

TRINITY COLLEGE DUBLIN
THE UNIVERSITY OF DUBLIN

School of Mathematics

JF Engineering
JF Engineering with Management
JF MSISS

Trinity Term 2016

MA1E02 — Engineering Mathematics II

? ? 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. A boat travels 50 metres due north while the wind exerts a force of 200 newtons towards the northwest. How much work does the wind do?
2. Find parametric equations for the line of intersection of the planes

$$x + y - z = 5$$

$$2x - y + 3z = 4$$

3. Find $k > 0$ (as an exact value) so that $\int_0^k e^{8x} dx = 5$.

4. Evaluate

$$\int \frac{1}{\sqrt{15 + 2x - x^2}} dx$$

5. Use integration by parts to find

$$\int_0^1 x^2 \sin(\pi x) dx$$

6. Find the solution of the (variables separable) differential equation

$$\frac{dy}{dx} = x^2 y^3$$

with $y = 1$ at $x = 0$.

7. Use sigma notation to write the Taylor series for $\ln x$ about $x_0 = 1$.

8. Use the ratio test to find the radius of convergence of

$$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{2^n(n+1)} (x-3)^n$$

9. For the following system of linear equations:

$$\begin{array}{rclcl} 3x_2 & + & 12x_3 & + & 6x_4 & = & -15 \\ 2x_1 & - & 3x_2 & + & 24x_3 & - & 2x_4 & = & -53 \\ & - & 6x_2 & - & 36x_3 & - & 4x_4 & = & 62 \\ 2x_1 & - & 9x_2 & - & 12x_3 & - & 6x_4 & = & 9 \end{array}$$

- [5 points] Write an augmented matrix for the system of equations.
- [5 points] Following the method of Gauss-Jordan elimination strictly, reduce the augmented matrix to reduced row echelon form.

10. Let

$$A = \begin{bmatrix} 17 & 10 & 19 \\ 8 & 0 & 9 \\ 9 & 11 & 10 \end{bmatrix}$$

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