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 Engineering **Trinity Term 2016**
JF Engineering with Management
JF MSISS

MA1E02 — Engineering Mathematics II

Thursday, May 12 **RDS** **14.00 — 16.00**

Professor R. M. Timoney

Instructions to Candidates:

Please attempt all questions.

All questions have equal weight (10 points each).

'Formulae & tables' are available from the invigilators, if required.

Non-programmable calculators are permitted for this examination,—please indicate the make and model of your calculator on each answer book used.

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

1. Find the equation of the plane in space that contains the 3 points $(1, 2, 3)$, $(2, 0, 1)$ and $(0, 3, 4)$.

2. Find parametric equations for the line with vector equation

$$x\mathbf{i} + y\mathbf{j} + z\mathbf{k} = 4\mathbf{i} - 2\mathbf{k} + t(-\mathbf{i} + 4\mathbf{j})$$

3. Use an appropriate sustitution to evaluate

$$\int 3xe^{-17x^2}\,dx$$

4. Calculate

$$\int_0^{\pi/3} \cos^2(2x)\,dx$$

5. Use partial fractions to evaluate

$$\int \frac{2x^2 - 9x - 9}{x^3 - 9x}\,dx$$

6. Find the solution of the (first order linear) differential equation

$$\frac{dy}{dx} - 4y = e^{3x}$$

with $y = 2$ at $x = 0$.

7. Use the integral test to determine whether the series

$$\sum_{n=1}^{\infty} \frac{1}{(n+1)\ln(n+1)}$$

converges or not.

8. Use sigma notation to write the Taylor series for e^x about $x_0 = 2$.

9. For the following system of linear equations:

$$\begin{aligned} 3x_2 &+ 12x_3 &+ 6x_4 &= -5 \\ -3x_2 &+ 24x_3 &- 2x_4 &= -53 \\ -6x_2 &- 36x_3 &- 4x_4 &= 62 \\ 2x_1 - 9x_2 &- 12x_3 &- 6x_4 &= 9 \end{aligned}$$

(a) [5 points] Write an augmented matrix for the system of equations.

(b) [5 points] Following the method of Gauss-Jordan elimination strictly, reduce the augmented matrix to reduced row echelon form.

10. Let

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 8 & 0 & 9 \\ 1 & 11 & 9 \end{bmatrix}$$

Find the inverse A^{-1} (if it exists).