

The fourth test is in class on Friday 4 November.

Here are some sample questions, so that you have an idea of what to expect.

1. Compute the following derivatives:

(a)  $f(x) = \arctan(x) \Rightarrow f'(x) =$

(b)  $f(x) = \ln(x) \Rightarrow f'(x) =$

(c)  $f(x) = \log_3(x) \Rightarrow f'(x) =$

(d)  $f(x) = \frac{\arctan(\log_3(7x))}{x^4 + 2x} \Rightarrow f'(x) =$

2. (a) Find the derivative of  $y = \frac{x^x \sin(2x)(x^5 - 7x)^6}{(\sqrt{x^9 + 1})3^x}$

(b) Let  $f$  be a continuous function with

- $f(0) = 3$
- $f(2) = 6$
- $f'(x) = 0$  for  $0 < x < 1$
- $f'(x) < 2$  for  $1 < x < 2$

Sketch such a function or explain why it is impossible.

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

(a) Find the intervals where  $f$  is increasing, and the intervals where it is decreasing.

(b) Find the intervals where  $f$  is concave up, and the intervals where it is concave down.

(c) We wish to approximate  $f(0.01312)$ . A crude approximation is  $f(0.01312) \approx f(0) = 1$ .

Use a linear approximation to  $f$  based at  $x = 0$  to give a better estimate for  $f(0.01312)$ .