

## Review Packet for Math 121 Exam #2

**Integrals:** Compute each of the following integrals, or else show that it diverges.

1.  $\int_3^{\infty} \frac{1}{x^2 - 4x + 7} dx$

2.  $\int_e^{\infty} \frac{1}{x(\ln x)^3} dx$

3.  $\int_0^{\infty} \frac{1}{(x+2)(2x+5)} dx$

4.  $\int_7^{\infty} \frac{1}{x^2 - 8x + 19} dx$

5.  $\int_2^{\infty} \frac{1}{x^2 - 2x + 4} dx$

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

7.  $\int_0^{\frac{\pi}{2}} \tan x dx$

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

9.  $\int_1^2 \frac{1}{x \ln x} dx$

10.  $\int_0^1 \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$

11.  $\int_1^{\infty} \frac{\ln x}{x} dx$

12.  $\int \frac{2x-5}{x^2+2x+2} dx$

13.  $\int_0^1 \frac{e^x}{\sqrt{e^x-1}} dx$

14.  $\int_0^1 \ln x dx$

15.  $\int_0^1 \frac{1}{(1-x^2)^{\frac{3}{2}}} dx$

16.  $\int_{-\infty}^3 \frac{1}{x^2 - 6x + 10} dx$

17.  $\int_{-5}^0 \frac{x}{x^2 + 4x - 5} dx$

18.  $\int_0^2 \frac{1}{(x-2)^2} dx$

19.  $\int_0^{\infty} \frac{1}{x^2 + 3x + 2} dx$

20.  $\int_0^{\frac{\pi}{2}} \tan^2 x dx$

21.  $\int_0^2 \frac{1}{(4-x^2)^{\frac{3}{2}}} dx$

22.  $\int \frac{4x^2 + 7x + 6}{(x+2)(x^2+4)} dx$

23.  $\int_1^{\infty} \frac{1}{x(x+1)} dx$

24.  $\int_{-3}^{-2} \frac{1}{x^2 - 4} dx$

25.  $\int_0^1 \arcsin x dx$  (leads to improper integral)

26.  $\int_0^1 \frac{e^{\frac{1}{x}}}{x^2} dx$

27.  $\int_{-1}^0 \frac{e^{\frac{1}{x}}}{x^2} dx$

28.  $\int_{-\infty}^0 \frac{x^2}{9+x^6} dx$

29.  $\int_2^{\infty} \frac{x}{e^{3x}} dx$

30.  $\int_0^e \frac{\ln x}{\sqrt{x}} dx$

**Sequences:** For each of the following Sequences, decide whether it Converges or Diverges. If it Converges, compute its limit.

$$\begin{array}{llll}
 31. \left\{ \frac{1+n-7n^4}{3n^4+8n^3+9} \right\}_{n=1}^{\infty} & 32. \left\{ \frac{n^3}{(n+1)^3} \right\}_{n=1}^{\infty} & 33. \left\{ \left( \frac{n-5}{n} \right)^n \right\}_{n=1}^{\infty} & 34. \left\{ \frac{(2n+3)!}{(2n+5)!} \right\}_{n=1}^{\infty} \\
 35. \left\{ \arctan(n^2+1) \right\}_{n=1}^{\infty} & 36. \left\{ \frac{\sqrt{n}}{(\ln n)^2} \right\}_{n=1}^{\infty} & 37. \left\{ n^{\frac{1}{n}} \right\}_{n=1}^{\infty} & 38. \left\{ n \sin \left( \frac{1}{n} \right) \right\}_{n=1}^{\infty} \\
 39. \left\{ \left( \frac{n+1}{n} \right)^n \right\}_{n=1}^{\infty} & 40. \left\{ \left( \frac{n}{n+1} \right)^n \right\}_{n=1}^{\infty} & & 
 \end{array}$$

**Series:** Find the **Sum** for each of the following series (all of which converge):

$$41. \sum_{n=1}^{\infty} \frac{2^n + 3^n}{6^n} \quad 42. \sum_{n=1}^{\infty} \frac{(-1)^{n+1} 2^{n-1}}{3^{n+1}} \quad 43. \sum_{n=1}^{\infty} \frac{(-1)^n 3^{n+2}}{2^{4n-1}} \quad 44. \sum_{n=1}^{\infty} \frac{(-1)^n 4^n}{3^{2n-1}}$$

**More Series:** Determine whether each of the following series **Converge** or **Diverge**. Name any Convergence test(s) you use, and justify all of your work

$$\begin{array}{lll}
 45. \sum_{n=1}^{\infty} \frac{2n^3 - \ln n}{5n^3 + 9} & 46. \sum_{n=1}^{\infty} \frac{\ln n}{n^2} & 47. \sum_{n=1}^{\infty} \frac{\sqrt{n} + 3}{4n^2 - 2} \\
 48. \sum_{n=1}^{\infty} \frac{n^{19} + 40n^6 + 4n^3 + 19}{4 + 17n^5 + n^{20}} & 49. \sum_{n=2}^{\infty} \frac{e^n}{\ln n} & 50. \sum_{n=1}^{\infty} \frac{5}{n^5} + \frac{1}{5^n} \\
 51. \sum_{n=1}^{\infty} \frac{1 + 3n^3}{n^5} & 52. \sum_{n=2}^{\infty} \frac{1}{n(\ln n)^7} & 53. \sum_{n=1}^{\infty} \frac{\arctan n}{1 + n^2} \\
 54. \sum_{n=1}^{\infty} \frac{n^2 + 1}{\arctan n} & 55. \sum_{n=1}^{\infty} \frac{2n + 5}{5n^3 + 3n^2} & 56. \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2 + 5n - 3} \\
 57. \sum_{n=1}^{\infty} \frac{\pi}{\arctan(2n)} & 58. \sum_{n=1}^{\infty} 3 + \frac{1}{3^n} & 59. \sum_{n=1}^{\infty} e^{\frac{1}{n}} \\
 60. \sum_{n=1}^{\infty} \frac{6}{n^6} + \frac{1}{(n+1)^6} & 61. \sum_{n=1}^{\infty} \cos^2 \left( \frac{\pi n^2 + n}{n^2 + 7} \right) & 62. \sum_{n=1}^{\infty} (-1)^n \frac{\cos^2(\pi n^2 + 1)}{n^2 + 7}
 \end{array}$$

**Even More Series:** Determine whether each of the following series **Converges Absolutely**, **Converges Conditionally**, or **Diverges**. Name any Convergence test(s) you use, and justify all of your work.

$$63. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{5n+2}$$

$$64. \sum_{n=1}^{\infty} (-1)^n \frac{n^3 + 6n}{n^8 + 1}$$

$$65. \sum_{n=1}^{\infty} \frac{5^{2n}}{(2n+1)! \ln n}$$

$$66. \sum_{n=1}^{\infty} \frac{n! n^6 n^n}{10^{4n} e^{2n}}$$

$$67. \sum_{n=1}^{\infty} (-1)^n \frac{1}{4n+3}$$

$$68. \sum_{n=1}^{\infty} \frac{(n!)^3 e^{2n}}{(3n)! n^n}$$

$$69. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{\arctan n}{n^7 + n}$$

$$70. \sum_{n=1}^{\infty} \frac{(-1)^n (3n)! n^2}{8^n (n!)^2 n^n}$$

$$71. \sum_{n=1}^{\infty} (-1)^n \frac{n^3 + 7}{n^7 + 3}$$

$$72. \sum_{n=1}^{\infty} \frac{(-1)^n (\ln n) \pi^n (2n)!}{n^n 4^n n!}$$