

Name: _____

CityU ID# _____

EE1002 Test 1

Instructions: 1. Attend all questions.

2. Show all necessary steps and provide full justification for your answers.

Question 1 (20%)

Calculate the limit of the following functions. If limit does not exist, show it/provide justification.

a) $\lim_{t \rightarrow 1} \frac{t^3 - 1}{t^2 - 1}$

b) $\lim_{x \rightarrow 1} \left(\frac{1}{x-1} - \frac{2}{x^2-1} \right)$

c) $\lim_{h \rightarrow 0} \frac{\sqrt{2+h} - \sqrt{2}}{h}$

d) $\lim_{x \rightarrow -\infty} \sqrt{4x^2 - x} + 2x$

Question 2 (20%)

Calculate each of the following derivatives:

a) $f(x) = (x^2 + 3x + 1)(x - 1)$

b) $y = e^{-x^2}$.

c) $f(t) = \frac{1+t^2}{\sqrt{t}}$

d) $f(x) = \cos(\sqrt{x+2} - 1)$

Question 3 (20%)

Suppose g is the inverse function to $f(x) = x^5 + x + 1$,

- (a) determine $g'(x)$; and
- (b) find $g'(1)$ and $g'(5)$

Question 4 (40%)

Given function $f(x) = (x^3 + 3x^2 + x + 1)$

- a) Find the first order derivative of f ;
- b) Find the second order derivative of f ;
- c) Find two different x values, let them be x_1 and x_2 , such that $f'(x)=0$;
- d) Determine the slope change (either positive or negative), and the function values of f and f'' at the points calculated in part c) by completing the following table:

x value	$(-\infty, x_1)$	$x_1 =$	(x_1, x_2)	$x_2 =$	(x_2, ∞)
$f'(x)$	Positive/ Negative	0	Positive/ Negative	0	Positive/ Negative
$f''(x)$					
$f(x)$					

- e) From the table above, determine the open intervals (i) where f is concave upward and (ii) where f is concave downward. Sketch the curve based on these information.
- f) What are the local minima and local maxima of f ? Explain why the sign of $f''(x)$ can be an indicator for local minima or local maxima of f .