The point value of each problem is indicated in the left margin. You must show all of your work for full credit. Points will be deducted for faulty reasoning, for sloppy notation, and for failure to simplify answers, even if your answer is correct. You may use a calculator, your class notes, and any reference material. Explicitly cite, in some manner, any published formulae you use.

(10) 1. Find $\lim_{x \to 0^+} (\sin x \ln \sin x)$.

Answer

(10) 2. Find $\int_0^\infty (x + 1)^{-1/3} dx$.

Answer
3. Find \( \int_0^1 \frac{e^x}{e^x - 1} \, dx \).

Answer

4. Find \( \lim_{n \to +\infty} \frac{(n!)^2}{(n + 1)!(n - 1)!} \).

Answer
(10) 5. Find the 3rd order Taylor polynomial $P_{3,2}(x)$ based at 2 for $f(x) = \frac{1}{x}$.

Answer $P_{3,2}(x) =$

(10) 6. Show that $P_{3,0}\left(\frac{\pi}{60}\right)$ approximates $\sin\left(\frac{\pi}{60}\right)$ with a remainder (error) $\leq 10^{-6}$?
(10) 7. By considering \( \frac{s_{n+1}}{s_n} \), show that \( s_n = \frac{n^3}{e^{n/2}} \) is a decreasing sequence for \( n \geq 6 \).

(10) 8. Evaluate \( \sum_{k=0}^{\infty} (0.9)^k \)

Answer: ____________________________________________________________________
(10) 9. Decide whether \( \sum_{k=0}^{\infty} \frac{1}{e^k + 2k + 4} \) converges.

Answer

(10) 10. Decide whether \( \sum_{k=2}^{\infty} \frac{1}{k(\ln k)^2} \) converges.

Answer