Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use arrows and equal signs when appropriate. Always simplify expressions. BOX final short answers. LABEL parts of problem. Keep answers EXACT (not decimal approximations, if possible).

a) Evaluate \( \int x e^{-x/2} \, dx \) by hand.
b) Use the result of part a) to evaluate \( I = \int_0^4 x e^{-x/2} \, dx \) exactly (no decimals).
c) Make a rough sketch of the region whose area is represented by this integral (you may use technology).
d) Evaluate the trapezoidal approximation \( T_4 \) of this integral (\( n = 4 \) divisions).
e) Evaluate \( I \) numerically (decimal equivalent) and the error \( E_k = I - T_4 \).
f) Compute the error bound \( |E_k| \leq \frac{k(b-a)^3}{12n^2} \), where \( n = 4 \) and \( k \) is the absolute maximum value of the second derivative of the integrand on the interval \([a,b]\) of integration (you may use technology to do this). Is \( E_k \) within this error bound?
g) What value of \( n \) is required to make the error less than \( \frac{1}{2} 	imes 10^{-4} \)?