

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Sections
Mathematics	205	All
Examination	Date	Duration
Midterm	20 October, 2013	1 h 30 min
Special	Only approved calculators are allowed.	
Instructions:	Show all your work for full marks	

1. (9 marks): (a) Approximate the definite integral $A = \int_1^4 (5 - x^2) dx$ by a right Riemann sum R_3 using 3 approximating rectangles of equal widths.
- (b) Now find the approximation by a left Riemann sum L_3 , again using 3 approximating rectangles of equal widths.
- (b) Calculate the exact value of A by integrating. Can you explain why $\frac{1}{2}(R_3 + L_3)$ is closer to A than either R_3 or L_3 ?

2. (5 marks): Use Part 1 of the Fundamental Theorem of Calculus to find $F'(x)$ for $F(x) = \int_{\cos x}^3 \sqrt{1+t^3} dt$.

3. (6 marks): Find $f(t)$, given $f'(t) = \frac{10t}{\sqrt[3]{t-2}}$ and $f(8) = -20$.

4. (12 marks): Calculate the following indefinite integrals

(a) $\int \frac{x^3}{\sqrt{16-x^2}} dx$ (b) $\int \frac{3x^2 + 4x + 4}{x^3 + x} dx$

5. (12 marks): Evaluate the following definite integrals (*do not approximate*):

(a) $\int_0^{\pi} \cos^4 x \tan^2 x dx$ (b) $\int_1^e x^2 \ln x dx$

6. (6 marks): Find the area of the region enclosed by the curves $x = |y|$ and $x = y^2 - 2$.

Bonus. (3 marks): Given that

$$\int_0^{\pi} [f(x) + f''(x)] \sin x dx = 2$$

and $f(\pi) = 1$, find $f(0)$.