

UNIVERSITY OF REGINA
DEPARTMENT OF MATHEMATICS AND STATISTICS
MATH 110-003-004 200730

Midterm Test 1 (B version)

Time: 50 minutes

Instructors:

Dr. Edward Doolittle

Name: _____

Student #: _____

Section: _____

(marks) You have 50 minutes to do each of the following questions. The test is worth a total of 40 marks. Please justify your conclusions and show all your work. A non-programmable calculator of approved type is permitted. No other aids are permitted. Use the backs of the pages for rough work.

1. Find the following derivatives.

(4) (a) $u'(1)$ where $u(t) = \sqrt{t} - \frac{1}{\sqrt{t}}$

(4) (b) g' where $g(t) = \frac{t - \sqrt{t}}{t^{1/3}}$

(4) (c) $\frac{d^2 f}{dx^2}$ where $f(x) = \frac{x^2}{1+2x}$

(4) 2. Find the limit $\lim_{x \rightarrow 7} \frac{\sqrt{x^2+9}-5}{x+4}$

- (6) 3. Calculate the derivative $f'(a)$ of the function

$$f(t) = \frac{2t + 1}{t + 3}$$

from first principles (i.e., using the definition of the derivative rather than differentiation formulas).

- (6) 4. Find equations of the tangent and normal lines to the curve

$$y = \frac{\sqrt{x}}{x+1}$$

at the point $P(4, 0.4)$ on the curve.

5. Consider the function

$$f(x) = \begin{cases} cx^2 + 2x & \text{if } -\infty < x < 2 \\ x^3 - cx & \text{if } 2 \leq x < \infty \end{cases}$$

- (4) (a) For what value(s) (if any) of the constant c is $f(x)$ continuous on the entire real line $(-\infty, \infty)$?
- (4) (b) For what value(s) (if any) of the constant c is $f(x)$ differentiable on the entire real line $(-\infty, \infty)$?

(4)

6. Is there a number a such that

$$\lim_{x \rightarrow -2} \frac{3x^2 + ax + a + 3}{x^2 + x - 2}$$

exists? If so, find the value of a and the value of the limit.