# Tutorial 3: Colour

A colour is defined by the following three tri-stimulus intensities obtained during a colour matching experiment:

$$r = 3 \quad g = 3 \quad b = 6$$

1. What is its (x, y) coordinate on the CIE diagram?

2. Plot this point on the CIE diagram. Construct a line on the CIE diagram to obtain a measurement of:

   i. The wavelength of the corresponding pure hue

  ii. The wavelength of the complement of its pure hue

 iii. The (x, y) coordinate of the corresponding pure hue

 iv. The saturation of the colour.

3. A monitor is calibrated and the three phosphors have the following CIE diagram coordinates:

	x	y
Red	0.62	0.34
Green	0.27	0.59
Blue	0.15	0.07

Plot the area of colours that can be displayed by the monitor on your CIE diagram
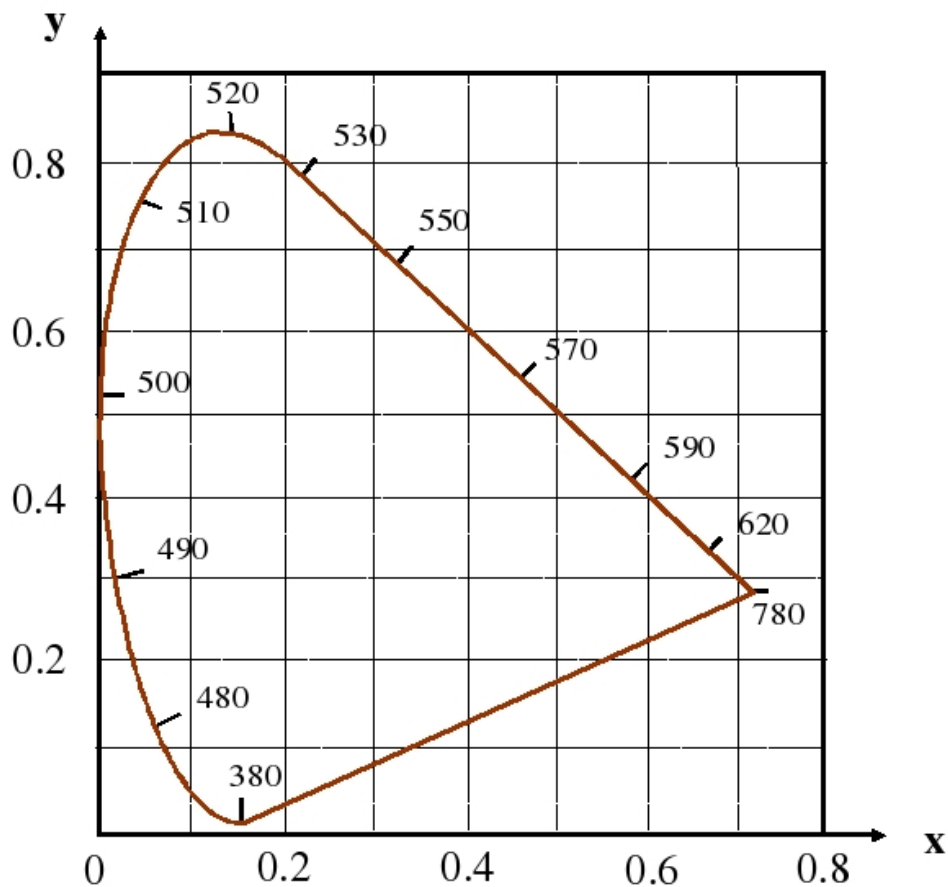
4. The monitor is driven by a computer system that represents colours by RGB values in the range [0, 255]. Find the matrix that will convert (r, g, b) values into (x, y, z) coordinates.

5. The inverse of the matrix of Q4 should be approximately:

$$\begin{pmatrix} 542 & -228 & -84 \\ -316 & 574 & 9 \\ 29 & -91 & 330 \end{pmatrix}$$

You can use this to check your result in Q4.

Compute the RGB values that would be used to represent the original colour defined in Q1.

6. Using the RGB result from part 5 calculate the corresponding HSV values of the colour.

7. A colour given by point $x = 0.1$, $y = 0.2$ on the CIE diagram cannot be represented by the light sources of the monitor. How could a light source of this colour be calibrated by subtractive matching, using light sources with the same coordinates as the monitor.