

**QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS**

**Final Examination
2.5 Hours**

Mathematics 131

Fall 2008

Instructions:

Answer all questions.

Show all work.

1) (i) Find the following limits (finite or infinite):

(a) $\lim_{x \rightarrow -2} \frac{x^2 - x - 6}{x^2 - 4}$

(b) $\lim_{x \rightarrow 4} \frac{x-4}{\sqrt{x}-2}$

(c) $\lim_{x \rightarrow 3^-} \frac{x^2 + 9}{x-3}$

(d) $\lim_{x \rightarrow +\infty} \frac{3x^2 - 4x + 1}{5x^2 + 3x + 2}$

(ii) Let $f(x) = \frac{x^3 + 1}{x + 1}$. Use your calculator to complete the table below and enter the results into your exam booklet. State the value of $\lim_{x \rightarrow -1} f(x)$, using the table values you obtain.

x	-1.1	-1.01	-1.001	-1	-0.999	-0.99	-0.9
$f(x)$							

2) Given $f(x) = 3 - 2x^2$, find $f'(x)$ using the definition of the derivative.

3) (i) Find $\frac{dy}{dx}$ for each of the following functions. **Do not simplify.**

a) $y = \sqrt[4]{\frac{1-2x}{5x+3}}$

b) $y = e^{3x^2} \ln(5 + 3x^4)$

(ii) Use logarithmic differentiation to find $f'(x)$ if $f(x) = \sqrt{\frac{(x^2 + 3)^2}{x-2}}$.

4) The cost of producing x units of a certain commodity is $c(x) = \frac{1}{4}x^2 + 5x + 58$ dollars.

a) Use marginal analysis to estimate the cost of producing the 7th unit.

b) Calculate the actual cost of producing the 7th unit.

5) Find an equation of the tangent line to the curve $x^2y + 3y^2 = 2x + 3$ at the point (0,1).

6) Let $f(x) = x^5 - 5x^4$. Using calculus, determine the intervals of increase/decrease and concavity of the function. Find relative extrema and inflection points, if any. Sketch the graph.

7) Find the absolute minimum and maximum values of the function $f(x) = x^4 - 8x^2 + 5$ on the interval $[-3, 1]$.

(continued on other side)

8) A 13 ft. ladder leans against the side of a wall. The top of the ladder is sliding down the wall at the rate of 3ft./sec. How fast is the foot of the ladder moving away from the wall when the top is 5 ft. above the ground?

9) A box is to be constructed with a square base and no top. The cost of material used for the sides is \$3 per square foot while material used for the bottom is \$12 per square foot. If the cost of making the box is \$3600, find the dimensions of the box that yield the maximum volume.

10) A colony of bacteria grows exponentially. If it takes 6 hours to double in size, how long will it take to triple in size?