Question 1C. Find the degree 4 Taylor approximation about \( x = 0 \) of the function below. For your numerical answer, enter the coefficient of \( x^4 \).

\[
\frac{d}{dx} \int_0^{2x} \cosh(t^2) \, dt
\]

Question 2A. The value of \( \int_2^3 \frac{3x^2 - 1}{x^3 - x} \, dx \) can be expressed as \( \ln k \). Determine \( k \) without using the substitution \( u = x^3 - x \).

Question 3A. Compute the interval of convergence for the power series below.

\[
\sum_{n=0}^{\infty} \frac{(x - 1)^n}{2^n n!(\ln n)^2}
\]

\( \bigcirc \) \((-1, 3]\)

\( \bigcirc \) \((-3, 1]\)

\( \bigcirc \) \([-1, 3]\)

\( \bigcirc \) \([-1, 3]\)

\( \bigcirc \) \((-1, 3]\)

\( \bigcirc \) \([-3, 1]\)

\( \bigcirc \) \((-3, 1]\)

\( \bigcirc \) \([-3, 1]\)

Question 4B. For the curve given parametrically by \( x(t) = t^3 \cos \frac{1}{t}, y(t) = t^3 \sin \frac{1}{t} \), the arc length for \( 0 \leq t \leq A \) is which of the following?

\( \bigcirc \) \( \frac{1}{27} (9A^2 + 1)^{3/2} \)

\( \bigcirc \) \( \frac{1}{27} \sqrt{9A^2 + 1} \)

\( \bigcirc \) \( \left[ (9A^2 + 1)^{3/2} - 1 \right] \)

\( \bigcirc \) \( \frac{1}{27} \left[ (9A^2 + 1)^{3/2} - 1 \right] \)
Question 5B. The series below converges for all values of $p$ strictly bigger than some number $k$. Find $k$. In your written work, justify divergence when $p = k$ and convergence when $p > k$.

$$
\sum_{n=1}^{\infty} \left( e^{2/n^p} - 1 \right)
$$

Question 6C. A continuous function $f(x)$ satisfies $0 \leq f(x)$, for $0 \leq x \leq 1$. When the region between $y = f(x)$ and the $x$-axis, as $x$ goes from $0$ to $1$, is rotated around the $y$-axis, the resulting solid has volume $8\pi$. If $F(x) = \int_0^x f(x) \, dx$ and $\int_0^1 F(x) \, dx = 1$, find $F(1)$ (the answer is a whole number).