8. [8 points]

a. [4 points] Write down the first 3 nonzero terms of the Taylor series for the function

$$S(x) = \begin{cases} \dfrac{e^{x^2} - 1}{3x^2} & x \neq 0, \\[2ex] \dfrac{1}{3} & x = 0, \end{cases}$$

centered at $x = 0$. You do not need to simplify any numbers in your answer.

Answer: _____

b. [4 points] Compute the following limit. **Fully justify** your answer including using **proper notation.**

$$\lim_{x \to 0} \frac{\displaystyle\int_0^x \left(e^{t^2} - 1\right) dt}{x^3}$$

Hint: Your answer from the previous part may be helpful at some point.

Answer: _____