Name: ____________________ EMPLID: ____________

1. State, for each series, whether it converges absolutely, converges conditionally, or diverges. Name a test which supports each conclusion and show the work to apply the test.

   (a) (4 points) $\sum_{n=2}^{\infty} \frac{(-1)^n(n)}{3n^2+4}$

   (a) ____________

   (b) (4 points) $\sum_{n=2}^{\infty} \frac{(-1)^n}{n(\ln n)^2}$.

   (b) ____________

2. (4 points) Find the interval of convergence of the series $\sum_{n=0}^{\infty} \frac{(x+1)^n}{(n+3)4^n}$. Remember to check endpoints, if applicable.

   2. ____________

3. (4 points) Graph $x^2 - y^2 + z^2 - 4x - 2z = 0$, labelling the coordinates of all vertices, if any.

4. Let $f(x) = \sum_{n=0}^{\infty} \frac{(n+1)x^n}{2^n}$ for each x for which the series converges.
   (a) (4 points) Write a power series in summation notation for the indefinite integral of f.

(a) ______________________________

   (b) (4 points) Find the exact value of $\int_0^1 f(x)\,dx$.

(b) ______________________________

5. (4 points) Find the area of the region that lies inside the curve $r = 1$ and outside $r = 1 - \cos\theta$.

5. ______________________________

6. (4 points) Decide whether the improper integral $\int_1^{\infty} \frac{\cos^2 x}{1+x^2}\,dx$ is convergent or divergent by comparing it to a known improper integral. (You must compare to a known improper integral in order to receive credit).

6. ______________________________

7. (4 points) Evaluate $\int_1^{e^2} \frac{\ln t}{\sqrt{t}}\,dt$.

7. ______________________________

8. (4 points) Evaluate $\int \tan^4 t\,dt$.

8. ______________________________

9. (4 points) Evaluate $\int_0^1 xe^{-2x}\,dx$.

9. ______________________________

10. (4 points) Evaluate $\int \frac{x^2}{\sqrt{9-x^2}}\, dx$.

10. ______________________

11. (4 points) Evaluate $\int_{-1}^{1} \frac{6t+7}{(t+2)^2}\, dt$.

11. ______________________

12. (4 points) Evaluate $\int_{-1}^{1} x^2\sqrt{x^3+1}\, dt$.

12. ______________________

13. (4 points) Use Trapezoid Rule with $n = 4$ to approximate $\int_1^2 8x^2\, dx$. No credit will be given for any other method.

13. ______________________

14. (4 points) A sample of radioactive material decays to one-third of its orginal mass after 8 days. Find the half-life of the material. Find the mass remaining after 20 days if the sample had mass of 2 mg initially.

14. ______________________

15. (4 points) Which of the sequences below converge, and which diverge? Find the limit(s) of the covergent ones, if any.

    (a) $a_n = \frac{\sin^2 n}{n}$

(a) ______________________

    (b) $a_n = \frac{3^n}{n^3}$

(b) ______________________

16. (4 points) Find the first four terms of the Maclaurin series of $\frac{\ln(1+x)}{1-x}$.

16. ______________________________

17. (4 points) How close is the approximation $\sin x \approx x$ when $|x| < 10^{-3}$. Justify your answer.

17. ______________________________

18. (4 points) (True/False) If f is continuous on $[0, \infty)$ and $\int_1^\infty f(x)\,dx$ is convergent, then $\int_0^\infty f(x)\,dx$ is convergent.

18. ______________________________

19. (4 points) (True/False) The Ratio Test can be used to determine whether $\sum_{n=1}^\infty \frac{10}{n^3}$ converges.

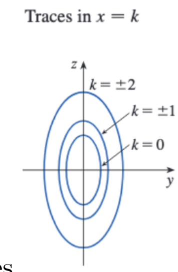
19. ______________________________

20. (4 points) (True/False) If $\sum_{n=1}^\infty a_n$ diverges then $\sum_{n=1}^\infty |a_n|$ diverges.

20. ______________________________

21. (4 points) For what values of x does the series $\sum_{n=0}^\infty \frac{2^n(x+2)^n}{n!}$ converge?

21. ______________________________



22. (4 points) Sketch and identify a quadric surface that could have the following traces

23. (4 points) Sketch the surface in $\mathbb{R}^3$ represented by $x^2 + z^2 = 25, 0 \leq y \leq 2$.