

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Sections
Mathematics	205	All
Examination	Date	Duration
Midterm	10 March, 2019	1 h 30 min
Special	Only approved calculators are allowed	
Instructions:	Show all your work for full marks	

1. (6+5 marks):

(a) Graph $f(x) = \begin{cases} \sqrt{1-x^2} - 1, & -1 \leq x \leq 0 \\ |x-1| - 1, & x > 0 \end{cases}$ on the interval $[-1, 3]$,

and use it to calculate the definite integral $\int_{-1}^3 f(x) dx$ in terms of area.

(b) Use the Fundamental Theorem of Calculus to find the function $f(x)$ and the constant A such that $\int_x^2 f(t) dt + A = x^2 + x$.

2. (6 marks): Find the antiderivative $F(x)$ of $f(x) = \frac{\cos^5(x) + 1}{\cos^2(x)}$ such that $F(0) = 0$.

3. (5+5 marks): Calculate the following indefinite integrals

(a) $\int \frac{x^2 - 2}{x^2 - x - 2} dx$ (b) $\int e^{2x} \sqrt{e^x + 1} dx$

4. (5 marks): Sketch the graphs of functions $x = 2y^2$ and $x = 4 + y^2$, and find the area enclosed (**do not approximate**).

5. (6+6 marks): Evaluate the following definite integrals (**do not approximate**):

(a) $\int_{\sqrt{2}}^2 \sqrt{4-x^2} dx$ (b) $\int_0^{\pi/4} \arctan(x) dx$

6. (6 marks): Sketch the region enclosed by the graphs of $y = \sqrt{x}$, x -axis and the line $x = 4$. Find the volume of a solid obtained by rotating this region about the axis $y = -1$.

Bonus. (3 marks): Given that $\int_0^1 e^{-x}[f(x) - f'(x)] dx = e$ and $f(0) = 0$, find $f(1)$.