1. (10 points) State, for each series, whether it converges absolutely, coverges conditionally or diverges. Name the test used to support each conclusion, and show the work to apply the test.

   (a) $\sum_{n=2}^{\infty} \frac{(-1)^n}{n\sqrt{\ln n}}$

   (b) $\sum_{n=1}^{\infty} \frac{(-1)^{n-1} \cos n^2}{n^2}$

   (c) $\sum_{n=1}^{\infty} \frac{(-1)^n (n+1)!}{10^n}$.

2. (5 points) Find the interval of convergence of the series $\sum_{n=0}^{\infty} \frac{(x+2)^n}{n3^n}$.

3. (5 points) Find the first three nonzero terms in the Maclaurin series of $f(x) = \frac{1}{1+2x}$ and determine its radius of convergence.

4. (5 points) Use power series to approximate $\int_0^{0.1} x^2 \ln(1+x),\ dx$ to five decimal places. Leave your answer as an unsimplified sum. Explain.

5. (10 points) Determine which of the following improper integrals converge and which diverge. Show why for each one. Evaluate one that converges.

   (a) $\int_1^\infty \frac{4x}{(x^2+1)^2}\,dx$

   (b) $\int_1^\infty \frac{1+e^{-x}}{x}\,dx$

   (c) $\int_0^3 \frac{1}{x^3}\,dx$

6. (5 points) Evaluate $\int_0^2 t \sinh t \, dt$.

7. (5 points) Evaluate $\int e^{3x} \cos x \, dx$.

8. (5 points) Evaluate $\int_0^{\frac{3}{2}} \frac{1}{\sqrt{9-x^2}} \, dx$.

9. (5 points) Evaluate $\int_0^1 \frac{x-4}{x^2-5x+6} \, dx$.

10. (5 points) Which of the sequences below converge, and which diverge? Find the limit(s) of the covergent ones.

    (a) $a_n = 10 - \frac{\sin n}{9^n}$

    (b) $a_n = 10 - \frac{11^n}{9^n}$

11. (5 points) Find the first three nonzero terms of the Taylor series of $f(x) = \cos x$ centered at $a = \frac{\pi}{2}$.

12. (5 points) Sketch the curve $r = 3 - 2\sin\theta$ and find the area that it encloses.

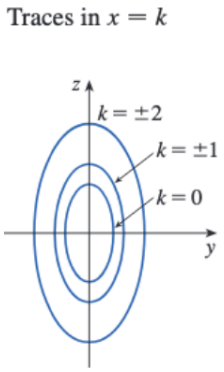
13. (5 points) Evaluate $\frac{d}{dx}(\sinh(\ln x))$.

14. (5 points) Evaluate $\int_1^{e^2} \frac{\ln t}{\sqrt{t}}\, dt$.

15. (5 points) Evaluate $\int_0^{\frac{\pi}{2}} \cos^7\theta \sin^3\theta\, d\theta$.

15. _____

16. (5 points) Use Simpson's Rule with $n = 4$ to approximate $\int_1^2 \sin x^2\, dx$. Leave your answer as an unsimplified sum.



17. (5 points) Sketch a quadric surface that could have the following traces