

Math 141

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Fall 2013

Name:

Student ID (last 6 digits): XXX-

TA recitation (check one):

Brian Allen: Anthony Zamberlan:
Lindsey Fox (2:10): Lindsey Fox (3:40):

MIDTERM 2

You have 50 minutes to complete the exam. Do all work on this exam, i.e., on the page of the respective assignment. Indicate clearly, when you continue your solution on the back of the page or another part of the exam.

Write your name and the last six digits of your student ID number on the top of this page. Check that no pages of your exam are missing. This exam has 6 questions and 9 printed pages (including this one and a page for scratch work in the end).

No books, notes or calculators are allowed on this exam!

Show all work! (Unless I say otherwise.) Correct answers without work will receive **zero**. Also, **points will be taken from messy solutions**.

Good luck!

Question	Max. Points	Score
1	20	
2	15	
3	15	
4	15	
5	15	
6	20	
Total	100	

1) Compute the derivatives of the following functions. [No need to simplify your answers!]

(a) [6 points] $f(x) = x \cdot e^x \cdot \cos(x)$

(b) [7 points] $f(x) = \frac{\sin(e^x + 1)}{2x^2}$

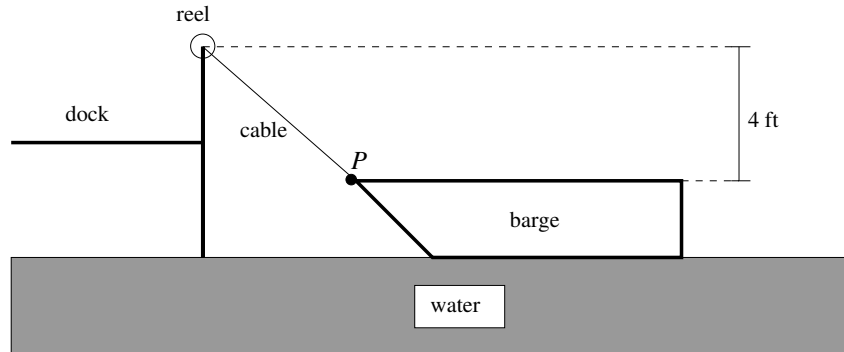
(c) [7 points] $f(x) = \arctan(x)^x$. [**Note:** $\arctan(x)$ is the same as $\tan^{-1}(x)$.]

2) [15 points] Find the equation of the line tangent to the curve given by

$$x^2y = x - y^3 + 1$$

at the point $(0, 1)$.

3) [15 points] A machine on a dock reels a cable, attached to a barge [see picture below], with a speed of 1 foot per second. The point at which the cable is attached, labeled P in the picture, is 4 feet lower than the reel and is located at the very front of the barge. How fast is the barge moving when the front of it [point P] is 3 feet away [horizontally!] from the dock?



4) [15 points] Use the tangent line approximation to estimate $\sqrt{10}$.

5) [15 points] Find [absolute] maximum and minimum [*both* x -coordinate and corresponding value of the function] of $f(x) = 2x^3 - 3x^2 + 2$ in the interval $[-1, 2]$.

6) [20 points] Let $f(x) = x^{7/3} - 7x^{1/3} + 1$. Its first and second derivatives are

$$f'(x) = \frac{7}{3}(x^{4/3} - x^{-2/3}) \quad \text{and} \quad f''(x) = \frac{14}{9}(2x^{1/3} + x^{-5/3})$$

respectively. [No need to check! Just use it!]

[**Note:** In all items below you can use “DNE” for “does not exist”.]

- (a) Give the intervals in which $f(x)$ is increasing and the intervals in which it is decreasing.
- (b) Give all critical points [x -coordinate only] and classify them as local maximum, local minimum or neither.
- (c) Give all intervals in which the graph of the function $f(x)$ is concave up and all intervals in which it is concave down.
- (d) Give all inflection points [x -coordinate only] of $f(x)$

Scratch: