Université d'Ottawa · University of Ottawa
Faculté des sciences
Mathématiques et de statistique
Faculty of Science
Mathematics and Statistics

MAT1330 D: Calculus for life sciences I

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Test I

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Surname ____________________ First Name ____________________

Student # ____________________

Take your time to read the entire paper before you begin to write, and read each question carefully. Make a note of the questions that you feel confident you can do, and then do those first: you do not have to proceed through the paper in the order given.

- You have 80 minutes to complete this exam. You can use the back of the pages to write your solutions.
- This is a closed book exam, and no notes of any kind are allowed. The use of cell phones, pagers or any text storage or communication device **is not permitted.**
- Only the Faculty approved TI-30 calculator is allowed.
- The correct answer requires justification written legibly and logically: you must convince me that you know why your solution is correct. Answer these questions in the space provided. Use the backs of pages if necessary.
- Where it is possible to check your work, do so.
- Good Luck!

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Q1	Q2	Q3	Q4	Q5	Q6	Q7	Total
/4	/9	/7	/8	/4	/4	/4	/40

Question 1. Solve the following equations:

a) $4^{-x} = 3^{2x+2}$

$x =$ [ ]

b) $\ln x + \ln(x+2) = 3\ln 2$

$x =$ [ ]

Question 2. Consider the DTDS $M_{t+1} = -0.7M_t + 5, \quad t = 0, 1, 2, \ldots.$

a) Find the updating function of the DTDS. [ ]

b) Find the equilibrium point of the DTDS.

$x^* =$ [ ]

c) Give the solution formula for the DTDS with general initial condition M_0:

$M_t =$ [ ]

d) Calculate M_{12} if $M_0 = 4$.

$M_{12} =$ [ ]

e) Graph the updating function and draw the cobweb diagram of the DTDS, starting from $M_0 = 4$ for 4 steps.

f) Is the equilibrium point stable or unstable?

Question 3. Evaluate the following limits. If a limit does not exist determine if it is $-\infty, \infty$ or neither.

a) $\lim_{x\to 1} \frac{2x-2}{x^2-1} =$

b) $\lim_{x\to 0} \frac{-x}{2x^2} =$

c) $\lim_{x\to 1} \frac{x-1}{\sqrt{x}-1} =$

Question 4. Consider the function $f(x) = \dfrac{2|x-3|}{x^2-5x+6}$.

a) Determine the domain of f.

$D_f =$

b) Write f as a piecewise function without the absolute value.

c) $\lim_{x\to 3^-} f(x) =$

d) $\lim_{x\to 3^+} f(x) =$

e) $\lim_{x\to 3} f(x) =$

c) Is f continuous at 3?

Question 5. Over the period of 24 hours, a woman has her highest daily temperature of 37.1°C at 2:00 P.M. and her lowest daily temperature is 36.5°C. Assume that temperature varies sinusoidally over a period of 24 hours. Find the parameters in the standard cosine description, i.e.

$$f(t) = A + B\cos\left(\frac{2\pi}{T}(t - \Phi)\right),$$

where t is in hours, and $t = 0$ corresponds to the midnight.

$A =$ [ ]

$T =$ [ ]

$B =$ [ ]

$\Phi =$ [ ]

Draw the graph of the function and identify the above four parameters on the graph.

Question 6.

a) For the function f, give the definition of $f'(a)$. $f'(a)=$ [ ]

b) Use the definition of the derivative to find $f'(1)$ for the function $f(x) = \dfrac{5}{x+4}$.

$f'(1) =$ [ ]

c) Write an equation for the tangent line of f at $(1, 1)$.

Question 7. Determine $f'(x)$ for each function. Do not simplify.

a) $f(x) = 5x^{\frac{3}{5}} + 2x^{\frac{1}{4}} + x + 15$.

$f'(x) =$ [ ]

b) $g(x) = -2x^2x^{-5}$.

$f'(x) =$ [ ]