What is in this Handout: This handout contains information related to MATH 219 Calculus I. Its purpose is to help you make an informed decision about which course in the Algebra- Precalculus-Calculus sequence is right for you at Framingham State. Below you will find the catalog description for these courses, and a general overview of MATH 219 Calculus I. The next page provides a set of competency exercises that could typically appear in a MATH 219 Calculus I course. Students with no exposure to calculus in high school are encouraged to enroll in either MATH 123 College Algebra or MATH 180 Precalculus.

The Algebra-Precalculus-Calculus Sequence:

MATH 123 College Algebra: This course is an exploration of numerical, graphical and symbolic approaches to algebraic concepts with emphasis on real-world applications, modeling, and problem-solving skills. Topics include polynomials, rational expressions, equations and inequalities, systems of linear equations, matrices, and the connection between functions and their graphs.

MATH 180 Precalculus: This course is a thorough preparation in the skills and topics needed to study calculus. After a review of polynomial and rational functions and their graphs, topics include inverse functions, exponential and logarithmic functions, and trigonometric functions.

MATH 219 Calculus I: This course is a study of functions, limits, continuity, the derivative, rules of differentiation of algebraic, trigonometric, exponential and logarithmic functions, applications of differentiation, definite and indefinite integrals, and the Fundamental Theorem of Calculus.

General Overview: Calculus is the study of change.

Limits and Continuity

1. Compute the following limits.

   (a) $\lim_{x \to 4^+} \dfrac{x^2 - 16}{x - 4}$

   (b) $\lim_{x \to -\infty} \dfrac{\sqrt{5x^2 - 10}}{-2x + 7}$

2. Determine the interval(s) where $g(x) = 3x - \dfrac{1}{\sqrt{4 - x^2}}$ is continuous.

3. If $f(x) = \dfrac{1}{x^2}$, compute: $\lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$.

Differentiation

1. If $g(t)$ represents the height of an object at time t, describe $g'(t)$.

2. If $f(x) = x^2 - 4x + \dfrac{1}{\sqrt{2x}}$, find the equation of the line tangent to $f(x)$ at $x = 2$.

3. Sketch $f(x) = 3x^3 - 10x^2 + 7x + 5$. Label all extrema and inflection points; indicate intervals in which $f(x)$ is increasing, decreasing, concave up, and concave down.

4. (a) Use tangent line approximation to approximate $f(x) = 4x^2 - 1$ when $x = \dfrac{3}{2}$.

   (b) Use L'Hôpital's rule to compute the following limit $\lim_{x \to 0^+} x \cdot e^{1/x}$.

   (c) Of all boxes with square base, and top, that have volume of 100m^3 what are the dimensions of the one that has minimum surface area?

   (d) That pesky ladder is sliding down the side of the house again. This time, when there is 12 feet from the top of the 13-foot ladder to the ground, the base is sliding out at a rate of one-half of a foot each second. How fast is the top of the ladder sliding down the side of the house?

Integration

1. Use a left-hand Riemann Sum to approximate the area bounded by $f(x) = 4x - x^2$ from $x = 1$ to $x = 4$.

2. Compute the following definite integral $\displaystyle\int_0^{\pi} -\sin(x) \; dx$.