CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	**Number**		**Section(s)**
Mathematics	209/2		All
Examination	**Date**	**Time**	**Pages**
Midterm	October 2014	1 Hour 30 minutes	2
Instructors			**Course Examiner**
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Special Instructions:

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

MARKS

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

(a) $\lim_{x\to 2} \dfrac{-x}{(x-2)^2}$ (b) $\lim_{x\to 5} \dfrac{\sqrt{x-1}-2}{x-5}$ (c) $\lim_{x\to\infty} \dfrac{3x^2-2x-1}{4x^3-5x}$

[6] **2.** Let $g(x) = 4x - x^2$. Work out the following in detail:

$$g'(x) = \lim_{t\to 0} \frac{g(x+t)-g(x)}{t}$$

[12] **3.** (a) If $f(x) = 7\sqrt[6]{x^3} - \frac{1}{x^5}$, find $f'(1)$. You need not simplify.

(b) If $g(x) = [1 + 3ln(x^2)][3x^4 - 4]$, find $g'(2)$. You need not simplify.

(c) Find $h'(x)$ if $h(x) = \frac{x^3-3}{3x+5}$. You need not simplify.

(d) Find the value of dy if $y = \sqrt{2x+8},\ x = 4$, and the change in x is 0.1.

[8] **4.** A company manufactures and sells x transistor radios per week. The weekly cost and revenue equations are

$$C(x) = 5,000 + 2x$$

$$R(x) = 10x - \frac{x^2}{1,000}$$

Both functions have domain $0 \le x \le 8,000$. Find the approximate changes in revenue and profit if production is increased from $2,000$ to $2,010$ units per week.

PLEASE TURN OVER

[9] **5.** The total cost (in dollars) of producing x washing machines is

$$C(x) = 10,000 + 200x - \frac{1}{10}x^2$$

(a) Find the average cost function and the average cost of producing 200 washing machines.

(b) Find the exact average cost of producing the $201st$ washing machine.

(c) Use the marginal average cost to approximate the cost of producing the $201st$ washing machine.

[8] **6.** Find x' for the function $x(t)$ defined implicitly below. Evaluate x' at the indicated point.

$$x^2 - tx^2 + t^3 + 11 = 0;\ (t, x) = (-2, 1)$$

[8] **7.** The radius of a spherical balloon is increasing at the rate of 3 centimeters per minute. How fast is the surface area of the sphere increasing when the radius is 10 centimeters? [Surface area $A = 4\pi r^2, \pi \approx 3.14$]