

LAST NAME:

Student no.:

Math 184 - Test 2 - Friday October 12, six pages

Please show your work. I expect some arguments and, typically, correct final answers will not receive full credit if no arguments are given. If you use a logarithm, indicate the base. No aids allowed e.g. no calculators, no cellphones etc.

1. [36 marks] Compute the derivatives of the following functions. Simplify these derivatives as appropriate but if you are pressed for time there will be part marks for an unsimplified correct answer.

a) [6 marks]

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

b) [6 marks]

$$f(x) = x^{3/2} + x^{2/3}$$

c) [6 marks]

$$f(x) = x^2 e^x + 5$$

d) [6 marks]

$$f(x) = x^2(\ln x)e^x$$

e) [6 marks]

$$f(x) = xe^{(x^2+1)}$$

f) [6 marks] We are given some limited information about two differentiable functions f, g in the following table:

x	0	1	2	3
$f(x)$	3	4	5	6
$f'(x)$	1	3	7	10
$g(x)$	1	2	5	9
$g'(x)$	3	4	2	1

Determine $(f \circ g)'(1)$.

2. [12 marks] Using the limit definition of the derivative, compute the derivative of $f(x) = \frac{1}{x+3}$. No marks will be given for the use of differentiation rules.

3. [11 marks] Find a point on the curve $y = x^2 + 2x$ for which the tangent line is parallel to $y = -2x + 6$.

4. [11 marks]

a) [6 marks] Find the tangent line to the curve $y = e^{3x} + e^{-2x}$ at $x = 0$.

b) [5 marks] Use a) to estimate $e^{0.3} + e^{-0.2}$.

5. [16 marks] A rocket goes vertically up into the sky. Let $r(t)$ denote the height in metres at time t seconds after launch. Assume

$$r(t) = -t^3 + t^2 + 20t$$

- a) [4 marks] What is the height of the rocket at time $t = 2$?
- b) [4 marks] Is the rocket going up at time $t = 4$? Explain.
- c) [4 marks] For what interval of time is the rocket accelerating upwards?
- d) [4 marks] When does the rocket crash to earth?

6. [14 marks] When a restaurant charges \$7 for its famed appetizer, it sells 50 of these appetizers in a night. If it raises the price to \$8 for the appetizer, it only sells 40 appetizers.
- a) [7 marks] Assuming that the price p is a linear function of the quantity q sold, give p as a function of q .
- b) [7 marks] Determine a price for the appetizer for which the Marginal Revenue is 0.