

Test 2

Calculus I  
MATH 125-07October 24, 2019  
Dr. Abdul-Rahman

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

Signature: \_\_\_\_\_

1. [25 points] Find the derivatives of the following functions

(a)  $g(x) = x^e + e^x$ .

(b)  $r(t) = \ln \left( \sin \left( \frac{t}{5} \right) \right)$ .

(c)  $f(\theta) = \sqrt{9 - \sec^2 \theta}$ .

(d)  $H(t) = (\tan \pi + \arctan \sqrt{t})^e$ .

(e)  $s(y) = \sqrt[3]{\cos^2 y + 3 + \sin^2 y}$ .

[Extra page for Question 1]

2. [20 points] If  $g(2) = 3$  and  $g'(2) = -4$ , find  $f'(2)$  for the following:

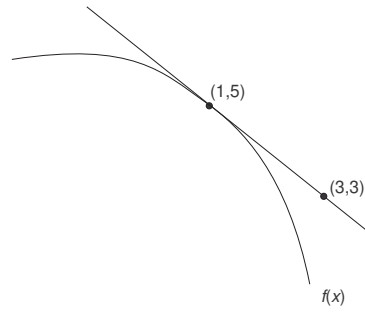
(a)  $f(x) = x \sin(g(x))$ .

(b)  $f(x) = x^2 \ln(g(x))$ .

(c)  $f(x) = \frac{x}{g(x)}$ .

(d)  $f(x) = \sqrt{g(x)}$ .

3. [20 points] Given the graph of a function  $f$  and its tangent line at  $x = 1$ .



- (a) Find  $f'(1)$ .
- (b) Find  $h'(1)$  if  $h(x) = (f(x))^3$ .
- (c) Find  $k'(1)$  if  $k(x) = (f(x))^{-1}$ .
- (d) Find  $g'(5)$  if  $g(x) = f^{-1}(x)$ .

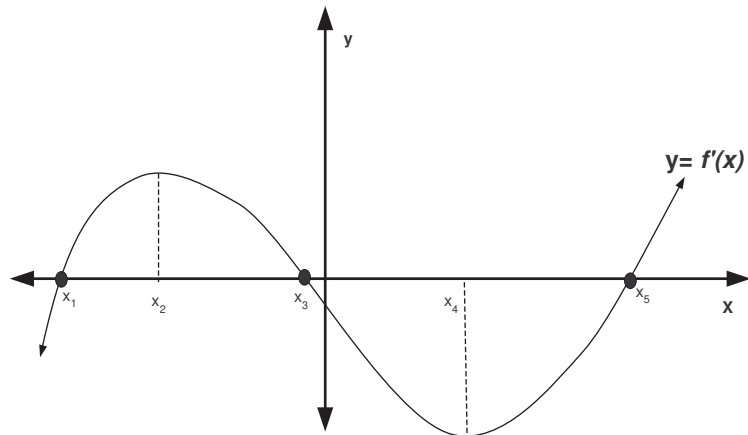
4. [20 points] Find the equation of the tangent line of the following curve

$$\ln(xy) = 2x \text{ at the point } (1, e^2).$$

5. [20 points] Find the global maximum and minimum for the function

$$f(x) = xe^{-\frac{x^2}{2}} \text{ on the interval } [-2, 2].$$

6. [30 points] Given the following graph of the **derivative function**  $f'$ .



Find the intervals where the function:

- (a)  $f(x)$  is increasing.
- (b)  $f(x)$  is concave up.

At what of the marked  $x$ -values can the following be true:

- (c)  $f(x)$  has a critical point.
- (d)  $f(x)$  has a local maximum.
- (e)  $f(x)$  has a local minimum.
- (f)  $f(x)$  has an inflection point.

7. [15 points] A piece of wire of length  $L$  cm is cut into two pieces. One piece, of length  $x$  cm, is made into a circle; the rest is made into a square.

(a) Find the value of  $x$  that makes the sum of the areas of the circle and square a minimum.

(b) Find the value of  $x$  giving a maximum.