

Course	Number	Section(s)	
Mathematics	209/2	All except EC	
Examination	Date	Time	Pages
Final	December 2014	3 Hours	2
Instructors	Course Examiner		
B. Rhodes, C. Santana, F. Romanelli, L. Dube, N. Fabien, R. Mearns			D. Sen

Special Instructions:

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

MARKS

[9] 1. Find the following limits:

(a) $\lim_{x \rightarrow 1^-} \frac{|x-1|}{x-1}$ (b) $\lim_{x \rightarrow -2} \frac{(x+2)^2}{x^2-4}$ (c) $\lim_{x \rightarrow \infty} \frac{x^2+4}{4-25x^2}$

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

(a) $y = 5x^{-7} - 2x^{-4}$

(b) $y = \frac{5}{x^{\frac{1}{2}}} - \frac{8}{x^{\frac{3}{2}}}$

(c) $y = \frac{2x^5 - 4x^3 + 2x}{x^3}$

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

(e) $y = \frac{\log_2 x}{1 + x^2}$

(f) $y = 2 \ln(x^2 - 3x + 4)$

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

[10] 4. A manufacturer of sunglasses currently sells one type for \$15 a pair. The price p and the demand x for these glasses are related by

$$x = f(p) = 9,500 - 250p \quad E = \frac{-p \cdot f'}{f}$$

(a) Calculate Elasticity E .

(b) Use answer in (a) to find whether revenue increase or decrease.

5. Given $f(x) = x^4(x - 6)^2$ find:

- (a) the critical values of f .
- (b) the intervals where $f(x)$ is increasing;
- (c) the intervals where $f(x)$ is decreasing;
- (d) the local maxima and minima.

[6] 6. Given $g(x) = \ln(x^2 - 2x + 10)$ find:

- (a) the intervals where $g(x)$ is concave upward;
- (b) the intervals where $g(x)$ is concave downward;
- (c) the inflection point(s);

[6] 7. Find the absolute extrema of $f(x) = x^4 - 8x^2 + 16$ on the interval $[-3, 4]$.

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

- (a) $\int_{-5}^5 (10 - 7x + x^2) dx$
- (b) $\int_0^1 x e^{-2x^2} dx$
- (c) $\int_0^3 \frac{x}{(1+x^2)^2} dx$

[10] 9. Compute the antiderivatives:

- (a) $\int \frac{x^2 e^x - 2x}{x^2} dx$
- (b) $\int \frac{x}{\sqrt{x+5}} dx$
- (c) $\int x^3(2x^4 + 5)^5 dx$
- (d) $\int \frac{e^{-x}}{(e^{-x}+3)} dx$

[10] 10. Find the area bounded by $y = x^3 + 1$ and $y = x + 1$.

[4] 11. If the exponential growth law applies to Canada's population growth, at what continuous compound growth rate will the population double over the next 100 years?

~~A. P. Loest~~
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