

Show all your work.

Name: _____

1. (12 points) Below are the water levels for the Red River recorded in Fargo, North Dakota during the flood of 1997. Readings were made at 1:00 A.M. each day.

Date	04/01	04/02	04/03	04/04	04/05	04/06
Level(ft)	15.62	16.30	17.21	20.25	23.63	27.47

- (a) Find the average rate of change of water level over the following periods.

(i) [04/04, 04/06]

(ii) [04/04, 04/05]

(iii) [04/03, 04/04]

- (b) Estimate the rate of change of water level on April 4th.

2. (12 points) Consider the function $f(x) = |x - 2|$.

(a) What is the domain of f ?

(b) At what number(s), if any, is f discontinuous? Explain your answer.

(c) At what number(s), if any, is f not differentiable? Explain your answer.

3. (12 points) Complete the following:

(a) Sketch the graph of $y = x^3$.

(b) On what interval is $f''(x)$ less than zero? Greater than zero?

(c) Where is $f'(x)$ not positive?

4. (12 points) Find the equation of the tangent line to $y = 3x^2 - 2x$ at the point $(1, 2)$.

5. (12 points) Find the derivative of the following function

$$f(x) = e^x (x^2 + 2).$$

6. (12 points) Find the derivative of

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

7. (14 points) Find the derivative of the function

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

8. (14 points) What is the slope of the tangent line to the curve

$$xy^3 + y - 1 = 0$$

at the point $(0, 1)$?