1K03E, Test 2

Date: 29 May 2013, Duration: 90 Minutes

Name : **Student ID** :

Instruction: The test consists of 2 parts (Part 1: Multiple choice, Part 2: Structured questions). For Part 1, please put down your multiple choice answers in the space below.

1	2	3	4	5	6	7	8

1. Let $f(x) = x^3$. Find the slope of the tangent line at $x = 3$.

A. 1,

B. 3,

C. 9,

D. 27,

E. 81.

2. Let $y = (3 - x^2)(x^3 + 6)$. Find $\frac{dy}{dx}$.

A. $5x^4 - 9x^2 - 12x$,

B. $-5x^4 + 9x^2 - 12x$,

C. $-5x^4 + 9x^3 - 12x^2 + x$

D. $-x^4 - 9x^2 - 12x$

E. $-5x^4 - 9x^2 + 12x$

3. Let

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

Find $f'(x)$.

A. $\frac{-3x^2}{(x^3-1)^2}$

B. $\frac{3x^2}{(x^3-1)^2}$

C. $\frac{-3x-1}{(x^3-1)^2}$

D. $\frac{-3x^2-1}{x^3-1}$

E. $\frac{3x^2}{x^3-1}$

4. Let $f(x) = (9x^2 - 1)^{\frac{1}{3}}$. Find $f'(x)$.

A. $\frac{1}{3}(9x^2 - 1)^{\frac{2}{3}}$

B. $6x(9x^2 - 1)^{\frac{2}{3}}$

C. $\frac{6x}{(9x^2-1)^{\frac{2}{3}}}$

D. $\frac{3}{(9x^2-1)^{\frac{2}{3}}}$

E. $\frac{1}{(9x^2-1)^{\frac{2}{3}}}$

5. Let $G(x) = x^3 + 3x - 3$. Find the second derivative $G''(x)$ of $G(x)$.

A. $3x^2 + 3$

B. $6x$

C. $6x + 3$

D. $6x - 3$

E. $6x^2$

6. Suppose that $xy = 1 + y^2$. Find $\frac{dy}{dx}$.

A. $\frac{1}{x-2y}$

B. $\frac{-1}{x-2y}$

C. $\frac{-y}{x-2y}$

D. $\frac{y}{x-2y}$

E. $\frac{-y}{x+2y}$

7. The gross annual earnings of a certain company are given by

$$f(t) = \sqrt{t^2 + t + 5}$$

thousand dollars t years after its formation. At what rate will the gross annual earnings of the company be growing 4 years after its formation?

A. 0.6

B. 0.7

C. 0.8

D. 0.9

E. 1

8. Let $f(x) = (x^2 - 4)^2$. For what value of n does $\frac{d^n y}{dx^n}$ is a constant zero function?

A. 1

B. 2

C. 3

D. 4

E. 5

Part 2: From questions 9 to 11. Please write down your solutions with steps in detail in the space provided below the questions.

9. (4 points) Let

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

Find all values of x such that the tangent line is horizontal.

10 (a). (2 points) State the definition of the derivative of a function $f(x)$ (in the form of limit).

(b). (2 points) Write down TWO interpretations of the derivatives.

11. Consider

$$y = \sqrt{25 - x^2}.$$

(a). (2 points) Find $\frac{dy}{dx}$.

(b). (2 points) Find the equation of the tangent line at $x = 3$.

(c). (2 points) Find the equation of the tangent line at $x = -4$.

(d). (2 points) Are the tangent lines in (b) and (c) perpendicular to each other? Explain.