Text Merlin by tomorrow to check our work (514) 568-3394

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Sections
Mathematics	203	All
Examination	**Date**	**Duration**
Midterm Test	8 March, 2015	1 h 30 min
Special Instructions:	Only approved calculators are allowed **Show all your work for full marks**	

1. (12 marks): **(a)** Solve for x : $\log_{10}(x) + \log_{10}(x-3) = 1$.

(b) Let $f(x) = \ln(x) - 1$. Find the composite function $g = f \circ f$ and determine the domain and the range of $g(x)$.

(c) Let $f(x) = \dfrac{x+3}{2x+1}$. Find inverse function $f^{-1}(x)$ and determine the domain of $f(x)$ **and** the domain of $f^{-1}(x)$.

2. (8 marks) Find the limit or explain why the limit does not exist:

(a) $\displaystyle\lim_{x\to\infty} \frac{1}{x(\sqrt{x^2+1} - \sqrt{x^2-1})}$

(b) $\displaystyle\lim_{x\to 4^+} \frac{3x-12}{|4-x|}$

3. (6 marks) Find **(a)** all horizontal and **(b)** all vertical asymptotes of the graph

$$y = \frac{x\sqrt{4x^2+9}}{x^2+2x-8}$$

4. (4 marks) Find the second derivative of the function $f(x) = \dfrac{\sin x}{1+\cos x}$, and calculate its value at $x = 0$, i.e. $f''(0)$.

(continued on the other side)

5. (16 marks) Find the derivatives of the following functions. (You don't need to simplify the final answer, but you must show how you calculate it):

(a) $f(x) = (1+\sqrt{x})\, x^{5/2}\, x^{-2}$ (hint : simplify first $f(x)$)

(b) $f(x) = (x^3 - 3x)\, e^{-x}$

(c) $f(x) = \dfrac{\sin(x)\cos(x)}{\sin(x) + \tan(x)}$

(d) $f(x) = \sqrt{e^{3x}\sin(x^2+1)}$

6. (4 marks) Write equation of the tangent line to the curve $y = e^{x-2}\sqrt{x-1}$ at the point $(2, f(2))$.

Bonus Question (3 marks). Consider the function

$$f(x) = \begin{cases} x + a & \text{if } x \leq 1 \\ ax^2 + b & \text{if } x > 1 \end{cases}$$

where a and b are parameters. Find the values of a and b that make $f(x)$ differentiable everywhere, or explain why this is impossible.