

**NYUAD**

**Calculus With Applications**

**Fall Term 2013**

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## Midterm Exam (Practice)

**First name:**

**Last Name:**

**ID:**

**Remarks:** Please show your work in all the questions. No calculators of any kind. This is only a sample for training purposes. The actual exam may differ in length and/or difficulty.

Problem	Possible	Points
1	16	
2	16	
3	16	
4	16	
5	16	
6	20	
Total	100	

1. Calculate  $\lim_{x \rightarrow 0} (1 + 2x)^{\frac{1}{x}}$

2. Calculate  $\lim_{x \rightarrow \infty} x^3(5 - \sin x)$

3. Where is the following function defined? Continuous? Differentiable?

$$f(x) = \sqrt{1 + \cos x}.$$

4. Calculate the derivative of the function  $f(x) = \arccos(1 + x \ln x)$

5. Find two non-negative numbers  $x$  and  $y$  such that  $x + 3y = 10$  and such that the sum  $x^2 + y^2$  is a minimum.

6. A bacteria culture initially contains 100 cells and grows at a rate proportional to its size. After three hours, the population has increased to 800.
- a) Find an expression for the number of bacteria after  $t$  hours.
  - b) Find the number of bacteria after 1 hour, after 4 hours.
  - c) When will the population reach 100,000? (a formula will be accepted as an answer)