MATH 2413 Fall 2012, Lectures 31–33

Qingwen Hu

Department of Mathematical Sciences
The University of Texas at Dallas
Richardson, Texas
qingwen@utdallas.edu

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Outline of Sections 4.7–5.1

1. General procedure to solve an optimization problem;
2. General form of optimization problems;
3. Anti-derivetives; The most general anti-derivative;
4. First derivative test for global max/min;
5.

$$\int 1\mathrm{d}x = x + C \qquad \int x^n \mathrm{d}x = \frac{1}{n+1}x^{n+1} + C$$

$$\int e^x \mathrm{d}x = e^x + C \qquad \int \frac{1}{x}\mathrm{d}x = \ln|x| + C$$

$$\int \cos x \mathrm{d}x = \sin x + C \qquad \int \sin x \mathrm{d}x = -\cos x + C$$

$$\int \sec^2 x \mathrm{d}x = \tan x + C \qquad \int \csc^2 x \mathrm{d}x = -\cot x + C$$

$$\int \sec x \tan x \mathrm{d}x = \frac{1}{\cos x} + C \qquad \int \csc x \cot x \mathrm{d}x = -\frac{1}{\sin x} + C$$

$$\int \frac{1}{\sqrt{1-x^2}}\mathrm{d}x = \arcsin x + C \qquad \int \frac{1}{1+x^2}\mathrm{d}x = \arctan x + C$$

Outline of Sections 4.7–5.1

1. Finite sum approximation of the area or net area of the region between the graph of $y = f(x), a \leq x \leq b$ and the x-axis.
2. Partition of the interval $[a, b]$; step size; representation of partitioning points; sample points;
3. Upper sum/lower sum;
4. sigma notation and its basic properties.

Exercises:

1. Give an example function which has local maximimum and local minimum but no absolute maximum and minimum;
2. Consider a differentiable function $y = f(x)$, $x \in (a, b)$. Is it true that if there exists a global maximum, then it must also be a local maximum?
3. Consider a differentiable function $y = f(x)$, $x \in (a, b)$. If we don't know whether or not a global maximum exists, can we search among the local maximums of f to determine its global maximum?
4. Consider $y = x^3$, $x \in [-1, 1]$. Partition the interval $[-1, 1]$ into $2n$ intervals with equal length. Find the partitioning points and write the finite sum approximation of the net area of the region between f and the x-axis, using rectangles with height equal to the function value at the right end point of each of the sub-intervals.