

# Final Exam: Practice 2

Name:

- *Basic Calculators are allowed. Graphic calculators are not allowed.*
  - *A page of formula is allowed. Only formulas are allowed on the page. The page will be checked during the exam.*
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## Problem 1

Use the definition of derivatives to find  $f'(x)$ , and then find the tangent line to the graph of  $y = f(x)$  at  $x = 1$

$$f(x) = x^2 + 4x + 1$$

**Problem 2**

Find  $f'(x)$ .

$$f(x) = \frac{x^8}{2} - \frac{4x^3}{7} - \frac{1}{\sqrt{x}} + \sqrt[3]{x} + 2024x + 1$$

$$f(x) = (\sqrt[4]{x} + 1)(x + 1)$$

$$f(x) = \frac{3x + 2}{3x - 2} \text{ (Simplify your answers.)}$$

$$f(x) = x^7 \sin x$$

$$f(x) = \frac{x}{3 \cos x}$$

$$f(x) = \cos^{2024} x$$

$$f(x) = \cos(2x^4 + x^2 + 1)$$

$$f(x) = \cos \left( 2 \sin x + 3 \cos x + x \right)$$

$$f(x) = \left( \cos x - \sin x \right)^{100}$$

$$f(x) = 4^x + 6^x - 7 \log_8 x + 9 \ln x - \frac{3 \log_2 x}{3} + \frac{\log_7 x}{2} + x + 1$$

$$f(x) = \ln \left( 2x^2 + 3x + \cos x \right)$$

$$f(x) = 3^{\sin x + \cos x}$$

$$f(x) = 3^{x^2 \cos x}$$

**Problem 3**

$$y + x^4y + 3x^3 = 2$$

(a) Find  $dy/dx$  or  $y'$  by differentiating implicitly.

(b) Solve the equation for  $y$  as a function of  $x$ , and find  $dy/dx$  from that equation.

(c) Write an equation for the tangent line at the point  $(0, 2)$

**Problem 4**

(a) Find the local linear approximation of  $f(x) = e^x$  at  $x_0 = 0$ . Notice that  $e^0 = 1$

(b) Use the local linear approximation obtained in part (a) to approximate  $e^{.01}$

**Problem 5**

Given that

$$f(x) = x^3 + 6x^2 + 9x + 1$$

Find all the intervals where

- a.  $f(x)$  is increasing
- b.  $f(x)$  is decreasing
- c.  $f(x)$  is concave upward
- d.  $f(x)$  is concave downward

**Problem 6**

Find all the relative extrema of

$$f(x) = 2x^3 - 9x^2 + 12x + 2$$

**Problem 7**

Find the absolute maximum and absolute minimum of  $f(x) = x^3 + 6x^2 + 9x + 1$  on the interval  $[-4, 4]$ .



**Problem 8**

The given equation has one (real) solution. Approximate the solution by Newton's method.

$$x^3 + 5x + 2 = 0$$

**Problem 9**

Find the following

$$\int \left( 2x^4 - x^3 + 2x + 1 \right) dx$$

$$\int \left( \sqrt[5]{x} - 3x + \frac{2}{x} + 1 \right) dx$$

$$\int \left( 3^x + 2 \sin x - 3 \cos x + 3x + 1 \right) dx$$

$$\int (x^2 + x + 1)(x^2 + 2)dx$$

**Problem 10**

Calculate the area between  $f(x) = x^2 - 7x + 6$  and x-axis bounded by  $x = 1$  and  $x = 10$