

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

Midterm Test 1 (A 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 $u = \sqrt[5]{t} + 4\sqrt{t^5}$

(4) (b) y' where $y = \frac{r^2}{1 + \sqrt{r}}$

(4) (c) $\frac{d^2 f}{dx^2}$ where $f(x) = \frac{1}{3-x}$

(4) 2. Find the limit $\lim_{x \rightarrow 7} \frac{\sqrt{x+2}-3}{x-7}$

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

$$f(x) = \frac{3+x}{1-3x}$$

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

$$y = \frac{3x + 1}{x^2 + 1}$$

at the point $P(1, 2)$ 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.