**Representing Data Further Extensions**

1. **Adding binary numbers** – find a Youtube clip to teach yourself how to do this. Test yourself with some sums on paper. Check your answers!
2. **How are negative numbers represented in binary?** – The answer is a system called ***Two’s Complement***. Watch the [following video](https://www.youtube.com/watch?v=YtMv4u-9poQ&safe=true) to understand how it works.

Now try to write the following negative base ten numbers in 8-bit twos complement: -87, -45, -12, -120.

1. **Finding the twos complement quickly.** – Take your first answer from part 2 and reverse all the bits (0s become 1s, 1s become 0s). Now add 1. Work out the base 10 value of this new binary number. How does it relate to the original? Now you have a quick way of switching from +ve to –ve or –ve to +ve!
2. **Binary subtraction.** – As you know, subtraction is the same thing as addition! Look: 54 – 22 is the same thing as 54 + (-22) right? So computers do subtraction by adding a negative number to a positive one.

Have a go at the following calculations (in binary):

54-22, 120-77, 67-89.