

SIMON FRASER UNIVERSITY

Faculty of Science
Department of Mathematics
MATH 154 - D100
Midterm 1

Last Name: _____

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Instructor: _____ Date: February 1, 2017

Instructions:

1. Do not open this booklet until told to do so.
2. Print your information legibly, correctly, and using large font on the lines provided above.
3. Please write firmly so that scanning picks up on your writing. Cross out unwanted work (do not erase). If extra space is needed use the last page and indicate where your work continues.
4. This exam contains 4 questions. Check to make sure your exam is complete.
5. Full marks are reserved for answers that are correct in all essential details, clearly indicate the method used, and could be understood by another student without undue effort.
6. Only scientific calculators with no graphing, and programming capabilities are allowed. All other electronic devices must be turned off!



1. True-False. Circle "T" for true or "F" for false. For this section, you do not need to justify your answers.

[1] (a) T or F: Let $f(x) = 3x^5$ and $g(x) = 100x^7$. For x approaching 0, function $f(x)$ dominates $g(x)$.

[1] (b) T or F: Any rational function is continuous at every point in its domain.

[1] (c) T or F: The derivative $f'(x_0)$ exists whenever $f(x)$ is continuous at x_0 .

[1] (d) T or F: A function f has a removable discontinuity (or a "hole") at point a if $f(a)$ is undefined.

[1] (e) T or F: The tangent line to $y = f(x)$ at point x_0 is the line with slope $f'(x_0)$ passing through point $(x_0, f(x_0))$.

[1] (f) T or F: Every power function has a derivative at every point in its domain.



2. Practice of definitions and concepts.

- [3] (a) Find all value(s) of c which make the function $f(x) = \begin{cases} (2x - c)^2; & \text{if } x \leq 1, \\ 3x - c; & \text{if } x > 1 \end{cases}$ continuous.

- [3] (b) Find all points where the function $f(x) = \frac{x^3 - 16x}{6x^3 + 8x^2}$ is discontinuous and classify the type of discontinuity at each such point.

- [3] (c) Compute the derivative of the function $f(x) = ax + bx^2$ from its definition.

Rates of change.

(a) Given the function $f(x) = x - 2x^2$. Sketch the graph of f , and find the equation of its secant line meeting the graph at $x = \frac{1}{2}$ and $x = 1$.

(b) For the function $f(x)$ from part (a), find the equation of the tangent line meeting the graph at $x = 1$.

(c) Describe the connection between the secant line and the tangent line.



- [4] (d) Scientists have observed the motion of motile bacteria in a display tube and derived a model in which at t seconds, the position of the bacteria is $x(t) = t^3 - 2t^2$ m from the origin. Determine the velocity and acceleration of the bacteria as a function of time.

_____ Use space below if you need extra space to show your work _____