

Sample Midterm II

- (1) (15 points) Find the tangent line of the curve

$$2 \cos x \sin y = 1$$

at the point  $(\pi/4, \pi/4)$ .

- (2) (10 points) Let  $f(x) = \tan x$ . Find  $f'''(\pi/4)$ .

- (3) (30 points) Find the derivatives of the following functions.

(a) (10 points)  $f(x) = \frac{\sin x}{x}$ .

(b) (10 points)  $f(x) = \sqrt{x + \sqrt{x + \sqrt{x}}}$ .

(c) (10 points)  $f(x) = (\cos x)^x$ .

- (4) (15 points) Let  $f(x)$  be a function that is twice-differentiable at 0 and let  $F(x) = [f(x)]^{-1}$ . Suppose that  $f(0) = 1$ ,  $f'(0) = 2$  and  $f''(0) = 3$ . Find  $F''(0)$ .

- (5) (10 points) Find the limit

$$\lim_{x \rightarrow 0} \frac{\sin 3x}{\sin 2x}.$$

- (6) (20 points) At noon, ship A is 150 km west of ship B. Ship A is sailing east at 35 km/h and ship B is sailing north at 25 km/h. How fast is the distance between the ships changing at 4:00 P.M.?