



Lecture Notes for

# ENGI 3425

# Mathematics for Civil Engineering I

**second edition**

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# Table of Contents


1. **Review of Calculus**
2. **Parametric and Polar Curve Sketching**
3. **Conic Sections**
4. **Quadric Surfaces**
5. **Parametric Vector Functions**
6. **Sequences and Series**
7. **Partial Differentiation**
8. **Multiple Integration, Moments**
9. **Introduction to Ordinary Differential Equations**

**Appendix**

A. **Formula Sheets**


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# Detailed Table of Contents


**1. Review of Calculus**

**1.1** Reminder of some Derivatives (review from MATH 1000)
**1.2** Reminder of some Integrals (review from MATH 1001)
**1.3** Hyperbolic Functions

**2. Parametric and Polar Curves**

**2.1** Parametric Vector Functions
**2.2** Parametric Curve Sketching
**2.3** Polar Coordinates
**2.4** Polar Curve Sketching $r = f(\theta)$

**3. Conic Sections**

**3.1** Standard Form
**3.2** General Conic Sections
**3.3** Polar Form for Conic Sections

**4. Quadric Surfaces**

**5. Parametric Vector Functions**

**5.1** Arc Length (Cartesian parametric and plane polar)
**5.2** Surfaces of Revolution
**5.3** Area under a Parametric Curve (including area swept out by a polar curve)

# Detailed Table of Contents (continued)


**6. Series**

**6.01** Sequences; general term, limits, convergence
**6.02** Series; summation notation, convergence, divergence test
**6.03** Standard Series; telescoping series, geometric series, *p*-series
**6.04** Tests for Convergence: comparison and limit comparison tests
**6.05** Tests for Convergence: alternating series; absolute and conditional convergence
**6.06** Tests for Convergence: ratio test
**6.07** Power Series, radius and interval of convergence
**6.08** Taylor and Maclaurin Series, remainder term
**6.09** Binomial Series
**6.10** Introduction to Fourier Series

**Appendix:**
**6.A** Integral Test [not examinable; for reference only]

**7. Partial Differentiation**

**7.1** Partial Derivatives - introduction, chain rule, practice
**7.2** Higher Partial Derivatives, Clairaut's theorem, Laplace's PDE
**7.3** Differentials; error estimation; chain rule [again]; implicit functions; partial derivatives on curves of intersection
**7.4** The Jacobian - implicit and explicit forms; plane polar; spherical polar
**7.5** Gradient Vector, directional derivative, potential function, central force law
**7.6** Extrema; Second Derivative Test for $z = f(x, y)$
**7.7** Lagrange Multipliers; nearest point on curve of intersection to given point
**7.8** Miscellaneous Additional Examples

**8. Multiple Integration**

**8.1** Double Integrals (Cartesian Coordinates)
**8.2** Double Integrals (Plane Polar Coordinates)
**8.3** Triple Integrals
**8.4** Second Moments of Area
**8.5** Additional Examples

**9. Introduction to Ordinary Differential Equations**

**Appendix:**
**A. Suggestions for Formula Sheets**

[Replace this sheet by the Course Outline handout that is supplied during the first week of classes in this course]

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