Graphic design is really fun, but there are often confusing phrases. What does the colour **#FF6666** look like? What are PhotoShop blend modes? What does delta E mean and why is it important? This worksheet will answer some of these questions.

Question 1: Hex Colours

Hexadecimal is a handy way of representing numbers. Instead of writing RGB values from 0 to 255, we can instead represent them in 2 characters. These 16 characters {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F} can be combined to make any number from 0 to 255. To find the first character we divide the colour value by 16. The remainder is then the next value.

e.g. let the red value be $R = 201$
$201/16 = 12 +$ remainder
Therefore the first character is C, as C represents 12
The remainder is 9, therefore the next character is 9
Thus, the colour with red value 201 is equal to C9

a) Check that the colour **#FF6666** is the same as the RGB value (255,102,102)

b) Convert the hex value **#10ADBA** to decimal RGB

c) Find the hex value of the RGB colour represented by (123,2,14)

Question 2: Blend Modes

Blend modes in PhotoShop are used to blend two layers of pixels together. These are really handy when doing work on images.

a) The normal blend mode simply grabs all of the pixels from the top layer and ignores the bottom layer. This blend mode can be represented by the function below where it takes in two pixels and simply returns the top one.

$normal(top, bottom) = top$

i.e. If the top layer is red (255,0,0) and the bottom layer is green

(0,255,0) the function would just return the red colour (255,0,0).

What is the output when $top = (12, 42, 111)$ and $bottom = (0, 5, 123)$?

b) Another common blend mode is multiply blend. It is often used to overlay colours while still preserving the highlights and shadows. To calculate the result, the function below is used on each RGB value.

$$multiply(top, bottom) = \frac{top \times bottom}{255}.$$

i.e. If the top layer is (255,10,15) and the bottom layer is (255,255,123) the function would return the colour (255,10,7).

What is the output when $top = (12, 42, 111)$ and $bottom = (0, 5, 123)$?
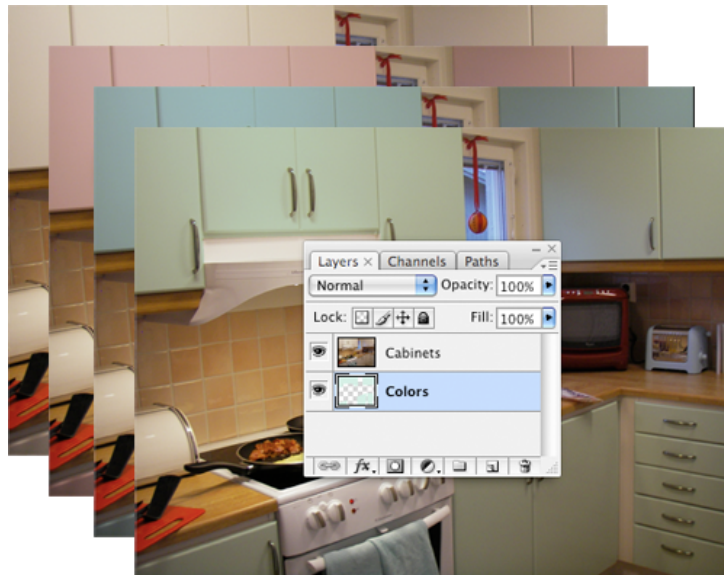
The cabinets have been coloured using multiply blend

Question 3: Delta E

When shopping for a monitor, certain professions such as film makers and graphic artists require screens with high colour accuracy. Colour accuracy is measured as the distance between the target colour and the recorded colour.

This distance is called the Delta E. This is calculated by the formula below were the little T means the target value and little R means the recorded value.

$$deltaE = \sqrt{(R_T - R_R)^2 + (G_T - G_R)^2 + (B_T - B_R)^2}$$

a) Say we want the screen to produce a colour of (2, 3, 4) but it produces a colour of (2.5, 3, 4).

Calculate the delta E for those two values.

This should be 0.5

b) Another monitor is tested. This time the target colour was (111, 12, 31) and the recorded was (120, 13, 33). Calculate the delta E for those two values.

c) The delta E of the first monitor was 0.5 and the second was about 9.27. Now that you are an official colour expert, which monitor would you recommend and why?

The Apple XDR display is very colour accurate with a delta E of 0.68