

**Math 112 FINAL EXAM, December 18, 2019**

Read each problem carefully. Show all your work for each problem! Use only those methods discussed thus far in class. No Calculators!

1. (10) Evaluate the following integrals:

$$(a) \int x\sqrt{x^2+1} dx, \quad (b) \int \frac{dx}{x^2+x}.$$

2. (10) Use the Disk method to find the volume of the solid generated by revolving the region bounded between the curves  $y = \sqrt{1-x^2}$  and  $y = 0$  about the  $x$ -axis.

3. (10) Evaluate the following integrals:

$$(a) \int xe^{-x} dx, \quad (b) \int \sec^2 x \tan^2 x dx.$$

4. (10) Evaluate the following integrals:

$$(a) \int (1 + \sin^2 x) dx \quad (b) \int \frac{1-x}{1+4x^2} dx.$$

5. (a) (5) Find the first three terms in the Taylor Series of the function  $f(x) = 1 + x^2$  at  $a = 1$ .

- (b) (5) Sum the following series

$$\sum_{n=0}^{\infty} \frac{2^n + 3^n}{5^{n+1}}.$$

6. (10) Use the **integral test** in (a) and a **comparison test** in (b) to determine whether the series converge or diverge:

$$(a) \sum_{n=2}^{\infty} \frac{1}{n \ln n} \quad (b) \sum_{n=1}^{\infty} \frac{1}{n} \left(\frac{1}{2}\right)^n.$$

7. (10) Use the **ratio test** in (a) and the **root test** in (b) to determine whether the series converge or diverge:

$$(a) \sum_{n=1}^{\infty} \frac{2^n}{n!} \quad (b) \sum_{n=1}^{\infty} \left(\frac{1+n}{1+2n}\right)^n.$$

8. (a) (5) Determine whether the following series converges. State which test you use.

$$\sum_{n=0}^{\infty} \frac{1+n^2}{1+10n^2}.$$

- (b) (5) Determine the radius of convergence and the interval of convergence for the power series:

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

9. (10) Evaluate the following integrals:

$$(a) \int_0^1 \frac{1}{\sqrt{1-x}} dx, \quad (b) \int \frac{x^3}{\sqrt{1-x^2}} dx.$$

10. (10) Find the area of the polar region that lies inside  $r = 4 \cos \theta$  and outside  $r = 2$ .