

Math 141: Sample Exam Number 2

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1 Derivatives

Find the derivative of each of the following functions (where they exist)

•

$$f(x) = x^2 - \frac{1}{x^2} + \frac{5}{x^4}$$

•

$$f(x) = \pi^3 - 3\pi^2$$

•

$$f(x) = \sin x \cos x$$

•

$$f(x) = \frac{\sin x}{x}$$

•

$$f(x) = \frac{x}{1 - \sin x}$$

•

$$f(x) = x \cos x^2$$

•

$$f(x) = \left(\frac{1}{1-2x}\right)^3$$

•

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

2 Implicit differentiation

Find $\frac{dy}{dx}$ for the following functions y defined implicitly through the given equations

•

$$(x^2 + y^2)^2 = 4x^2y$$

•

$$(x^2 + y^2)^2 = \frac{25}{3}(x^2 - y^2)$$

•

$$x^{\frac{2}{3}} + y^{\frac{2}{3}} = 1.$$

3 Extreme Values

Find critical numbers for the function in the given interval, and find the absolute extrema for the function on the given interval. Also, please say where the extremum are achieved.

•

$$f(x) = x^3 - 3x, \quad [-1, 3]$$

•

$$f(x) = 1 - x^{\frac{2}{3}}, \quad [-1, 1]$$

•

$$f(x) = \tan x + \sec x, \quad [0, 2\pi]$$

•

$$f(x) = \frac{x}{x^2 + 4}, \quad [0, 3]$$

•

$$f(x) = x\sqrt{1-x^2}, \quad [-1, 1]$$