CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number		Section(s)
Mathematics	209/4		All except EC
Examination	**Date**	**Time**	**Pages**
Final	April 2015	3 Hours	2

Instructors **Course Examiner**

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Special Instructions:

- ▷ Answer all questions.
- ▷ **Only approved calculators are allowed.**

MARKS

[9] **1.** Find the following limits:

(a) $\lim_{x\to 3^-} \dfrac{x-3}{|x-3|}$ (b) $\lim_{x\to 7} \dfrac{(x-7)^2}{x^2-4x-21}$ (c) $\lim_{x\to -\infty} \dfrac{2x^3}{3(x-2)^2}$

[18] **2.** Find the derivative for each of the following (do not simplify):

(a) $y = x^{-\frac{7}{3}} - 3x^{-4}$

(b) $y = 9x^{\frac{1}{3}}(x^3+5)$

(c) $y = \dfrac{x^2-3x+1}{x^2-1}$

(d) $y = (1+e^x)\ln x$

(e) $y = \dfrac{2\sqrt{x}}{x^2-3x+1}$

(f) $y = [\ln(x^2+3)]^{\frac{3}{2}}$

[6] **3.** Use implicit differentiation to find $y' = \frac{dy}{dx}$ for $x\ln y + 2y = 2x^3$.

[6] **4.** The average pulse rate y (in beats per minute) of a healthy person x inches tall is given approximately by

$$y = \frac{590}{\sqrt{x}} \quad ; \qquad 30 \le x \le 75$$

Approximately how will the pulse rate change for a change in height from 64 to 65 inches?

[12] **5.** Given $f(x) = 2x^3 - 3x^2 - 36x$ find:

(a) the critical value(s) of f.

(b) the interval(s) where $f(x)$ is increasing;

(c) the interval(s) where $f(x)$ is decreasing;

(d) the local maxima and minima.

[6] **6.** Given $g(x) = -x^4 + 12x^3 - 12x + 24$ find:

(a) the interval(s) where $g(x)$ is concave upward;

(b) the interval(s) where $g(x)$ is concave downward;

(c) the inflection point(s);

[6] **7.** Find the absolute extrema of $f(x) = x^4 - 4x^3 + 5$ on the interval $[-1, 2]$.

[9] **8.** Evaluate the following; answers must be accurate to 3 decimals:

(a) $\int_{-1}^{0} x^2(2 + x^3)^{-2}\, dx$

(b) $\int_{-1}^{1} \frac{e^{-x} - e^{x}}{(e^{-x} + e^{x})^2}\, dx$

(c) $\int_{0}^{5} \frac{x}{(x^2 + 10)}\, dx$

[10] **9.** Compute the antiderivatives:

(a) $\int \frac{x}{\sqrt{x-3}}\, dx$

(b) $\int \frac{x^3}{\sqrt{2x^4+3}}\, dx$

(c) $\int 4x^2\sqrt{x^3 + 5}\, dx$

(d) $\int \frac{e^{x}}{(e^{x}+2)^2}\, dx$

[10] **10.** Find the area bounded by $y = x^3 - 3x^2 - 9x + 12$ and $y = x + 12$.

[8] **11.** A 17-foot ladder is placed against a wall. If the foot of the ladder is pushed toward the wall at 0.5 foot per second, how fast is the top of the ladder rising when the foot is 8 feet from the wall?