1. Let $I = \int_0^1 x^4 sin(x^2)\ dx$
   (a) Use a left sum to approximate I accurate within 0.001 of its actual value.
   (b) Use an infinite series to approximate I accurate within 0.001 of its actual value.

2. Find the volume of the solid formed when the graph of $f(x) = \dfrac{3x}{\sqrt{1+9x^6}}$ for $0 \leq x \leq \frac{\pi}{4}$ is rotated about the x-axis.

3. Do the following converge or diverge?
   (a) $\displaystyle\int_2^\infty x^3 e^{-x^2}\ dx$
   (b) $\displaystyle\int_1^\infty \frac{3^x}{4^x+7}\ dx$
   (c) $\displaystyle\sum_{k=1}^\infty (-1)^k \frac{3k^2}{8k^3-8}$
   (d) $\displaystyle\sum_{j=1}^\infty \frac{3j^2}{j!}$

4. Show that $\displaystyle\int_4^\infty \frac{3x^3}{2x^5 + \ln(x)}\, dx$ converges and find a definite integral I_1 that approximates I accurate within 0.01.

5. Show $\displaystyle\sum_{k=4}^{\infty} \frac{3\cos(k)}{2k^2 + \sin(k)^2}$ converges absolutely and find an N such that S_N approximates I accurate within 0.01.

6. Let $I = \displaystyle\int_0^4 \sqrt{1 + (xe^{-x^2})^2}\, dx$.
   Explain how I can be interpreted as:
   - a one-dimensional measure corresponding to a function $f(x)$,
   - a two-dimensional measure corresponding to a function $g(x)$,
   - and as a three-dimensional measure corresponding to a function $h(x)$.

   Be sure to give formulas for $f(x)$, $g(x)$ and $h(x)$.