

Fariborz Maseeh Department of Mathematics and Statistics

MTH 253: Calculus III

Updated: Fall 2021

Description: Introduction to differential equations, infinite series, parametric equations, polar coordinates and conic sections. This is the third course in a sequence of three: MTH 251, MTH 252, and MTH 253, which must be taken in sequence.

Credits: 4

Prerequisite: Mth 252

Course Objectives: This is the third course in a sequence of three: Mth 251, Mth 252 and Mth 253 which must be taken in sequence. The course focuses on differential equations, infinite sequences and series, along with parametric equations. The course also includes conic sections and polar coordinates.

Student Learning Outcomes: Upon completion of this course students will be able to:

- Apply graphical and numerical methods to the solution of differential equations.
- Analyze models involving $y'=k(y-b)$ and the logistic equation.
- Solve first order linear differential equations.
- Apply appropriate conditions for convergent/divergent sequences and series.
- Correctly employ strategies for testing series for absolute or conditional convergence/divergence, including the Integral test, Comparison test, Root test, Ratio test, and Alternating Series tests.
- Estimate the sum of convergent infinite series.
- Find and use appropriate Taylor series to approximate functions locally.
- Determine intervals of convergence of power series and estimate the error in Taylor approximations.
- Describe curves using parametric equations and use such expressions to analyze arc length and speed.
- Use polar and rectangular coordinates, converting between these two when necessary.
- Analyze conic sections, including parabolas, ellipses, and hyperbolas.

Topics:

1. *Introduction to Differential Equations:* Solving differential equations, models involving $y'=k(y-b)$, basic graphical and numerical methods, the logistic equation, first-order linear differential equations.

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2. *Infinite Sequences and Series*: Convergence/divergence, partial sums of series, absolute vs. conditional convergence, ratio test, root test, power series, interval of convergence, Taylor series.
3. *Parametric equations, Polar Coordinates, and Conic sections*: Parametric curves in two dimensions, arc length, speed, polar coordinates vs. rectangular coordinates, conic sections.

Textbook:

Jon Rogawski, Colin Adams, and Robert Franzosa *Calculus: Early Transcendentals*, 4th ed., Freeman, W.H.& Company 2019.

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MTH 253 Textbook Mapping:

Jon Rogawski, Colin Adams, and Robert Franzosa *Calculus: Early Transcendentals*, 4th ed.,
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Review

- 7.7 Improper Integrals
- 10.7 Taylor Polynomials

9 Introduction to Differential Equations

- 9.1 Solving Differential Equations
- 9.2 Models Involving $y=k(y-b)$
- 9.3 Graphical and Numerical Methods
- 9.4 The Logistic Equation
- 9.5 First-Order Linear Equations

10 Infinite Series

- 10.1 Sequences
- 10.2 Summing an Infinite Series
- 10.3 Convergence of Series with Positive Terms
- 10.4 Absolute and Conditional Convergence
- 10.5 The Ratio and Root Tests and Strategies for Choosing Tests
- 10.6 Power Series
- 10.8 Taylor Series

11 Parametric Equations, Polar Coordinates, and Conic Sections

- 11.1 Parametric Equations
- 11.2 Arc Length and Speed
- 11.3 Polar Coordinates
- 11.4 Area and Arc Length in Polar Coordinates
- 11.5 Conic Sections