

**MATH 181**  
**Sample exam problems for the 2nd hour exam**  
**Fall 2009**

1. Compute the improper integral:  $\int_0^{+\infty} x e^{-x} dx$
2. Compute the improper integral:  $\int_0^{+\infty} \frac{dx}{x^2 + 1}$
3. Determine whether the improper integral  $\int_1^{+\infty} \frac{x^2 + 2x + 5}{x^3 + x + 1} dx$  converges or not.
4. Determine whether the improper integral  $\int_0^1 \frac{e^x dx}{\sqrt{x}}$  converges or not.
5. Determine whether the improper integral  $\int_1^{+\infty} \frac{dx}{\sqrt{x^3 + x + 1}}$  converges or not.
6. Compute the arclength of the graph of the function  $f(x) = x^{3/2}$  from  $x = 0$  to  $x = 1$ .
7. Compute the arclength of the graph of the function  $f(x) = x^{1/2} - \frac{1}{3}x^{3/2}$  on the interval  $[1, 4]$ .
8. Compute the surface area of the surface obtained by rotating the curve  $y = x^3$  on  $[0, 1]$  about the  $x$ -axis.
9. Find the center of mass of the constant density lamina lying below the semicircle  $y^2 + x^2 = 1$  with  $y \geq 0$  and above the  $x$ -axis.
10. Compute the 2nd Taylor polynomial of the function  $x^3 - 3x^2 + 5x + 3$  centered at the point  $a = 1$ .
11. Compute the 3rd Taylor polynomial of the function  $f(x) = \ln x$  centered at  $a = 1$ .
12. Compute the 6th Maclaurin polynomial of the function  $f(x) = \cos x$ .
13. Give an upper bound for the error  $|\cos 1 - T_4(1)|$  where  $T_4(x)$  is the 4th Maclaurin polynomial of the function  $\cos x$ .
14. Compute the sum of the series:  $\frac{1}{3} - \frac{2}{9} + \frac{4}{27} - \frac{8}{81} + \dots$
15. Compute the sum of the series  $\sum_{n=1}^{+\infty} \frac{2}{n(n+2)}$ .
16. Determine whether the series  $\sum_{n=1}^{+\infty} \frac{n^2 + 1}{n^3 + n + 1}$  converges or not.
17. Determine whether the series  $\sum_{n=1}^{+\infty} \frac{\ln n}{n^2}$  converges or not.

18. Determine whether the series  $\sum_{n=2}^{+\infty} \frac{1}{n^2 + \cos(\pi n)}$  converges or not.
19. Determine whether the series  $\sum_{n=2}^{+\infty} \frac{\sin n}{n^2}$  converges or not.
20. Determine whether the series  $\sum_{n=1}^{+\infty} \frac{\cos(\pi n)}{\sqrt{n}}$  converges or not.
21. Determine whether the series  $\sum_{n=1}^{+\infty} \frac{(n!)^2}{(2n)!}$  converges or not.
22. Determine whether the series  $\sum_{n=1}^{+\infty} \frac{3^n}{n^4}$  converges or not.
23. Determine whether the series  $\sum_{n=2}^{+\infty} \frac{(-1)^n}{n \ln n}$  is absolutely convergent, conditionally convergent or divergent.
24. Determine whether the series  $\sum_{n=1}^{+\infty} \frac{(-1)^n n^2}{2^n}$  is absolutely convergent, conditionally convergent or divergent.