Engineering Maths Tutorial 2

1) The equation for 'image distance' in a lens is given by $\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$ where f is the focal length of a lens, d_o is the distance from the object to the lens and d_i is the distance from the image to the lens.
   a) Find f when $d_i = 6$ m and $d_o = 3$ m
   b) Rearrange to make d_i the subject

2) a) Fully factorise $x^{13} - 4x^{11}$
   b) Fully factorise $x^4 - 13x^2 + 36$
   c) Fully factorise $3x^3 - 10x^2 + 3x$

3) a) Solve the equation $\frac{10x-4}{15x+2} = \frac{1}{2}$
   b) Solve the equation $\frac{5x-9}{2} = \frac{x}{3} + \frac{7x-1}{10}$
   c) Solve the equation $\frac{4}{r+3} = \frac{3}{r+2}$

4) a) Write as a single log: $5\log(2x) - \log(x^9) + \log(8)$
   b) Write as a single log: $2\log(7) + \log(14) - \log(49) + 4\log(4) - \frac{2}{3}\log(64)$
   c) Write as a single log: $\log(6r) + \log(2r^2) - 3\log(r) - \log(4)$

5) Solve the following equations:
   a) $9^x = 729$
   b) $5^{x+2} = 3125$
   c) $2^{2x+3} = 8$
   d) $11^{3x+1} = 14641$

6) a) Solve the equation: $\log(x + 3) = 1$
   b) Solve the equation: $\log(2x - 1) = -2$
   c) Solve the equation: $\log(7x - 6) = 0$

7) Simplify the following:

a)

$$\frac{2\sqrt{4(x^2y^3)^3x^2y^{11}}}{4(x^2y^5)^2}$$

b)

$$\frac{\sqrt[4]{81x^{12}y^{20}}}{(3xy^2)^3}$$