Theoretical Methods Problem Sheet 1

Matrices, Determinants and Linear Equations

Evaluating determinants

Calculate the following matrix determinants:

1. $\begin{vmatrix} 1 & 8 \\ 6 & 2 \end{vmatrix}$ 2. $\begin{vmatrix} 2 & 3 \\ 4 & 1 \end{vmatrix}$ 3. $\begin{vmatrix} 3 & 2 \\ 1 & 6 \end{vmatrix}$

4. $\begin{vmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \end{vmatrix}$ 5. $\begin{vmatrix} 1 & 1 & 0 \\ 2 & 3 & 2 \\ 3 & 2 & 3 \end{vmatrix}$ 6. $\begin{vmatrix} 2 & 2 & 0 \\ 2 & 3 & 2 \\ 3 & 2 & 3 \end{vmatrix}$

Explain why the answers to questions 5. And 6. are related.

Solving Systems of Linear Equations

Solve for x and y in the following sets of equations using the method of determinants

1. $2x + y = 4$
   $x + 2y = 6$
   $x + 3y = 1$
2. $2x + 3y = 2$
   $3x + 4y = 3$

Spectroscopic Analysis

The use of the Beer Lambert law in spectroscopic analysis was mentioned in the lectures and the table of data included below was presented. Set up and solve the 4x4 system of equations needed to determine the concentrations in this system

	p-xylene	*m*-xylene	*o*-xylene	ethyl-benzene	A_{total}
λ	εl	εl	εl	εl	
12.5	1.502	0.0514	0	0.0408	0.1013
13.0	0.0261	1.1516	0	0.0820	0.09943
13.4	0.0342	0.0355	2.532	0.2933	0.2194
14.3	0.0340	0.0684	0	0.3470	0.03396