

CONCORDIA UNIVERSITY
Math-205, Midterm Examination
23 May, 2012

Instructions: This is a closed-book test, notes are not allowed.

Answers without showing any intermediate work will not be accepted.

The marks for each question are indicated, with $100\% = 40$ marks.

- [10] **1.** (a) Write the sigma notation formula for the right Riemann sum R_n of $f(x) = 3x^2$ on the interval $[1,2]$ with partitioning on n subintervals of equal length, and calculate the definite integral $\int_1^2 f(x) dx$ as the limit of R_n at $n \rightarrow \infty$.

(Reminder: $\sum_{k=1}^n k = n(n+1)/2$, $\sum_{k=1}^n k^2 = n(n+1)(2n+1)/6$)

- (b) Calculate the derivative of $F(x) = \int_0^{x^2} \frac{t-4}{1+\cos^2(t)} dt$, and find the points x where the local extrema (maximum or minimum) of $F(x)$ are reached.

- [5] **2.** Find the function $F(x)$ such that $F(0) = 1$ and $\frac{dF}{dx} = \frac{\sec^2(x)}{1+\tan(x)} + x e^{-x^2}$.

- [12] **3.** Calculate the following indefinite integrals

(a) $\int x(x^{-1} + \sqrt{x})^2 dx$ (b) $\int \frac{t^2 + 4t}{t^2 + 4} dt$ (c) $\int \frac{e^x}{e^{2x} - 9} dx$

- [8] **4.** Evaluate the following definite integrals (*give the exact values, do not approximate*):

(a) $\int_0^4 \frac{x}{\sqrt{2x+1}} dx$ (b) $\int_0^1 x^2 \cos(\pi x) dx$

- [5] **5.** Find the mean value of the function $f(x) = \sin^3(x) \cos^2(x)$ on the interval $[0, \pi/2]$.

- [2] **Bonus.** Assuming $f(x)$ is a continuous function of x , find $F'(x)$ for

$$F(x) = \int_1^x [x + f(t)] dt$$

NOTE: the answer is **not** $F'(x) = x + f(x)$.