

PRINT NAME: _____

PERM NUMBER: _____

DISCUSSION SECTION AND TA'S NAME: _____

- (1) No books and notes are allowed.
- (2) You may use a calculator and a notecard.
- (3) Show your work in details.
- (4) Be sure to spell your TA's name correctly.
- (5) Have a nice Thanksgiving.

Problem	Points	Score
1	15	
2	10	
3	30	
4	15	
5	10	
6	20	
Total	100	

2

(1) (15 points) Find the tangent line of the curve

$$2 \sin x \cos y = 1$$

at the point $(\pi/4, \pi/4)$.

(2) (10 points) Let $f(x) = \cot x$. Find $f'''(\pi/4)$.

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(3) (30 points) Find the derivatives of the following functions.

(a) (10 points) $f(x) = \frac{x}{\sin x}$.

(b) (10 points) $f(x) = \sqrt{x\sqrt{x\sqrt{x}}}$.

(c) (10 points) $f(x) = x^{\cos x}$.

- (4) (15 points) Let $f(x)$ be a function that is twice-differentiable at 0 and let $F(x) = [f(x)]^2$. Suppose that $f(0) = 1$, $f'(0) = 2$ and $f''(0) = 3$. Find $F''(0)$.

6

(5) (10 points) Find the limit

$$\lim_{x \rightarrow 0} \frac{\sin 2x}{\sin 3x}.$$

- (6) (20 points) Boyle's Law states that when a sample of gas is compressed at a constant temperature, the pressure P and volume V satisfy the equation $PV = C$, where C is a constant. Suppose that at a certain instant the volume is 600 cm^3 , the pressure is 150 kPa , and the pressure is increasing at a rate of 20 kPa/min . At what rate is the volume decreasing at this instant?