1) Use the midpoint rule to approximate
\[ \int_1^5 x^2 e^{-x} \, dx, \quad n = 4. \quad \text{i.e. find } M_4 \]

\[ \Delta x = \frac{5-1}{4} = 1 \]

So, our subintervals are

\[
\begin{align*}
[1, 1+\Delta x] &= [1, 2] \\
[2, 2+\Delta x] &= [2, 3] \\
[3, 3+\Delta x] &= [3, 4] \\
[4, 4+\Delta x] &= [4, 5]
\end{align*}
\]

The midpoints of these subintervals are 1.5, 2.5, 3.5, 4.5. Thus:

\[ M_4 = f(1.5) \Delta x + f(2.5) \Delta x + f(3.5) \Delta x + f(4.5) \Delta x \]

\[ = \left( \frac{3}{2} \right)^2 e^{-1.5} + \left( \frac{5}{2} \right)^2 e^{-2.5} + \left( \frac{7}{2} \right)^2 e^{-3.5} + \left( \frac{9}{2} \right)^2 e^{-4.5} \]

The answer is perfectly fine. But, if you want decimals:

\[ M_4 \approx 1.61 \]

Note: The exact answer \[ \int_1^5 x^2 e^{-x} \, dx \approx 1.59 \]

Pretty good estimate
2) Evaluate \( \int_{-2}^{2} |x| \, dx \) by interpreting it in terms of area.

The region between \( |x| \) and the \( x \)-axis is two triangles.

So, the area of this region equals the sum of the areas of the two triangles.

\[
\text{area}_{\text{triangle 1}} = \frac{1}{2} \cdot 2 \cdot 2 = 2
\]

\[
\text{area}_{\text{triangle 2}} = \frac{1}{2} \cdot 2 \cdot 2 = 2
\]

Thus \( \int_{-2}^{2} |x| \, dx = 2 + 2 = 4 \).