CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)
Mathematics	209	All
Examination	**Date**	**Pages**
Final	June 2009	3
Instructors		**Course Examiner**
M. Amir, L. Dube, U. Tiwari		R. Raphael

Special Instructions

- ▷ Ruled booklets to be used.
- ▷ **Only approved calculators are allowed.**

MARKS

[11] **1.** (i) Find $\lim\limits_{x\to\infty} \dfrac{7x^3+5x^2+2}{4x^3-2x+5}$

(ii) Given $\lim\limits_{x\to 5} f(x) = -7$ and $\lim\limits_{x\to 5} g(x) = 8$, find

(a) $\lim\limits_{x\to 5} [-3g(x)]$ (b) $\lim\limits_{x\to 5} [-5f(x)]$ (c) $\lim\limits_{x\to 5} [g(x) * f(x)]$

(iii) Find the value of each of the following:

(a) $\lim\limits_{x-3} \dfrac{x^2-9}{(x+3)}$ (b) $\lim\limits_{x\to a} \dfrac{x^2-3x+2}{(x+7)}$

$= -6$

[5] **2.** Using the definition of the derivative $\lim\limits_{h\to 0} \dfrac{f(a+h)-f(a)}{h}$, find the derivative if $f(x) = -7x^3 - 8$.

[14] **3.** Do not simplify answers.

(a) If $f(x) = 3x^{14} - 8x^2 + 2e$, find $f'(x)$.

(b) If $f(x) = (4x^3-8)(x^5-2x^3+1)$, find $f'(x)$.

(c) If $f(x) = \dfrac{x^3-1}{x^2+3}$, find $f'(x)$.

3. (Continued)

(d) If $y = e^{(x^2-5)}$, then $y' = ?$

(e) If $y = \ln[(4x^2 - 3)^4]$, then $\dfrac{dy}{dx} = ?$

(f) If $y = \dfrac{1}{\sqrt[7]{2 - 3x}}$, then $\dfrac{dy}{dx} = ?$

[3] **4.** Find y' given $x^3y^2 = 5x^3e^y - 7$.

[11] **5.** A small machine shop manufactures drill bits used in the petroleum industry. The shop manager estimates that the total daily cost (in dollars) of producing x bits is

$$C(x) = 1{,}000 + 25x - 0.1x^2$$

(a) Find $\overline{C}(x)$ and $\overline{C'}(x)$.

(b) Find $\overline{C}(10)$ and $\overline{C'}(10)$, and interpret these quantities.

(c) Use the results from parts (b) to estimate the average cost per bit at a production level of 11 bits per day.

[11] **6.** Suppose that for a company manufacturing transistor radios, the cost and revenue functions are given by

$$C = 5{,}000 + 2x$$
$$R = 10x - 0.001x^2$$

where the production output in 1 week is x radios. If production is increasing at the rate of 500 radios per week when production is 6,000 radios, find the rate of increase per week in

(a) Cost;

(b) Revenue;

(c) Profit.

[11] **7.** Compute the following:

(a) $\int x^6(x^7-2)^3\,dx$

(b) $\int \sqrt[5]{x^7}\,dx$

(c) $\int \frac{2}{\sqrt{1-7x}}\,dx$

(d) $\int \frac{\ln(7x^2)}{x}\,dx$

(e) $\int e^{(6x^2-x^3)}\,(4x-x^2)\,dx$

[7] **8.** A manufacturer of sunglasses currently sells one type of \$4 a pair. The price p and the demand x for these glasses are related by

$$x = f(p) = 7{,}000 - 500p$$

If the current price is increased, will revenue increase or decrease?

[4] **9.** How long will it take \$100 to become \$200 if it is invested at 2.6% compounded continuously?

[11] **10.** Find the area bounded by the graphs of $f(x) = \frac{1}{2}x + 3, g(x) = -x^2 + 1, x = -2$ and $x = 1$.

[12] **11.** Let $f(x) = x^4 + 4x^3$.

(a) Find where $f(x)$ is increasing, is decreasing, and has local extrema.

(b) Find where $f(x)$ is concave up, is concave down, and has points of inflection.

(c) Graph $f(x)$.