

Name: \_\_\_\_\_

Please show all work and box the answers, where appropriate.

1. (10 pts.)

(a) Let  $f(x) = x^4 \cos^2(x^3 + 1)$ . Find the differential  $df$ .(b) Suppose  $x^2 y(x + y^2) = 2$ . Find  $dy/dx$ .2. (10 pts.) Consider  $f(x) = \sin x$  on the interval  $[\pi, 4\pi]$ .(a) Find all critical points of  $f$  in the given interval and classify them using the second derivative test.(b) Find the global maximum (resp. minimum) of  $f$  on the given interval and find all  $x$  where it is attained. Sketch the graph of  $y = f(x)$  on the above interval.3. (10 pts.) Sketch  $y = f(x)$  on the interval  $[-1, 3]$  and determine whether the Mean Value Theorem applies. If so, find all points in the interval satisfying the conclusion of the theorem. Otherwise explain why the theorem fails to apply.(a)  $f(x) = x^2$ (b)  $f(x) = |x|$ 4. (10 pts.) Consider  $f(x) = x^2 + 1$  on the interval  $[-1, 1]$ . Compute the upper and lower Riemann sums with  $n = 3$ . For each sum, sketch the corresponding rectangles on the graph of  $y = f(x)$ . Compare your results to the exact area under the graph of  $y = f(x)$ .

5. (10 pts.) Evaluate

(a)  $\frac{d}{dx} \int_{\sin(x)}^2 \sqrt{1-t^2} dt$

(b)  $\int_{\pi/2}^{\pi} \sin(x) \cos^2(x) dx$

1	2	3	4	5	total (50)	%