

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Sections
Mathematics	203	All
Examination	Date	Duration
Midterm	18 February, 2012	1 h 30 min
Special Instructions:	Only approved calculators are allowed Show all your work	

MARKS

- [6] 1. Solve for x (Note: guessing the answer and checking by substitution is not an acceptable solution.)
- (a) $\log_2(3x) - \log_2(1 - x) = 2$
- (b) $9^x - 4 \cdot 3^x = 12$
- [7] 2. (a) Let $f(x) = \sqrt{x}$ and $g(x) = \frac{1}{x^2 - 1}$. Find the following functions and their domains:
- (i) $f \circ g$
- (ii) $g \circ f$
- (b) Given the function $f(x) = \frac{1}{3} \ln(2 + e^x)$, find the inverse function f^{-1} and the domain of f^{-1} .
- [6] 3. Evaluate the limits:
- (a) $\lim_{x \rightarrow 0} \frac{\sqrt{3x^2 + 4} - 2}{x^2}$
- (b) $\lim_{x \rightarrow -\infty} \frac{\sqrt[3]{1 + 6x^4 - 8x^9}}{3x^3 - 4x^2 + 2}$
- [3] 4. Let $f(x) = \frac{x - 4}{x^2 + 2x - 24} + 2$.
- Find the equations of all horizontal and vertical asymptotes.

(continued on the other side)

- [12] 5. 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) $f(x) = \frac{3x^{2/3}}{1+x^3}$

(b) $f(x) = e^x(\sin x - \cos x)$

(c) $f(x) = \sqrt{x + \sqrt{x^2 + 1}}$

(d) $f(x) = \ln(1 + \arctan x)$

[6] 6. Let $f(x) = \frac{1}{x}$.

- (a) Use the definition of derivative

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

to find $f'(2)$.

- (b) Find the equation of the tangent line $T(x)$ to the graph of $f(x)$ at the point $(2, f(2))$.

[3] **Bonus Question.**

Use the definition $|x| = \sqrt{x^2}$ and the Chain Rule to show that if $f(x) = |\sin x|$

then $f'(x) = \frac{\sin x}{|\sin x|} \cos x$ whenever $\sin x \neq 0$.

What can you say about $f'(x)$ when $\sin x = 0$?