

Calculators and Mobile Phones are not allowed  
Answer the following questions

(3 pts) Find  $\frac{dy}{dx}$ , if  $y = \tan \sqrt{x^2 + 1} + \cos^5(x^3 + 5)$ .

(3 pts) State Rolle's Theorem. If  $f(x) = \cos 2x + 2 \cos x$ , show that  $f$  satisfies the conditions of Rolle's theorem on the interval  $[0, 2\pi]$  and find a number  $c \in (0, 2\pi)$  that satisfies the conclusion of the theorem.

(4 pts) Find an equation of the tangent line to the graph of

$$x^2y + \sin(xy + y^2) = x + 2$$

at the point whose  $y$ -coordinate is 0.

(4 pts) Use differentials to find an approximate value of  $\sqrt{(1.01)^2 + 3}$ .

(4 pts) A closed box with a square base is to be made to have a volume of  $64 \text{ ft}^3$ . If the cost of the material used is 50 cents per  $\text{ft}^2$  and if there is no waste of material Find the dimensions that will minimize the cost of the material.

(7 pts) Let

$$f(x) = \frac{x-2}{x^2}$$

- Find the intervals on which  $f$  is increasing or decreasing, and find the extrema of  $f$  (if any).
- Find the intervals on which the graph of  $f$  is concave downward or concave upward, and find the points of inflection (if any).
- Find the horizontal and vertical asymptotes for the graph of  $f$  (if any).
- Sketch the graph of  $f$ .