

## Math 246, Jeffrey Adams

Review for Test I, Monday, September 24, 2018

### Chapter 1

(\*) Existence and uniqueness theorems: you need to know the form of these results but not the details.

Section I.1 : First order equations

- explicit equations
- initial value problems
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Section I.2 : Linear equations

- Normal form
- Homogeneous equations
- Non-homogeneous equations, integrating factors
- Initial Value problems
- \* Existence and uniqueness (Theorem 2.1)

Section I.3 : Separable Equations

- Autonomous equations
- General separable equations
- Initial value problems, interval of definition
- Implicit solutions
- \* Existence and uniqueness (Theorem 3.1)

Section I.4 : General Theory

- \* Existence and uniqueness (Theorem 4.1)

Section I.5 : Graphical Methods

- Autonomous equations: phase-line portraits
- Plotting explicit solutions
- Contour plots of implicit solutions
- Direction fields

Section I.6 : Applications

- Water tanks
- Force
- Population dynamics

Section I.7 : Numerical Methods

- explicit Euler algorithm
- local and global error,  $O(h)$
- Error term for: explicit Euler, Runge-Kutta trapezoid, Classical Runge-Kutta

Section I.8 : Exact Equations

- Exact differential forms
- Implicit solution of exact equations
- Integrating factors