

MAC2312 Section U03
Suggested problems for Test 3
(Test 3 is Friday April 7th, in class)

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1. Evaluate the integral.

$$\int_0^{\pi/2} \cos^3 x \, dx$$

2. Evaluate the integral.

$$\int_0^{\pi/4} \sin^3 x \cos^3 x \, dx$$

3. Evaluate the integral.

$$\int \sec^5 x \tan^3 x \, dx$$

4. Evaluate the integral.

$$\int x\sqrt{4-x^2} dx$$

5. Evaluate the integral.

$$\int \frac{1}{x^2\sqrt{9-x^2}} dx$$

6. Evaluate the integral.

$$\int_1^{\sqrt{3}} \frac{1}{x^2 \sqrt{4-x^2}} dx$$

7. Evaluate the integral.

$$\int \frac{x}{\sqrt{9+x^2}} dx$$

8. Evaluate the integral.

$$\int \frac{x+6}{x^2-3x-4} dx$$

9. Evaluate the integral.

$$\int_2^8 \frac{5x + 13}{x^2 + 4x - 5} dx$$

10. Evaluate the integral.

$$\int \frac{2x^2 - 9x - 9}{x^3 - 9x} dx$$

11. Evaluate the integral.

$$\int_2^3 \frac{1}{x^3 - x} dx$$

12. Evaluate the integral.

$$\int \frac{2x^2 + 3}{x^3 - 2x^2 + x} dx$$

13. Evaluate the integral.

$$\int \frac{2x + 7}{x^2 + 1} dx$$

14. Use the Trapezoid Rule and Simpson's rule to estimate the integral, using $n = 2$ subintervals.

$$\int_2^3 \frac{1}{x^3 - x} dx$$

15. Evaluate the integral.

$$\int \frac{1}{x^3 + x} dx$$

16. Use the Trapezoid Rule and Simpson's rule to estimate the integral, using $n = 4$ subintervals.

$$\int_1^3 \frac{1}{x^3 + x} dx$$

17. Evaluate the integral.

$$\int \frac{x+1}{x^3+x} dx$$

18. Determine whether the integral converges or diverges, and if it converges, find its value.

$$\int_1^{\infty} \frac{1}{x^2} dx$$

19. Determine whether the integral converges or diverges, and if it converges, find its value.

$$\int_0^{\infty} e^{-x} dx$$

20. Determine whether the integral converges or diverges, and if it converges, find its value.

$$\int_0^{\infty} \frac{x}{1+x^2} dx$$

21. Determine whether the integral converges or diverges, and if it converges, find its value.

$$\int_0^{\infty} \frac{1}{1+x^2} dx$$

22. Determine whether the integral converges or diverges, and if it converges, find its value.

$$\int_3^4 \frac{1}{\sqrt{x-3}} dx$$

23. Determine whether the integral converges or diverges, and if it converges, find its value.

$$\int_3^4 \frac{1}{(x-3)^2} dx$$

24. Find a formula for the general term of the sequence, starting with $n = 1$.

$$1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \dots$$

25. Find a formula for the general term of the sequence, starting with $n = 1$.

$$\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}, \dots$$

26. Evaluate each of the following limits.

a. $\lim_{n \rightarrow \infty} \frac{1}{2^n}$

b. $\lim_{n \rightarrow \infty} \frac{n}{2^n}$

c. $\lim_{n \rightarrow \infty} \frac{2n - 1}{2n}$

d. $\lim_{n \rightarrow \infty} \frac{\ln n}{n}$

e. $\lim_{n \rightarrow \infty} \frac{\pi^n}{4^n}$

27. Determine whether the series converges. If it converges, find its value.

$$\sum_{k=1}^{\infty} \left(\frac{2}{3}\right)^{k+2}$$

28. Determine whether the series converges. If it converges, find its value.

$$\sum_{k=1}^{\infty} \left(-\frac{3}{4}\right)^{k-1}$$

29. Determine whether the series converges or diverges.

$$\sum_{k=3}^{\infty} \frac{1}{k-2}$$

30. Determine whether the series converges or diverges.

$$\sum_{k=5}^{\infty} \left(\frac{e}{\pi}\right)^{k-1}$$

31. Determine whether the series converges or diverges.

$$\sum_{k=1}^{\infty} \frac{1}{\sqrt{k}}$$

32. Determine whether the series converges or diverges.

$$\sum_{k=1}^{\infty} k^{-2/3}$$

33. Determine whether the series converges or diverges.

$$\sum_{k=1}^{\infty} \frac{k^2 + 1}{k^2 + 3}$$

34. Determine whether the series converges or diverges.

$$\sum_{k=2}^{\infty} \frac{1}{k \ln k}$$