## CONCORDIA UNIVERSITY

## Department of Mathematics & Statistics

Course	Number	Sections
Mathematics	205	All
Examination	Date	Duration
Midterm	5 March, 2017	$1\ \mathrm{h}\ 30\ \mathrm{min}$
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  $\int_{2}^{6} f(x) dx$  in terms of area.
- (b) Use the Fundamental Theorem of Calculus to find the function f(x) and the constant A such that  $\int_{x}^{2} f(t) dt = x x^{2} + A$ .
- **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) 
$$\int \frac{e^x}{e^{2x} - e^x - 2} dx$$
 (b)  $\int x^5 \sqrt{x^3 - 4} dx$ 

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

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

- **5.** (6 marks): Sketch the graphs of functions  $y = \frac{3}{x}$  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  $f(x) = \frac{g(x)}{x^2} + g''(x) \ln x$ .