CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Sections
Mathematics	205	All
Examination	**Date**	**Duration**
Midterm	5 March, 2017	1 h 30 min
Special	Only approved calculators are allowed	
Instructions:	**Show all your work for full marks**	

1. (10 marks):

    (a) Graph the function $f(x) = \begin{cases} -\sqrt{4-x^2} & -2 \le x \le 2 \\ |x-3|-1 & x > 2 \end{cases}$ on the interval $[-2,6]$,

        and use it to calculate the definite integral $\int\limits_{-2}^{6} f(x)\,\mathrm{d}x$ in terms of area.

    (b) Use the Fundamental Theorem of Calculus to find the function $f(x)$ and

        the constant A such that $\int\limits_{x}^{2} f(t)\,dt = x - x^2 + A$.

2. (6 marks): Find the antiderivative $F(t)$ of $f(t) = (\sec^4 t + 1)$ such that $F(0) = 0$.

3. (10 marks): Calculate the following indefinite integrals

    (a) $\displaystyle \int \frac{e^x}{e^{2x} - e^x - 2}\, dx$ **(b)** $\displaystyle \int x^5 \sqrt{x^3 - 4}\, dx$

4. (12 marks): Evaluate the following definite integrals (*do not approximate*):

    (a) $\displaystyle \int\limits_{0}^{\sqrt{2}} \sqrt{4 - x^2}\, dx$ **(b)** $\displaystyle \int\limits_{0}^{\pi/2} x \sin(2x)\, dx$

5. (6 marks): Sketch the graphs of functions $y = \dfrac{3}{x}$ and $y = (4 - x)$, and find
       the area enclosed (*do not approximate*).

6. (6 marks): Sketch the region enclosed by the graph of $y = \sqrt{1+x}$, the x-axis and
       the line $x = 3$. Find the volume of a solid obtained by rotating this
       region about the axis $y = -1$.

Bonus. (3 marks): Given two times differentiable function $g(x)$ find the
       antiderivative of $f(x) = \dfrac{g(x)}{x^2} + g''(x) \ln x$.