Calculus I Topic List:

Functions in General:

1. Terms to Know and Interpret Graphically: function, graph of a function, domain, range, y-intercept, x-intercept, root, odd function, even function, symmetric to the origin, symmetric to an axis, period of a function, upper and lower bounds, inverse function, invertible, slope, increasing, decreasing, local and global maximum and minimum, concave up and down, inflection points, continuous, differentiable

2. Be familiar with polynomial, rational, absolute value, logarithmic, exponential, trigonometric, and inverse trig functions and know how their graphs are affected by a change in parameter (e.g., $f(x)+a$, $f(x+a)$, $f(ax)$, $af(x)$)

Limits

1. Understand the intuitive definition of the following:

$$\lim_{x\to a} f(x) = L \quad lim_{x\to a^+} f(x) = L \quad lim_{x\to a^-} f(x) = L \quad lim_{x\to\infty} f(x) = L \quad lim_{x\to-\infty} f(x) = L$$

$$lim_{x\to a} f(x) = \infty \quad lim_{x\to a} f(x) = -\infty \quad lim_{x\to\pm\infty} f(x) = \infty \quad lim_{x\to\pm\infty} f(x) = -\infty$$

2. Find limits of each of the above types by symbolic (algebraic), graphical and numerical methods

3. Use of limits to determine whether a function has vertical and/or horizontal asymptotes

Derivatives

1. Formal Definition: Know the definition as the limit of a difference quotient and be able to use the definition to estimate and/or find the exact value of $f'(a)$ for a given function $f(x)$

2. The use of both *prime* notation ($f'(x)$, f"(x), $f^{(k)}(x)$) and *Leibniz* notation ($\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$)

3. Know and be able to apply derivative formulas both forwards and backwards (to find antiderivatives) for each of the following when functions are given symbolically, graphically and numerically (i.e. in tabular form)

c	x^n	e^x	$ln\,x$	$sin\,x$
$cos\,x$	$tan\,x$	$cot\,x$	$sec\,x$	$csc\,x$
cf	$f \pm g$	$f \cdot g$	f/g	$f \circ g$

4. Graphical Interpretation: Understand $f'(a)$ as the slope (of the tangent line) and the difference quotient as the slope of a secant line to a function $f(x)$.
   (a) Be able to estimate the value of $f'(a)$ and the sign of $f''(a)$ from a graph of $f(x)$.
   (b) Given information about $f'(x)$ and $f''(x)$, be able to sketch a graph of $f(x)$
   (c) Be able to use f' to find where $f(x)$ is increasing, decreasing, concave up, concave down
   (d) Be able to use f' and f'' to locate local (and global) maxima and minima, and inflection points

5. Rate of Change Interpretation: Understand $f'(x)$ as the (instantaneous) rate of change, and the difference quotient as the average rate of change of position For example, be able to interpret $f(x)$ as position, $f'(x)$ as velocity, and $f''(x)$ is acceleration

6. Use of derivatives in optimization applications