1. Determine whether the series is convergent or divergent.

$$(a)\quad \sum_{n=2}^{\infty} \frac{n}{\sqrt{n^5 - 2n^2}} \qquad\qquad (b)\quad \sum_{n=2}^{\infty} \frac{1}{n \log_2 n}$$

2. Evaluate the integrals.

$$(a)\quad \int \frac{x^2 - x}{(x+1)(x^2+1)}\, dx \qquad\qquad (b)\quad \int \cos(\ln x)\, dx$$

3. Find the interval of convergence of the power series

$$\sum_{n=1}^{\infty} \frac{(-3)^n}{n2^n}(x-1)^n$$

4. Calculate the limits.

$$(a)\quad \lim_{x\to 0} \frac{\sin^{-1} x - x}{x^3} \qquad\qquad (b)\quad \lim_{x\to\infty} \left(\frac{x}{x+1}\right)^x$$

5. Let $f(x) = \ln(3+x)$. (a) Find the Maclaurin polynomial $T_4(x)$ for $f(x)$. (b) Find the radius of convergence R for the Maclaurin series $T(x)$ for $f(x)$.

6. Find the maxima of the following functions on $[1, \infty)$. (You do not have to use a derivative test to show that it is the maximum.)

$$(a)\quad f(x) = \frac{\ln x}{x^3} \qquad\qquad (b)\quad f(x) = xe^{-x^2/8}$$

7. Determine whether the series converges absolutely, conditionally or not at all.

$$(a)\quad \sum_{n=1}^{\infty} \frac{\cos n}{\cosh n} \qquad\qquad (b)\ \sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}\,\ln n}$$

8. Given that

$$\sum_{n=2}^{\infty} \left(\frac{a}{2}\right)^n = 2$$

determine the value of a.

9. Determine whether the improper integral converges or diverges. Do not attempt to evaluate the integrals.

$$(a)\quad \int_0^1 \frac{\ln(x+1)}{\sqrt{x}}\, dx \qquad\qquad (b)\quad \int_1^{\infty} \frac{dx}{x^{1/3} + x^{2/3}}$$

10. Calculate the area of the region of the plane bounded by the curves $y = xe^{x^2}$ and $y = x/e^x$.