



Instructor: Dr. R.A.G. Seely

Test 1

(short practice version)

(Marks)

# Cal I (S) (Maths 201–NYA)

**Justify** all your answers—just having the correct answer is not sufficient.

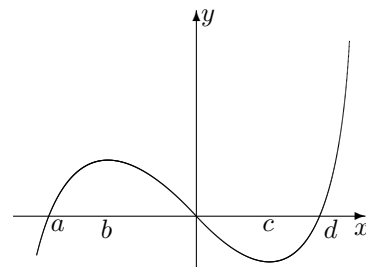
*Pace yourself—a rough guide is to spend not more than 2m minutes or so on a question worth m marks.*

- (2×3) 1. For each of the following functions, find the derivative  $f'(x)$  using a limit definition. Be sure to state clearly the limit definition of “derivative” that you are using. Simplify your answer.

(a)  $f(x) = \frac{2}{4-x}$

(b)  $f(x) = \sqrt{1+2x}$

- (2) 2. Given the following graph of a function  $y = f(x)$ , draw a rough sketch of the graph of the derivative  $y' = f'(x)$ .



- (4×3) 3. For each of the following functions, find the derivative  $\frac{dy}{dx}$  using the derivative formulas. You do not need to simplify your answers.

(a)  $y = 16x^4 - \frac{4x^7}{21} + \frac{2}{3x^4} + \sqrt[3]{e}$

(b)  $y = (x^3 - 2x)\sqrt{5x^7 - 6x + \frac{1}{x}}$

(c)  $y = \frac{(5x^2 - 3x + 8)^6}{18}$

(d)  $y = e^{x^3+2x}(5x^4 - \sqrt[3]{x+1})^4$

- (5×3) 4. For each of the following functions, find the derivative  $\frac{dy}{dx}$  using the derivative formulas. You do not need to simplify your answers. *Hint: You may want to use logarithmic differentiation for some of these.*

(a)  $y = \frac{(7x^4 - 6x + e^2)^9}{\sqrt[5]{3x^7 - \frac{2}{x} - 2}}$

(b)  $y = \sec^3(x^2 - x) \cos^2(5x^4 - 5)$

(c)  $y = \frac{e^{x^2+1} \sin(2x)}{\sqrt[4]{7x+3}}$

(d)  $y = \cot^4(\sqrt{x^4 - 7x^6 + 17x})$

(e)  $y = (\ln x)^{x^2+1}$

- (3) 5. For the equation  $x^2y^5 - 3y^2 = \ln(xy^2) - 3$ , find the first and second derivatives  $\frac{dy}{dx}$ ,  $\frac{d^2y}{dx^2}$ . What are their values at the point (1, 1)?

- (3) 6. Find the slope and the equation of the tangent line to the curve  $y = \frac{2x+1}{x+2}$  at the point where  $x = 1$ .

- (3) 7. Find the slope and the equation of the tangent line to the curve  $x^3y - y^3 = 3x + y^2$  at the point (2, 1).

- (3) 8. Find all  $x$  values where the curve  $y = 2x^3 + 3x^2 - 36x - 12$  has a horizontal tangent.

- (3) 9. A ball is given a push down an inclined plane, so that the distance  $x$  (in meters) travelled after  $t$  seconds is given by  $x = 5t + 3t^2$ .

What is the velocity  $v$  as a function of  $t$ ?

Find the velocity after 2 s. What is the initial velocity?

How long does it take for the velocity to reach 35 m/s?

(Total: 50)