



**Coláiste na Tríonóide, Baile Átha Cliath**  
**Trinity College Dublin**

Ollscoil Átha Cliath | The University of Dublin

**Faculty of Engineering, Mathematics and Science**

**School of Mathematics**

**JF Maths/TP/TSM**

**Trinity Term 2018**

**MA1111 — Linear Algebra I**

**Wednesday, May 16**

**Exam Hall**

**09:30 — 11:30**

**Paschalis Karageorgis**

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**Instructions to Candidates:**

Attempt all questions. All questions are weighted equally.

Non-programmable calculators are permitted for this examination.

Formulae and tables are available from the invigilators, if needed.

**You may not start this examination until you are instructed to do so by the Invigilator.**

1. Find a quadratic polynomial, say  $f(x) = ax^2 + bx + c$ , such that

$$f(1) = 2, \quad f(2) = 6, \quad f(3) = 8.$$

2. Show that the matrix  $A$  is invertible and determine its inverse.

$$A = \begin{bmatrix} 1 & 4 & 5 \\ 2 & 3 & 4 \\ 1 & 5 & 6 \end{bmatrix}.$$

3. Let  $A_n$  denote the  $n \times n$  matrix whose diagonal entries are equal to 2 and all other entries are equal to 5. Compute the determinant of  $A_n$ .

4. Find a linear transformation  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$  such that

$$T\left(\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 3 \\ 2 \end{bmatrix}, \quad T\left(\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}\right) = \begin{bmatrix} 7 \\ 5 \end{bmatrix}, \quad T\left(\begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}\right) = \begin{bmatrix} 1 \\ 3 \end{bmatrix}.$$

5. Suppose that the columns of an  $m \times n$  matrix  $A$  form a complete set for  $\mathbb{R}^m$ . Show that there exists some  $n \times m$  matrix  $B$  such that  $AB$  is the identity matrix.