MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

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TEST 1 **MATHEMATICS 2000** FEBRUARY 12TH, 2020

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| **Name** | **MUN Number** |
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[13] 1. Find the limit of each sequence $\{a_i\}$, or explain why it diverges.

(a) $a_i = \dfrac{2i^3(i-5)}{(3i^2-4)(3i^2+4)}$

(b) $a_i = \dfrac{\sin^2(i)}{5^i}$

(c) $a_i = \dfrac{\ln(\ln(i))}{\sqrt{i}}$

[3] 2. Based on your results for #1(a), can anything be determined about whether the series $\displaystyle\sum_{i=1}^{\infty} \frac{2i^3(i-5)}{(3i^2-4)(3i^2+4)}$ converges or diverges? Justify your answer.

[6] 3. Use the Bounded Monotonic Sequence Theorem to show that $\{a_i\}$ is convergent, where

$$a_i = \frac{4(i-1)!}{1 \cdot 5 \cdot 9 \cdots (4i-3)}.$$

[4] 4. Find the sum of the convergent series $\displaystyle\sum_{i=0}^{\infty} \frac{3^i - 4^i}{3^i 4^i}$.

[4] 5. Find and sketch the domain of the function $f(x, y) = \dfrac{\sqrt{y - x}}{x + 3}$.

[5] 6. Evaluate $\lim\limits_{(x,y)\to(0,0)} \dfrac{12x^4y}{x^6 + 3y^3}$ or show that the limit does not exist.

[5] 7. Find all the first- and second-order partial derivatives of $z = x\ln(x)\sin(5y)$.

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[40]