

# Advanced Topics in Technical Mathematics

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## 1 Course Description

**Course:** 2030:480 Advanced Topics in Technical Mathematics

**Credits:** 2

**Prerequisites:** 2030:255 or equivalent with a grade of C– or better, or placement test.

**Bulletin Description:** Prerequisites: 2030:255 or equivalent with a grade of C– or better, or placement test. Matrices, introduction to series, partial derivatives, least squares adjustments, and coordinate systems.

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## 2 Course Outcomes

After completing this course the student should have the following competencies:

1. the ability to perform matrix addition, scalar multiplication of matrices, transposing of matrices, and matrix multiplication;
2. the ability to find the solution of a linear system of equations using matrices;
3. an understanding of power series;
4. the ability to find the partial derivative of a function;
5. the ability to recognize and solve technical problems by using partial derivatives;
6. the ability to calculate the least squares adjustment using the observed equation and matrix methods;
7. an understanding of polar, spherical, geocentric and geodetic coordinate systems and position computation.

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## 3 Course Outline

1. Matrices
  - (a) Basic operations on matrices
  - (b) Multiplication of matrices
  - (c) The inverse of a matrix
  - (d) The transpose of a matrix
  - (e) Solving a system of linear equations using matrices
2. Series
  - (a) Introduction to series
  - (b) Power series
3. Partial derivatives
  - (a) Power rule
  - (b) Product rule
  - (c) Chain rule
  - (d) Partial derivatives
  - (e) Applications of partial derivatives
4. Least squares adjustments
  - (a) Introduction to least squares adjustments
  - (b) Conditions for least squares
  - (c) Observation equation method
  - (d) Matrix methods in least squares adjustments
5. Coordinate systems
  - (a) The polar coordinate system
  - (b) The spherical coordinate system
  - (c) The geocentric and geodetic coordinate systems
  - (d) The local geodetic coordinate system
  - (e) Ellipsoidal radii of curvature

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## 4 Textbook

Supplemental material is used for this course.

The course 2980:310, Survey Computations and Adjustments has Topics in Advanced Mathematics as a corequisite. In order to ensure that students taking these two courses during a single semester have learned the mathematics they need for Survey Computations and Adjustments, the order of the supplemental material should be followed in Advanced Topics in Technical Mathematics.

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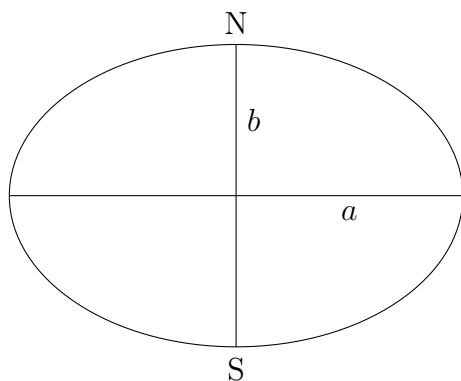
## 5 Calculator Policy

All students are **required** to have a **graphing** calculator with minimum functionality equivalent to that of the **Texas Instruments TI-83** calculator. Every student is **required** to have possession of their calculator by the end of the first week of classes. No exceptions to this policy will be made by the instructor.

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## 6 Formula Policy

*The formulas that students are required to know by heart at the end of this course are listed below.*



$a$  = semi-major axis

$b$  = semi-minor axis

$\phi$  = latitude

$$f = \frac{a - b}{a}$$

$$e^2 = \frac{a^2 - b^2}{a^2}$$

$$M = \frac{a(1 - e^2)}{(1 - e^2 \sin^2(\phi))^{3/2}}$$

$$N = \frac{a}{\sqrt{1 - e^2 \sin^2(\phi)}}$$