

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)
Mathematics	209	All
Examination	Date	Pages
Final	December 2008	3
Instructors	Course Examiner	
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Special Instructions		
▷ Ruled booklets to be used.		
▷ Only approved calculators are allowed.		

MARKS

[11] 1. (i) Find $\lim_{x \rightarrow \infty} \frac{4x^3 - 2x + 5}{7x^3 + 5x^2 + 2}$

(ii) Given $\lim_{x \rightarrow 3} f(x) = -5$ and $\lim_{x \rightarrow 3} g(x) = 4$, find

(a) $\lim_{x \rightarrow 3} [-2g(x)]$ (b) $\lim_{x \rightarrow 3} [-3f(x)]$ (c) $\lim_{x \rightarrow 3} [g(x) * f(x)]$

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

(a) $\lim_{x \rightarrow 5} \frac{x^2 - 25}{(x - 5)}$ (b) $\lim_{x \rightarrow 3} \frac{x^2 - 3x + 2}{(x - 1)}$

[5] 2. Using the definition of the derivative $\lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$, find the derivative if $f(x) = -2x^3 + 5$.

[14] 3. Do not simplify answers.

(a) If $f(x) = 3x^{15} - 4x^3 + e$, find $f'(x)$

(b) If $f(x) = (x^3 - 2x^2 + 1)(3x^2 - 7)$, find $f'(x)$.

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

3. (Continued)

(d) If $y = e^{(x^3+7)}$, then $y' = ?$

(e) If $y = \ln[(3x^2 + 5)^4]$, then $\frac{dy}{dx} = ?$

(f) If $y = \frac{1}{\sqrt[5]{2x-1}}$, then $\frac{dy}{dx} = ?$

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

[11] 5. The total profit (in dollars) from the sale of x lawn mowers is

$$P(x) = 30x - 0.03x^2 - 750, \quad 0 \leq x \leq 1,000$$

- (a) Find the average profit per mower if 50 mowers are produced.
- (b) Find the marginal average profit at a production level of 50 mowers, and interpret the results.
- (c) Use the results from parts (a) and (b) to estimate the average profit per mower if 51 mowers are produced.

[11] 6. Suppose that for a company manufacturing transistor radios, the cost, revenue and profit equations 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 2,000 radios, find the rate of increase per week in

- (a) Cost;
- (b) Revenue;
- (c) Profit.

[11] 7. Compute the following:

(a) $\int 3x^3(x^4 + 5)^3 dx$

(b) $\int \sqrt[4]{x^3} dx$

(c) $\int \frac{5}{\sqrt{1-6x}} dx$

(d) $\int \frac{\ln(5x)}{x} dx$

(e) $\int (2x + x^2) e^{(3x^2+x^3)} dx$

[7] 8. Use the price-demand equation to determine whether demand is elastic, is inelastic, or has unit elasticity at the indicated values of p for

$$x = f(p) = 1,875 - p^2$$

(a) $p = 15$

(b) $p = 25$

(c) $p = 40$

[4] 9. How long will it take money to triple if it is invested at 5.5% compounded continuously?

[11] 10. Find the area bounded by $f(x) = x^2 - x$ and $g(x) = 2x$, for $-2 \leq x \leq 3$.

[12] 11. Let $f(x) = x^4 - 2x^3$.

(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 $f(x)$.

