0 or c = 0***

***but if 5 × b × c = 0 we know that 5 ≠ 0 but we say b could be 0 or c could be 0***

***Similarly if 8(x – 5)(x + 7) = 0***

***we know 8 ≠ 0 so x = 5 or x = – 7***

**Another problem occurs if the equation is of the form *x2 – 3x = 0***

***On factorising this we get: x(x – 3) = 0***

*This is exactly the same as* ***a × b = 0***

*so of course* ***x = 0 or x = 3***

**An equation like the following can be immensely instructive:**

 ***6x(x – 4)(x + 7)(2x – 10) = 0***

 ***which is like: a × b × c × d × e = 0***

***(we know that 6 ≠ 0) but x = 0 or x = 4 or x = – 7 or x = 5***

**Hopefully, if students constantly remember the basic idea that if**

 ***a × b = 0 then a = 0 or b = 0***

**then they will have no problem in fully “understanding” how to solve:**

***6x3 – 6x2 – 12x = 0 which can be written as 6x(x2 – x – 2) = 0***

 ***6x(x – 2)(x + 1) = 0***

 ***so x = 0 or x = 2 or x = – 1***