

Name I.D. Section...

Mahidol University International College
Final Examination
ICMA106 Calculus I
Second Trimester 2018–2019
6 April 2019, 14:00 - 15:50

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 the first 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 $u = (t^2 + \sin t)^2 + \tan(t^2)$.

(3 points)

(b) Find f where $f'(x) = \sec^2 x - \sin x$, $f(0) = 4$.

(7 points)

SCORE

Problem 2. (10 points)

The radius of a cylinder is **increasing** at a rate of 1 meter per hour, and the height of the cylinder is **decreasing** at a rate of 4 meters per hour. At a certain instant, the base radius is 5 meters and the height is 8 meters. What is the rate of change of the volume of the cylinder at the instant?

SCORE

Problem 3. (10 points)

Let $f(x) = x^3 - 3x^2 - 9x + 27$. Sketch a graph of this polynomial and label the coordinates of the intercepts, relative extrema, and inflection points.

Hint: $x^3 - 3x^2 - 9x + 27 = (x + 3)(x - 3)^2$

SCORE

Problem 4. (10 points)

Find the absolute maximum and minimum values of $f(t) = t\sqrt{4 - t^2}$ on the interval $[-1, 2]$.

SCORE

Problem 5. (10 points)

A closed cylindrical can must have a volume of 1000 in^3 . What dimensions will minimize its surface area?

SCORE

Problem 6. (10 points)

A rectangular poster is to have an area of 90 square inches with 1-inch margins at the bottom and sides and a 3-inch margin at the top. What dimensions give you the largest printed area?

SCORE

Problem 7. (15 points)

Evaluate the integrals (a - e).

a)
$$\int \frac{z^2 - 5z + 6}{z - 2} dz$$

b)
$$\int (t + 2)(1 + t)^4 dt$$

c)
$$\int_0^1 s\sqrt{s} ds$$

$$\text{d) } \int_{\pi/4}^{\pi/2} (\csc^2 x - x) dx$$

$$\text{e) } \int (5 + x + \tan^2 x) dx$$

SCORE

Problem 8. (10 points)

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

$$y = \cos x + 1, y = x, x = 0, x = \frac{\pi}{4}.$$

SCORE

Problem 9. (10 points)Find the area of the region bounded by the graphs of $x + y = 0$ and $x = y^2 + 4y$.

You may tear this page apart as a scratch paper.

You may tear this page apart as a scratch paper.