HG1M02—Applied Algebra for Engineers

Coursework 1

To be handed in no later than Friday 23rd February. Coursework **must** be handed in to one of the designated mathematics coursework collection points; **not** to me, and **not** to [any] school office. For more details, see overleaf.

1. Evaluate the determinants

2 -	.3	1	-3	and	2	1	
1	2	-4	2	anu	1	-4	•

Use your results to solve the simultaneous equations

$$2x - 3y = 1,$$
$$x + 2y = -4$$

for x and y by the use of determinants [no marks for any other method!].

2. Evaluate the determinants

(a)
$$\begin{vmatrix} \sqrt{2} & 0 & -3 \\ 2 & 0 & 0 \\ \pi^2 & 1 & e^{-3} \end{vmatrix}$$
, (b) $\begin{vmatrix} 110 & 117 & 110 \\ 111 & 118 & 118 \\ 112 & 119 & 105 \end{vmatrix}$,

using, as appropriate, the properties of determinants given in the module booklet to simplify the arithmetic.

3. Find the three values of λ such that

$$\begin{vmatrix} \lambda - 1 & 2 & 3 \\ 2 & \lambda + 2 & 6 \\ -1 & 1 & \lambda + 1 \end{vmatrix} = 0.$$

4. A tetrahedron [triangular pyramid] has its vertices *ABCD* at position vectors \boldsymbol{a} , \boldsymbol{b} , \boldsymbol{c} and \boldsymbol{d} respectively. Show that the mid-point, E, of *AB* has position vector $\boldsymbol{e} = \frac{1}{2}(\boldsymbol{a} + \boldsymbol{b})$, and write down the position vectors \boldsymbol{f} and \boldsymbol{g} of the mid-points F and G of *CD* and *EF* respectively. From your result, show that the three lines joining the mid-points of opposite sides of the tetrahedron are concurrent [meet in one point].

Marks: Q1: 2 marks for each determinant, 2 for writing down each of x and y in terms of the previous answers, total 10. Q2: 5 marks for each determinant, total 10. Q3: 7 marks for evaluating the determinant in terms of λ , 3 for the roots, total 10. Q4: 3 marks for finding e, 2 each for f and g, 3 for the final result, total 10. Grand total: 40.

Handing in coursework:

All mathematics coursework **must** be handed in to one of the **coursework collection points** in either the Pope building [near room B2] or the Mathematics and Physics building [in the far corner of the area at the top of the main stairs].

You need to use a **green** cover sheet [provided at the collection point]. Fill in sections A and C of the cover sheet, **time-stamp** the receipt [instructions at the collection point], tear off your recipt, and **staple** the rest of the sheet to your work [stapler provided]. These instructions are also given at the collection points. Make sure your name is on every sheet, in case of accident, and drop your work into the box. In section A, the bits you *need* to get *right* are your **name**, and the module **code** [HG1M02].

You have to sign that your work is not plagiarised. This means that it is your work, and is not copied from work done by someone else. There is no reason why you should not talk about the problems with your friends, but there is a clear moral difference between that and simply copying down their solutions. Plagiarists are not fit to be members of this or any other academic community, and plagiarism is a very serious offence.

You are reminded that this coursework counts $6\frac{2}{3}\%$ towards your assessment for this module. If you are late [without acceptable reason], you will lose 5% per working day; after five days, you will receive a mark of zero. Applications for any extension to the deadline should be made to me, and *must* be accompanied by a completed 'Extenuating Circumstances Form' giving your reasons for the application and signed by your personal tutor. You can get these forms from your school office or from your tutor. I will tell you whether or not your application will be allowed, and if so what your new deadline is; if you believe my decision to be unfair, then you may appeal to the Director of Mathematics Service Teaching, Dr S. Hibberd. — ANW