

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Show all work clearly and in order, and box your final answers. Justify your answers whenever possible. You have 20 minutes to take this 10 point quiz.

1. Consider the function

$$f(x) = \int_0^x te^{-t^3} dt.$$

Unfortunately, it is not possible to write the formula for  $f$  any more explicitly than that. Doing so would involve computing a symbolic antiderivative of  $te^{-t^3}$ , which is impossible. However, we do not have to give up on working with such a function.

- (a) 10 points<sup>1</sup> Show that near  $x = 0$ ,

$$f(x) \approx \frac{x^2}{2} - \frac{x^5}{5} + \frac{x^8}{16} - \frac{x^{11}}{66}.$$

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<sup>1</sup>In class part.

- (b) 10 points<sup>2</sup> One way to compare  $f(x)$  and its approximation is to graph them both. Graphing  $f(x)$  can be problematic, even with computer technology. There is another way to see how accurate our estimate is. On the same axes, graph

$$y = xe^{-x^3} \quad \text{and} \quad y = x - x^4 + \frac{x^7}{2} - \frac{x^{10}}{6}.$$

Are the graphs of these two functions similar near  $x = 0$ ? Should we expect them to be?

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<sup>2</sup>Take-home part due next class!