

## CALCULUS MA-1001 MIDTERM 2

Name: \_\_\_\_\_ Department: \_\_\_\_\_ ID: \_\_\_\_\_

(1) (10ps) Consider the following function:

$$f(x) = \begin{cases} x^2 \sin(1/x) & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$$

Is  $f$  differentiable at 0? If yes, compute  $f'(0)$ , if not then explain why.

(2) (20ps) Find the equation(s) of the tangent line(s) to the graph of  $f(x) = 4x^2$  that pass through the point  $(-3, 9)$ .

- (3) (15ps) For what values of  $c$  does the polynomial  $P(x) = x^4 + cx^3 + x^2$  have a) two inflection points? b) one inflection point? c) no inflection points?

- (4) (15ps) Find a number  $a$  and a function  $f(x)$  that satisfy for  $x > 0$ :

$$\frac{2}{\pi} + \int_a^{\sqrt{x}} \frac{f(t)}{t^3} dt = \frac{\sin(x)}{x}.$$

(5) (10ps) Given  $\int_0^{\frac{1}{2}} \sqrt{1-x^2} dx = \frac{\sqrt{3}}{8} + \frac{\pi}{12}$ , find  $\int_0^{\frac{1}{2}} x \sqrt{1-4x^4} dx$ .

(6) (10ps) Find  $\int_0^{\sqrt{3}} x^3 \sqrt{x^2+1} dx$

(7) (10ps) Find  $\int x^{\frac{1}{2}} \sin(x^{\frac{3}{2}}+1) dx$

(8) (10ps) Find  $\int \frac{\sin(2t+1)}{\cos^2(2t+1)} dt$