

## IVA'S CALCULUS I: Homework based on Thursday 3/13 and Friday 3/14 lectures

### Purpose

The main purpose of this assignment is to have you practice APPLYING TAYLOR APPROXIMATIONS.

### Due date

Monday 3/17/2014, by 5pm.

---

### Problems

1. Write at least four terms of the Taylor approximations of the following functions. All approximations are to be valid near  $x \approx 0$ .

- $e^x \approx$  \_\_\_\_\_
- $e^{-x} \approx$  \_\_\_\_\_
- $e^{-x^2} \approx$  \_\_\_\_\_
- $\sin(x) \approx$  \_\_\_\_\_
- $\sin(2x) \approx$  \_\_\_\_\_
- $\cos(x) \approx$  \_\_\_\_\_
- $\cos(x^2) \approx$  \_\_\_\_\_
- $\ln(1+x) \approx$  \_\_\_\_\_
- $\ln(1-x) \approx$  \_\_\_\_\_
- $(1+x)^\alpha \approx$  \_\_\_\_\_
- $\frac{1}{1-x} \approx$  \_\_\_\_\_
- $\sqrt{1+x} \approx$  \_\_\_\_\_
- $\sqrt{1-x} \approx$  \_\_\_\_\_
- $\sqrt{1+x^2} \approx$  \_\_\_\_\_
- $\frac{1}{\sqrt{1+x}} \approx$  \_\_\_\_\_
- $\frac{1}{\sqrt{1-x^2}} \approx$  \_\_\_\_\_

(over)

2. Use the Taylor approximations you just found to compute the following limits without any use of the calculator.

(a)  $\lim_{x \rightarrow 0} \frac{\ln(1-x)}{x}$

(b)  $\lim_{x \rightarrow 0} \frac{e^x - 2 + e^{-x}}{x^2}$

(c)  $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} + \sqrt{1-x}}{x^2}$

(d)  $\lim_{x \rightarrow 0} \frac{e^{-x^2} - 1}{x^4}$

(e)  $\lim_{x \rightarrow 0} \frac{1 - \cos(x^2)}{x^4}$

3. The very last limit should be familiar from your homework on limits. What was the point of that earlier homework problem? How would you describe the advantage of the new method you just learned?