Name _____ Student ID _____ Section Instructor _____
Seat Number _____

Mahidol University International College

ICNS 103 Midterm Examination

26 October 2013 – 08.00 - 09.50 35 points

Directions: Solve the following problems using the bottom of each page for scratchwork. Write up your solution and answer (in simplified form) in the space provided. Calculators are NOT allowed for this examination.

SCORE

Problem 1: 10 points

1.1 Use the graph of the function $y = f(x)$ below to answer the following questions.

(a) $\lim_{x \to 1^+} f(x) =$ ..... (1 pt.)

(b) $\lim_{x \to -1^-} f(x) =$ ..... (1 pt.)

(c) $f(1) =$ ..... (1 pt.)

1.2 Find the value (if any) of the following limits.

(a) $\lim_{x\to 0} \dfrac{x^3+3x^2}{x^3-4x^2}$ (1 pt.)

(b) $\lim_{x\to -\infty} \dfrac{2x^3}{(x-1)^3}$ (1 pt.)

1.3 Find all points of discontinuity for $f(x) = \dfrac{x^2+6x+9}{2x-15+x^2}$. (2 pts.)

1.4 Use the definition of continuity to determine whether the following function is continuous at 5.

$$f(x) = \begin{cases} x^2+1, & \text{if } x \geq 5; \\ 6x-4, & \text{if } x < 5. \end{cases}$$

(3 pts.)

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SCORE

Problem 2: 10 points

2.1 Let $f(x) = 3x^2 - 7x + 4$. Use the definition of the derivative to find $f'(x)$. (3 pts.)

2.2 Find an equation of the tangent line to the curve $y = \sqrt{x} + \dfrac{1}{\sqrt{x}}$ at the point $\left(4, \dfrac{5}{2}\right)$.
(3 pts.)

 scratchwork

2.3 Find all points (x, y) on the curve $y = \frac{x^3}{3} - \frac{3x^2}{2} + x - 1$ where the **slope** of the tangent line at each of those points is -1. (4 pts.)

SCORE

Problem 3: 10 points

3.1 The average cost, $\overline{c}$, of producing a cell phone is determined by the following function:

$$\overline{c} = \frac{(q^2 - 1)(2q + 3)}{q}.$$

Find the marginal cost when 10 phones are produced and interpret the result. (3 pts.)

3.2 Find an equation of the tangent line to the curve $y = \dfrac{2x - 3}{4x + 1}$ at the point $(0, -3)$. (3 pts.)

3.3 Differentiate the given functions.

(a) $y = \sqrt[3]{(x^2 - 5x + 7)^2}$ (2 pts.)

(b) $y = \left(\dfrac{x-2}{x-1}\right)^3$ (2 pts.)

SCORE

Problem 4: 5 points

4.1 Differentiate the given functions. **Simplify** the result.

(a) $y = \dfrac{e^x}{1+e^x}$ (2 pts.)

(b) $y = x(\ln x)^2 - 2x\ln x + 2x$ (2 pts.)

4.2 Let $f(x) = -\dfrac{1}{x} - \dfrac{1}{x^2} - \dfrac{1}{1+\ln x}$. Find $f'(1)$. (1 pt.)

 scratchwork