

Name ..... I.D. .... Section. ...

**Mahidol University International College**  
**Final Examination**  
**ICMA/ICNS 102, ICMA 106: Principle of Mathematics, Calculus I**  
**First Trimester 2017-2018**

**Instructions.** The exam consists of 9 main problems (**95 points=35%**) with points indicated in each problem. Show all your work clearly. A calculator is NOT allowed for this exam. Make sure to fill in your name, student I.D., and your section instructor's name in the space provided on every page. If not otherwise specified, your answer to every problem must be in **simplest** form.

SCORE

**Problem 1.** (10 points)

(a) Find the differential  $du$  if  $u = \sqrt{x} \csc(5x)$ .

(3 points)

(b) Find  $f$  where  $f'(t) = 2t - 3 \sin t$ ,  $f(0) = 5$ .

(7 points)

SCORE

**Problem 2.** (10 points)

A spherical balloon is to be deflated so that its radius decreases at a constant rate of 15 cm/min. At what rate must air be removed when the radius is 9 cm?

SCORE

**Problem 3.** (10 points)

Let  $f(x) = x^3 - 3x + 2$ . Sketch a graph of this polynomial and label the coordinates of the intercepts, relative extrema, and inflection points.

**Hint:**  $x^3 - 3x + 2 = (x - a)^2(x - b)$  for some integers  $a$  and  $b$ .

SCORE

**Problem 4.** (10 points)

Find the absolute maximum and minimum values of  $f(x) = 6x^{4/3} - 3x^{1/3}$  on the interval  $[-1, 1]$ .

SCORE

**Problem 5.** (10 points)

An open field is bounded by a lake with a straight shoreline. A rectangular enclosure is to be constructed using 500 ft of fencing along three sides and the lake as a natural boundary on the fourth side. What dimensions will maximize the enclosed area? What is the maximum area?

SCORE

**Problem 6.** (10 points)Find the points on the parabola  $y = x^2$  closest to the point  $(0, 1)$ .

SCORE

**Problem 7.** (15 points)

Evaluate the integrals (a - e).

a) 
$$\int \frac{x^3 - 2\sqrt{x}}{x} dx$$

b) 
$$\int v(v^2 + 2)^3 dv$$

c) 
$$\int_{\pi/6}^{\pi/3} \frac{\csc^2 x}{\cos^2 x + \sin^2 x} dx$$

$$\text{d) } \int_0^{\pi/4} \frac{1 + \cos^2 \theta}{\cos^2 \theta} d\theta$$

$$\text{e) } \int \frac{\cot(\sqrt{x})}{\sqrt{x} \sin(\sqrt{x})} dx$$



SCORE

**Problem 8.** (10 points)

Sketch the region enclosed by the following curves and find its area.

$$y = 2x, \quad y = x^2.$$

SCORE

**Problem 9.** (10 points)

Find the area enclosed by the line  $y^2 = 4x$  and the parabola  $y = 2x - 4$ .

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