

KEY

Math 163 — Quiz 06

Thursday October 25th 2012

**Instructions** Remember to show all your work so you can get partial credit.

1. How many partitions  $n$  of the interval  $[0, 1]$  does one need to take to in order to approximate the integral  $\int_0^1 e^{x^2} dx$  within  $1/1000$  using the midpoint rule. (Hint:  $E_M = \frac{K(b-a)^3}{24n^2}$  where  $K$  is the maximum of  $|f''(x)|$  on the interval  $[a, b]$ .)

$$f'(x) = e^{x^2} (2x)$$

$$f''(x) = e^{x^2} (2x)^2 + e^{x^2} 2$$

$$= e^{x^2} ((2x)^2 + 2) \quad \text{increasing fns}$$

$$K = f''(1) = e(4+2) = 6e$$

$$\frac{6e(1)}{24n_0^2} = \frac{1}{1000} \Rightarrow \frac{e}{4} \cdot 1000 = n_0^2$$

$$\Rightarrow n_0 = \sqrt{\frac{1000e}{4}} \quad \text{since } n_0 > 0$$

$$\approx 26.07$$

$$\Rightarrow n = \# \text{ of intervals you need to take} = \lceil 26.07 \rceil = 27.$$