

SINCLAIR COMMUNITY COLLEGE
DAYTON, OHIO

MATERIALS AVAILABLE FOR
MATH 215 - DIFFERENTIAL EQUATIONS

SEPTEMBER 9, 2009

Video Lectures: <http://ocw.mit.edu/OcwWeb/Mathematics/18-03Spring-2006/CourseHome/index.htm>

I. Introduction to Differential Equations

1. Definitions and Terminology

Differential Equations CD 1.1

2. Initial-Value Problems

Differential Equations CD 1.2

3. Differential Equations as Mathematical Models

II. First-Order Differential Equations

HANDOUT "Notes on First-Order Differential Equations"

2. Separable Variables

201-204 CD Lectures Disk 6, 6.2 (growth and decay)

Disk 6, 6.3 (separation of variables)

Differential Equations CD 1.4

V-CALC Tape 11 Sec. 5.6 "Differential Eqns.: Growth and Decay"

VOM D-1 "Separation of Variables"

WORKSHEET VOM D-1 "Separation of Variables"

3. Linear Equations

201-204 CD Lectures Disk 6, 6.4

Differential Equations CD 1.3

VOM D-3 "Linear First-Order Differential Equations"

WORKSHEET VOM D-3 "Linear First-Order Differential Equations"

4. Exact Equations

Differential Equations CD 1.5

5. Solutions by Substitutions

III. Modeling With First-Order Differential Equations

1. Linear Models

Differential Equations CD 2.1-2.5

VOM D-4 "Applications of Differential Equations"

WORKSHEET VOM D-4 "Applications of Differential Equations"

II. First-Order Differential Equations (revisited)

1. Solution Curves Without a Solution

1.1 Direction Fields

6. A Numerical Method

IX. Numerical Solutions of Ordinary Differential Equations

1. Euler Methods and Error Analysis

201-204 CD Lectures Disk 6, 6.1 (slope fields and Euler's method)

2. Runge-Kutta Methods

IV. Higher Order Differential Equations

HANDOUT "Notes on Higher Order Differential Equations"

1. Preliminary Theory - Linear Equations

1.1 Initial-Value and Boundary-Value Problems

1.2 Homogeneous Equations

1.3 Nonhomogeneous Equations

2. Reduction of Order

Differential Equations CD 4.2

3. Homogeneous Linear Equations with Constant Coefficients

201-204 CD Lectures Disk 12, 16.2

Differential Equations CD 3.1-3.4

VOM D-5 "Second-Order Differential Equations"

WORKSHEET VOM D-5 "Second-Order Differential Equations"

VOM D-6 "Auxiliary Equations with Repeated or Complex Roots"

WORKSHEET VOM D-6 "Auxiliary Equations with Repeated or Complex Roots"

V. Modeling with Higher-Order Differential Equations
HANDOUT "Notes on Linear Models: Initial-Value Problems"

1. Linear Equations: Initial-Value Problems

1.1 Spring/Mass Systems: Free Undamped Motion

Differential Equations CD 6.2

HANDOUT "Converting $A \sin x + B \cos x$ to $K \sin(x + \Phi)$ "

IV. Higher-Order Differential Equations (revisited)
HANDOUT "Notes on Higher Order Differential Equations"

4. Undetermined Coefficients - Superposition Approach

Differential Equations CD 4.3

VOM D-7 "Nonhomogeneous Equations"

WORKSHEET VOM D-7 "Non-Homogeneous Equations"

or **5. Undetermined Coefficients - Annihilator Approach**

6. Variation of Parameters

Differential Equations CD 4.4

V. Modeling with Higher-Order Differential Equations (revisited)
HANDOUT "Notes on Linear Models: Initial-Value Problems"

1. Linear Equations: Initial-Value Problems

HANDOUT "Converting $A \sin x + B \cos x$ to $K \sin(x + \Phi)$ "

1.2 Spring / Mass Systems: Free Damped Motion

Differential Equations CD 6.1-6.2

1.3 Spring / Mass Systems: Driven Motion

Differential Equations CD 6.3-6.4

VI. Series Solutions of Linear Equations

1. Solutions About Ordinary Points

1.1 Review of Power Series

201-204 CD Lectures Disk 8, 9.8-9.10

1.2 Power Series Solutions

Differential Equations CD 7.2

VII. The Laplace Transform

HANDOUT "Notes on The Laplace Transform"

1. Definition of the Laplace Transform

Differential Equations CD 8.1

2. Inverse Transforms and Transforms of Derivatives

WORKSHEET VOM D-8 "Laplace Transforms I"

2.1 Inverse Transforms

2.2 Transforms of Derivatives

3. Operational Properties I

WORKSHEET VOM D-8 "Laplace Transforms I"

3.1 Translation on the s-Axis

3.2 Translation on the t-Axis

4. Operational Properties II

WORKSHEET VOM D-9 "Laplace Transforms II"

4.1 Derivatives of a Transform

4.2 Transforms of Integrals

4.3 Transform of a Periodic Function

6. Systems of Linear Differential Equations