

Name: _____

Calculus I

Professor Piotr Hajłasz

Second Exam

November 7, 2014

Problem	Possible points	Score
1	20	
2	30	
3	10	
4	10	
5	20	
6	20	
Total	110	

To get A you only need 100 points, so 10 points is a bonus. In other words, if you miss 10 points on the exam you still get a full score.

Problem 1. (20p) Find the absolute maximum and minimum values of $f(x) = 10x(2 - \ln x)$ on the interval $[1, e^2]$.

Problem 2. (30p=10+10+10p) Evaluate the limits

(a)

$$\lim_{x \rightarrow 0} \left(\frac{1}{x} - \frac{1}{\sin x} \right).$$

(b)

$$\lim_{x \rightarrow 0^+} \frac{\ln x}{\ln(e^x - 1)}.$$

(c)

$$\lim_{x \rightarrow (\pi/2)^+} e^{\left(\tan x - \frac{1}{\cos x}\right)}.$$

Problem 3. (10p) Find the inverse of $f(x) = e^x - e^{-x}$. **Hint:** *At some point replacing e^x by z will lead to a quadratic equation in z . Since $z = e^x > 0$, only one solution will be acceptable.*

Problem 4. (10p=5+5p) Using Newton's method for the approximation of the solution to $e^{-x} = x - 2$:

(a) Find the general formula for x_{n+1} in terms of x_n .

(b) Find x_2 if $x_1 = 1$. Simplify the answer.

Problem 5. (20p) Find the point on the line $\frac{x}{a} + \frac{y}{b} = 1$, that is closest to the origin.

Problem 6. (20p) Sketch the graph of the function $f(x) = x^4 - 4x^3 + 10$. Make sure that you clearly label: intervals where the function is increasing, decreasing, concave up and concave down, local and absolute maxima/minima and inflection points.