Question 1.
Evaluate the following integral exactly. Show all your working.

\[ \int_{e^2}^{e} \frac{1}{x \ln x} \, dx. \]
Question 2.

Determine whether the following integrals diverge or converge. Justify your answers.

(i)\[ \int_{1}^{\infty} \frac{\ln x}{x^2} \, dx \]

(ii)\[ \int_{e}^{\infty} \frac{1}{x \ln x + \sqrt{x}} \, dx \]
Question 3.

Find the volume of the solid generated by rotating the curve \( y = \sqrt{x} \) around the \( x \)-axis for \( 0 \leq x \leq 1 \).
Question 4.

Find the length of the curve \( f(x) = \frac{2}{3}(x - 1)^{\frac{3}{2}} \) for \( 1 \leq x \leq 2 \).