The X Factor

Lens conversion factor came into play early in the digital imaging revolution. It was developed as a way for 35mm shooters to know how the perspective of their lens would look on a digital camera. To get an idea of how it works, imagine a 4x6 print. Now draw a box on the picture about 2cm in from the edges. The 4x6 print represents the full size sensor(or 35mm film) while the box inside represents the sensor in your camera, (or any other digital camera). Keep in mind that this is only a representation and not dimensionally accurate. If you were to enlarge the part of the picture inside the box that you drew to a 4x6 print, it would appear as though it was taken will a longer lens. The X factor is a ratio of the sensor size relative to the full size sensor (or 35mm film). There are many different size sensors out there so the x factor be different depending on the cameras that you are using.

On a digital SLR like the Canon Rebel XTi, the X factor is 1.6. I usually use 1.5 because the math is doable in my head and the difference is not significant. Therefore, a 50mm lens will give you the same perspective a 75mm lens on a 35mm camera (50 x 1.5 = 75), a 100mm lens will give you the same perspective as a 150mm lens on a 35mm (100 x 1.5 = 150), and so on. So, the X factor is really just a conversion to give lens magnification on a DSLR relative to a film SLR or Full Size sensor DSLR.

Interesting to note that photographers had this similar issue before digital as well. There are many other film formats out there besides 35 mm and each one requires different focal length lenses to achieve the same effect.

The zoom factor is a ratio of the longest focal length of a lens divided by the shortest focal length of a lens. It is not particularly relevant for a DSLR because the lenses are interchangeable and the zoom factor will be different depending upon the lens.

So lets do some calculations. The zoom factor for a 18mm - 55mm lens is 55mm/18mm=3 or 3x optical zoom. Calling it optical zoom is somewhat redundant because we are talking about a lens which is only optical but eh. The zoom factor for a 50mm - 200mm lens is 200/50= 4 or 4x optical zoom. The zoom factor for a 75mm - 300mm lens is 300/75=4x or 4x optical zoom. And on it goes. You can use the X factor to recalculate the relative focal lengths but it won't change the answer so why make life more confusing.

In the world of fixed lens cameras and point and shoot cameras this is great to know because you can get an intuitive idea of how a camera will respond. For example; a canon SD1000 has a 3x optical zoom with its widest angle being 38mm equivalent. Using the zoom factor ratio we can determine that when it is fully zoomed out it will have the equivalent of 38mm x 3 = 114mm lens on a 35mm camera. On a super zoom such as the Olympus 550UZ, the zoom is 18x and starts at a 35mm equivalent of 28mm. Therefore when zoomed fully out it will have a 35mm equivalent of 28mm x 18 = 504mm.

With a DSLR, the lens is interchangeable, and each lens will have its own zoom factor as shown earlier in some of the calculations. What happens when you have more than one lens in you camera kit? Do you have different lens with different focal ranges and different zoom factors or do you a series of lens that will take you through an expanded zoom range and a zoom factor that encompasses you entire kit? There is no definitive answer to this but I prefer to view my camera as a system and therefore would look at it as a zoom factor that encompasses the entire range of my lens. Using this logic then, lets recalculate the zoom factor for a DSLR kit.

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Lets assume that you have an 18 - 55mm lens that comes with the camera. Then, as calculated above, you have a lens with a 3x optical zoom starting at 18mm. Now assume that you decide to purchase a 55 - 200mm lens. As calculated earlier, this lens is a 4x optical

zoom. But in your kit you now have lens ranging from 18 mm to 200mm, so effectively, you have the capability of 200mm/18mm=11 or 11x optical zoom starting at 27mm equivalent (18mmx1.5=27mm). Interesting huh?

The images below will give you an idea of what you will get from the different focal lengths.

Optical Zoom

1X (38mm)

3X (114mm)

4x (152mm)

6X (228mm)