1. What is the coefficient of x^2 in the Maclaurin series generated by the function $\ln(1 + \sin x)$?

(A) 1 (B) $\frac{1}{2}$ (C) 2 (D) $-\frac{1}{2}$ (E) -2

2. What is the sum of the series

$$1 - \ln 2 + \frac{(\ln 2)^2}{2!} - \frac{(\ln 2)^3}{3!} + \dots + (-1)^n \frac{(\ln 2)^n}{n!} + \dots ?$$

(A) $2e$ (B) e^{-2} (C) $\frac{1}{2}$ (D) $\frac{\pi}{2}$ (E) 2

3. What is the radius of convergence of the power series

$$\sum_{n=1}^{\infty} \frac{3^n x^n}{n!} ?$$

(A) $\frac{1}{3}$ (B) e (C) 1 (D) 0 (E) ∞

4. When $|x| < 0.3$, which of the numbers below is the best estimate of the error in the approximation $\sin x \approx x$?

(A) 0.0045 (B) 0.0090 (C) 0.0270
(D) 0.0009 (E) 0.0027

5. The Taylor's Formula gives the following identity

$$f(x) = f(0) + f'(0)x + \frac{f''(0)}{2!} x^2 + \ldots + \frac{f^{(n)}(0)}{n!} x^n + R_n(x)$$

What is the expression for $R_n(x)$?

(A) $R_n(x) = \frac{f^{(n+1)}(0)}{(n+1)!} x^{n+1}$

(B) $R_n(x) = \frac{f^{(n)}(c)}{n!} x^n$ for some c between 0 and x.

(C) $R_n(x) = \frac{f^{(n+1)}(c)}{(n+1)!} x^{n+1}$ for some c between 0 and x

(D) $R_n(x) = f^{(n+1)}(c)\, x^{n+1}$ for some c between 0 and x

(E) None of the above

6. Which of the following is the Maclaurin series for

$$\sinh x = \frac{e^x - e^{-x}}{2} \quad ?$$

(A) $1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \ldots + \frac{x^n}{n!} + \ldots$

(B) $1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \frac{x^4}{4!} - \ldots$

(C) $1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \ldots$

(D) $x + \frac{x^3}{3!} + \frac{x^5}{5!} + \ldots$

(E) $x - \frac{x^3}{3!} + \frac{x^5}{5!} - \ldots$

7. Express the integral $\int_0^1 \frac{\sin x}{x}\,dx$ by an infinite series.

8. Does the series $\sum_{n=1}^{\infty} (-1)^n \frac{\ln n}{n}$ converge? If so, is the convergence absolute or conditional? Explain your answer.

9. For which x does the series $\sum_{n=2}^{\infty} \frac{x^n}{\ln n}$ converge ?

For which x is the convergence absolute? For which x is the convergence conditional? Explain your answer.

10. Find the Taylor polynomial of order 4 generated by $f(x) = e^x \sin x$ at 0.