1 Warning

Community College of Philadelphia is a firm adherent to the principle of academic freedom. In light of this, faculty are not required to follow a particular approach or a particular textbook for the courses they teach. Most faculty, however, have more or less uniform guidelines for specific courses, and indeed, many use a particular textbook or approach in order to conform to area institutions. Therefore, the sample syllabus found here is not binding to faculty, but represents a synthesis of what most faculty do or aspire to do when they teach a particular course. What follows should not be interpreted as a prescription, but rather, as a means to help the placement of our students in transfer institutions.

2 Catalogue Description

Topics to be covered: functions, graphs, limits, continuity, derivatives and antiderivatives of algebraic and transcendental functions; techniques of differentiation; applications of derivatives, polynomial approximation; L'Hopital's rule; applied maximum and minimum problems; the definite integral, the fundamental theorem of calculus, the substitution rule. Prerequisite: MATH 162.

3 Allotted Time

Math 171 is a four credit course. Thus it meets for $\mathbf{4} \times \mathbf{14} = \mathbf{56}$ hours in a semester, including two hours for a final examination. Instructors usually give three or four exams (generally lasting at least **55** minutes), and a **2**-hour long final exam.

4 Topics Outline

- Review of Functions: Polynomial, circular, exponential and logarithmic functions and their graphs. Natural domain of a function. Transformations of the graphs of functions.
- Limits: One sided and two sided limits. Algebra of limits. Sandwich Theorem. The limit $\lim_{x\to 0} \frac{\sin x}{x}$.
- Continuity: Infinite and jump discontinuities. Weierstrass-Bolzano Intermediate Value Theorem.
- Rates of Change and Derivatives: Definition of the derivative. Physical interpretation of the derivative. Computation of the derivative from the limit definition.
- Differentiation Rules: Sum, product, quotient and chain rules.
- Derivatives of transcendental functions: circular, exponential, and logarithmic functions and their derivatives.
- Implicit and logarithmic differentiation.
- Related rates.
- Maxima and minima: Fermat's Theorem on critical points.
- Optimization: Applied problems in maxima and minima.
- Curve Sketching: Monotonicity of curves. Concavity and convexity of curves.
- Mean Value Theorems: Rolle's Theorem and its consequences. Mean Value Theorem and its consequences. Darboux-continuity of the derivative.
- Indeterminate forms.
- Antiderivatives.
- Indefinite integrals.
- The definite integral.
- Fundamental Theorem of Calculus.
- Integration by substitution.
- The logarithm as an integral.

5 Competencies

1. The Student will demonstrate knowledge of limits by:
   (a) computing limits at a point and at infinity algebraically,
   (b) applying the definition of continuity,
   (c) determining where a function is continuous or discontinuous.
2. The Student will demonstrate knowledge of differentiation by:
   (a) defining the derivative of a function as a limit,
   (b) finding the derivative of a function using the definition,
   (c) finding the equation of the line tangent to a curve at a point using a derivative,
   (d) finding the rate of change of a function using a derivative,
   (e) finding derivatives of polynomial, trigonometric, exponential, logarithmic, and hyperbolic functions using differentiation rules,
   (f) finding derivatives using the chain rule,
   (g) implicitly differentiating equations,
   (h) computing higher order derivatives,
   (i) determining maximum and minimum points of a function and intervals where it increases or decreases,
   (j) determining points of inflection of a function and intervals where it is concave or convex,
   (k) using the first and second derivative tests to find local extrema,
   (l) applying Rolle's theorem and the mean value theorem,
   (m) solving optimization problems,
   (n) solving problems involving related rates.
3. The Student will demonstrate knowledge of integration by:
   (a) finding antiderivatives involving polynomial, trigonometric, inverse trigonometric, exponential, logarithmic, and hyperbolic functions,
   (b) evaluating a definite integral as a limit of a Riemann sum,
   (c) computing the average value of a function over an interval,
   (d) computing definite integrals using the fundamental theorem of calculus,
   (e) solving applied problems using definite integrals,
   (f) finding indefinite integrals with a change of variables,
   (g) finding the area or regions under and between curves,
   (h) finding the volume of solids of revolution.