CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)
Mathematics	209	All
Examination	**Date**	**Pages**
Final	April 22 2017	3
Instructors		**Course Examiner**
ALL		R. Raphael

Special Instructions

- ▷ Ruled booklets to be used.
- ▷ Approved calculators allowed.

MARKS

[6] **1.** (a) Find the following limits

(i) $\lim_{x \to 1} \dfrac{2x^5 + 7x - 1}{x^2 + 5x + 3}$

(ii) $\lim_{x \to 2} \dfrac{x^2 + x - 6}{2x^2 - 3x - 2}$

(b) Prove or disprove by giving an example: there exists a function f from the real numbers to the real numbers that is discontinuous at exactly three points.

[4] **2.** Find the derivative $f'(x)$ of the functions $f(x)$: (Do not simplify)

(a) f(x)= $4x^5 - 9x^2 + x - 22$

(b) f(x)= $\dfrac{x^{-7}}{8} + \dfrac{1}{\sqrt[2]{x}}$

[10] **3.** Find $\frac{dy}{dx}$ (do not simplify):

(a) $y = \frac{7 - x^3}{e^{3x}}$

(b) $y = ln(3x^4 + 7)$

(c) $y = (4x - 5)^3(3x^2 + 4)$

(d) $y = (5 + x^3 lnx)^3$

[8] **4.** Let $f(x) = 4x^4 - x^2 - 7$

(a) Find the slope of the tangent line to the curve when $x = 1$

(b) Find the equation of the tangent line to the curve when $x = 1$

[13] **5.** Let $f(x) = x^4 - 2x^3$

Find

(a) the critical and inflection points of $f(x)$

(b) the intervals where $f(x)$ is increasing and where it is decreasing

(c) the intervals on which $f(x)$ is concave up and on which it is concave down

(d) use the above to sketch the graph

[9] **6.** If the cost of a seminar is \$400 per person 1000 people attend. For every \$5 dollar reduction in cost 20 more people will attend the seminar.
How much should be charged for the seminar to maximize revenue?

[6] **7.** Find the absolute extrema of the function $f(x) = x^3 - 12x$ on the interval $[-5, 5]$.

[4] **8.** A country has Lorenz curve $f(x) = x$. Find its Gini index. What can you conclude from the Gini index?

[10] **9.** Find the equation(s) of the tangent line(s)to the graph of $y - xy^2 + x^2 + 1 = 0$ at the point(s) with $x = 1$.

[10] **10.** Compute these antiderivatives:

(a) $\int (5x^7 - 4x^3 - 9)\,dx$

(b) $\int \frac{e^{-2x}}{4 + e^{-2x}}\,dx$

(c) $\int \frac{x^2}{\sqrt{x-5}}\,dx$

[10] **11.** Evaluate the integrals:

(a) $\int_0^1 (x^4 - 5)\,dx$

(b) $\int_6^{10} \frac{2}{x-4}\,dx$

(c) $\int_4^7 \sqrt{x-2}\,dx$

[10] **12.** Find the area bounded by the graphs of $f(x) = 5 - x^2$ and $g(x) = 2 - 2x$.