

**CONCORDIA UNIVERSITY**  
**Department of Mathematics & Statistics**

Course	Number	Section
Mathematics	205	CA
Examination	Date	Duration
Midterm	July 18, 2016	90 minutes
Instructor	Course Examiners	
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<b>Special Instructions:</b>	Only approved calculators are allowed. <b>Show all your work for full marks.</b>	

[Marks]

- [10] 1. (a) Write the sigma notation formula for the right-endpoint Riemann sum  $R_n$  of the function  $f(x) = -x^2 + 3x$  on the interval  $[-2, 2]$  using  $n$  subintervals of equal length, and calculate the definite integral  $\int_{-2}^2 f(x) dx$  as the limit of  $R_n$  as  $n \rightarrow \infty$ .

$$\text{(Reminder: } \sum_{i=1}^n i = \frac{n(n+1)}{2}, \quad \sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6} \text{ )}$$

- (b) Evaluate the definite integral  $\int_{-1}^4 f(x) dx$  where  $f(x) = 2|x - 1| - 2$  by interpreting it in terms of area.

- [6] 2. Calculate the derivative of the function  $F(x) = \int_0^x e^{-t} \cos^2(1 + 5t) dt$  and determine where  $F(x)$  is decreasing.

- [6] 3. Find the antiderivative  $F(x)$  of  $f(x) = \frac{2x + 1}{x^2 + 4}$  such that  $F(0) = 0$ .

- [10] 4. Calculate the following indefinite integrals:

$$\text{(a) } \int \frac{\arcsin(\sqrt{x})}{\sqrt{x}} dx \quad \text{(b) } \int \frac{1}{x^2 - 9} dx$$

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

$$\text{(a) } \int_0^2 \frac{\sqrt{4 - x^2}}{x^2} dx \quad \text{(b) } \int_{-\pi/4}^{\pi/4} \sec^3 \theta d\theta$$

- [6] 6. Calculate the area enclosed by the curves  $y = x^2$  and  $y = \sqrt{x}$ .

- [3] **Bonus question.** If  $f(t) = \frac{\cos(t)}{t^8 + t^4 + 1}$  and  $F(x) = \int_0^x f(t) dt$ , evaluate  $\int_{-e/\sqrt[3]{\pi}}^{e/\sqrt[3]{\pi}} F(x) dx$ .