
Student Name : _____ Student Number: _____

MIDTERM TWO

READ THE DIRECTIONS

ONCE YOU START, MAKE SURE YOUR EXAM HAS 5 PAGES (including the coverage)

Page 1	14	
Page 2	13	
Page 3	12	
Page 4	11	
Total	50	

- Show all work for full credit.
- BOX in your answer to each question.
- Unless otherwise indicated always use EXACT numbers. (i.e $\sqrt{\pi}$ instead of 1.77).
- You may use a scientific calculator during this examination; graphing calculators and other electronic devices are not allowed and should be turned off for the duration of the exam.
- If you use trial-and-error, a guess-and-check method, or numerical approximation when an exact method is available, you will not receive full credit.
- You may use one double-sided, hand-written, 8.5 by 11 inch page of notes.
- You have 60 minutes to complete the exam - so, spend on average ≤ 15 minutes per page.

1. Take the derivative of each function.

(a) (3 points) $f(x) = \sin(\cos(\tan(e^x)))$

(b) (4 points) $g(x) = \ln(x)^{\ln(x)}$

(c) (3 points) $h(x) = \arctan(1/x) + \arctan(x)$. *Note: $\arctan x$ is another notation for $\tan^{-1} x$*

(d) (4 points) $F(x) = \frac{(x+1)(x+2)^2(x+3)^3(x+4)^4}{\pi^x}$. *If you prefer, you can write $F(x)$ in your solution.*

2. A sharknado (tornado filled with sharks) whirls through a city with position

$$(x(t), y(t)) = (t + \sin t, t - \sin t).$$

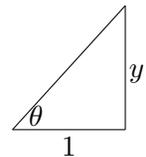
(a) (3 points) Find all times $0 \leq t \leq 2\pi$ when the tangent line is horizontal.

(b) (5 points) Find the three times $0 \leq t \leq 2\pi$ when the speed of the sharknado is equal to 2.

(c) (5 points) A news van drives in the city with the sharknado and has coordinates $(x(t), y(t)) = (1 + t, 1 + t)$. Find a time $0 \leq t \leq \pi$ when the sharknado is moving directly towards the van.

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3. (8 points) A circular puddle is evaporating so that its circumference is changing at B cm/sec with B an unknown constant. Find the rate B so that the area of the puddle is shrinking at 1 cm²/sec when the circumference is 10π .

4. (4 points) In a right triangle with fixed base 1. The height of the other leg is given by $\theta = \arctan(y)$. Use tangent line approximation at $y = 1$ to estimate θ when $y = 1.1$.



5. Let C be the curve defined by the relation

$$xy^2 + 2x^2y - 2 = x.$$

(a) (2 points) Find all y such that the point $(1, y)$ is on the curve C .

(b) (6 points) Find the equation of the tangent line at each point from part (a).

(c) (3 points) Using tangent line approximation, approximate a number b near 1 such that the point $(b, \frac{9}{10})$ is on the curve C .