

SYLLABUS FOR MATH 241/251A (4) – CALCULUS I

Course Description: Basic concepts, differentiation with applications, integration. Credit allowed for at most one of 203, 215, 241, 251A. FS FQ

Prerequisite for 241: A grade of C or better in Math 140 or Math 215 or precalculus assessment as specified by the department.

Prerequisite for 251A: Math department consent plus one of the following: A grade of A in Math 140, high score on the placement exam, high SAT or ACT score.

Text: *Calculus* by James Stewart, current edition, Cengage Learning. A MultiTerm e-Pack (WebAssign and online text for up to 4 years) is available directly from the publisher. It can be combined with a loose leaf printed version for an extra charge. Contact your instructor for additional information.

Format: This four credit class meets for 150 minutes of lecture and 50 minute of recitation per week.

Final Exam: There will be a common final exam for all sections of Math 241 and Math 251A.

Timeline: Week 1: Getting started:

- (1) Discuss instructor's syllabus, academic expectations from the department website, preview.
- (2) Review of precalculus material. Many students are not settled during the first week, so it is best to spend time on important material, without making it too difficult to students to catch up.

Week 2–3: Tangent lines, limits, and continuity. The precise definition of a limit (Section 1.7) may be incorporated throughout.

- (1) Section 1.4: Tangent lines to curves.
- (2) Section 1.5: Limits of functions, including one-sided and infinite limits.
- (3) Section 1.6: Limit laws (algebra and pinching).
- (4) Section 1.7: Precise definition of a limit.
- (5) Section 1.8: Continuity.

Week 4–6: Derivatives.

- (1) Section 2.1: Derivatives and rates of change.

- (2) Section 2.2: Definition of the derivative, computations from first principles. The derivative as a function on an open interval and higher derivatives.
- (3) Section 2.3: Differentiation formulas (linearity, product and quotient rules).
- (4) Section 2.4: Derivatives of trigonometric functions.
- (5) Section 2.5: Chain Rule.
- (6) Section 2.6: Implicit differentiation.
- (7) Section 2.7: Applications (cut short).
- (8) Section 2.8: Related rates.
- (9) Section 2.9: Differentials and linear approximation.

Week 7–10: Applications of Differentiation.

- (1) Section 3.1: Absolute and local extrema, critical points, Fermat's theorem.
- (2) Section 3.2: Mean Value Theorem and some of its corollaries.
- (3) Section 3.3: Monotonicity, concavity, second derivative test.
- (4) Section 3.4: Limits at infinity and horizontal asymptotes.
- (5) Section 3.5: Summary of curve sketching.
- (6) Section 3.7: Applied optimization problems (more than one lecture).
- (7) Section 3.8: Newton's method.
- (8) Section 3.9: Antiderivatives.

Week 11–15: Integration and basic applications

- (1) Section 4.1: Area estimates with finite sums, sigma notation.
- (2) Section 4.2: Definite integral, basic properties.
- (3) Section 4.3 & 4.4: Fundamental Theorem of Calculus.
- (4) Section 4.5: Indefinite integrals and substitution.
- (5) Section 5.1: Areas between curves.
- (6) Section 5.2: Volumes by slicing and rotation about axes.
- (7) Section 5.3: Volumes via shells.

Course objectives: Upon successful completion of Math 241 the student will have an understanding of the above listed topics, be able to solve routine problems, and be able to apply the ideas. A successful Math 251A student will have an in-depth understanding of the topics, be able to solve routine and challenging problems, and be able to apply the ideas creatively.

Program objectives: In this introductory level course students learn the basics about differentiation and integration of functions in one variable. The approach is more computational than theoretical. The course

material is fundamental for majors in mathematics, the physical sciences, and engineering. The course is the first in a four (three) semester sequence.