MATH6038: Maple (Sample) Test

Use Maple to help you find the answers to the following questions.

Name: Perfect Student

ANSWER ALL QUESTIONS IN THE SPACES PROVIDED.

DO NOT LOOK AT YOUR NEIGHBOUR'S WORK.

THIS IS AN OPEN-BOOK ASSESSMENT AND ANY INFORMATION YOU CAN ACCESS AT YOUR WORKSTATION YOU ARE FREE TO USE.

1. Solve the following linear systems.

(a)

$$\begin{aligned} x + 2y - z &= 2 \\ 2x + 5y + 2z &= -1 \\ 7x + 17y + 5z &= -1 \end{aligned}$$

Ans: $x = 12 + 9t, y = -5 - 4t, z = t$

(b)

$$\begin{aligned} x + 10z &= -6 \\ 3x + y - 4z &= 16 \\ 4x + y + 6z &= 10 \end{aligned}$$

Ans: $x = 4, y = 0, z = -1$

(c)

$$\begin{pmatrix} 1 & 1 & -1 \\ 4 & -5 & 2 \\ 5 & -4 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}.$$

Ans: No Solutions

[Note: Easiest way is to use Gaussian Elimination Tutor]

2. For the matrices

$$A = \begin{pmatrix} 2 & 1 & 0 \\ 3 & -2 & -1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 2 & 1 \\ -3 & 2 & 0 \end{pmatrix}, \quad C = \begin{pmatrix} 5 & 3 \\ 2 & -1 \\ 3 & 4 \end{pmatrix}.$$

Determine each of the following, if defined Define A := ... etc

(a) $A + B$

Ans: $\begin{pmatrix} 3 & 3 & 1 \\ 0 & 0 & -1 \end{pmatrix}$

(b) $A + C$

Ans: undefined

(c) $(A + B)^T$ with(Statistics) Transpose(A+B)

Ans: $\begin{pmatrix} 3 & 0 \\ 3 & 0 \\ 1 & -1 \end{pmatrix}$

(d) AC A_C or A.C

Ans: $\begin{pmatrix} 12 & 5 \\ 8 & 7 \end{pmatrix}$

(e) CA

Ans: $\begin{pmatrix} 19 & -1 & -3 \\ 1 & 4 & 1 \\ 18 & -5 & -4 \end{pmatrix}$

3. Find the inverse of the matrix

$$B = \begin{bmatrix} 1 & 0 & -2 \\ -3 & 1 & 4 \\ 2 & -3 & 4 \end{bmatrix}.$$

Use Matrix Inverse Tutor

Ans: $\begin{pmatrix} 8 & 3 & 1 \\ 10 & 4 & 1 \\ 7/2 & 3/2 & 1/2 \end{pmatrix}$

4. Does the following homogenous system of linear equations have non-trivial solutions?

$$\begin{aligned} 2x - 4y - 5z &= 0 \\ 3x + y - 4z &= 0 \\ x - 6y - z &= 0. \end{aligned}$$

Determinant $\neq 0$ $\Rightarrow$ no non-trivial sols

Trivial $(x,y,z) = (0,0,0)$

Ans: No (trivial solutions only)

5. Calculate the determinant of

$$\begin{bmatrix} 1 & 3 & 2 \\ 2 & -1 & -3 \\ 5 & 2 & 1 \end{bmatrix}.$$

Ans: -28

6. The probability of a citizen completing the online payment by the deadline for the Household Charge is 0.65. Use a *Binomial distribution* to find the probability that in a group of 15 citizens,

   (a) exactly 10 will have paid online by the deadline.
   Ans: 0.2123

   (b) at least 3 will have paid online by the deadline.
   Ans: 0.9999

7. Suppose that the number of goals scored in 90 minutes of European Soccer Championship play is a *Poisson distribution* with an average of 2.5 goals per game. Find the probability that in a given 90 minute match

   (a) there is a 0-0 draw.
   Ans: 0.0821

   (b) five or more goals are scored.
   Ans: 0.1088