Final Exam Formula Sheet –Math 1552

Trig Identities

- $\sin^2(x) = \frac{1}{2}(1 - \cos(2x))$
- $\cos^2(x) = \frac{1}{2}(1 + \cos(2x))$
- $\sin(2x) = 2\sin(x)\cos(x)$
- $\cos(2x) = \cos^2(x) - \sin^2(x)$

Integrals

- $\int \frac{1}{1+(ax)^2} dx = \frac{1}{a} * \tan^{-1} ax + C$
- $\int \frac{1}{\sqrt{1-(ax)^2}} dx = \frac{1}{a} * \sin^{-1} ax + C$
- $\int e^{ax} dx = \frac{1}{a} * e^{ax} + C$
- $\int b^{ax} dx = \frac{1}{a\ln(b)} * b^{ax} + C$
- $\int \tan(x)\, dx = \ln|\sec(x)| + C$
- $\int \sec(x)\, dx = \ln|\sec(x) + \tan(x)| + C$
- $\int \csc(x)\, dx = -\ln|\csc(x) + \cot(x)| + C$
- $\int \cot(x) = \ln|\sin(x)| + C$

Series Tests

- <u>Geometric Series</u>

$$\sum_{n=0}^{\infty} r^n = \frac{1}{1-r}, |r| < 1 \rightarrow converges$$

- <u>P-Test</u>

$$\lim_{n\to\infty} \frac{1}{n^p}, p > 1 \rightarrow converges$$

- <u>Direct Comparison Test</u>

$a_k \le b_k$ *and* $\sum b_k$ *converges* $\rightarrow$ *converges*

$a_k \ge b_k$ *and* $\sum b_k$ *diverges* $\rightarrow$ *diverges*

- <u>Limit Comparison Test</u>

If the limit is a positive finite # and....

$\sum b_k$ *converges then* $\sum a_k$ *converges*

$\sum b_k$ *diverges then* $\sum a_k$ *diverges*

- <u>Ratio Test</u>

$$\left|\frac{a_{n+1}}{a_n}\right| = L$$

L< 1 $\rightarrow$ *converges*

L> 1 $\rightarrow$ *diverges*

- <u>Root Test</u>

$$|a_n|^{\frac{1}{n}} = L$$

L< 1 $\rightarrow$ *converges*

L> 1 $\rightarrow$ *diverges*

Trig Substitution

- $x^2 - a^2 \rightarrow a\sec\theta$
- $a^2 - x^2 \rightarrow a\sin\theta$
- $x^2 + a^2 \rightarrow a\tan\theta$

Common MacLaurin Series

- $e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}, x \in \mathbb{R}$
- $\sin x = \sum_{n=0}^{\infty} \frac{x^{2n+1}}{(2n+1)!} * (-1)^n, x \in \mathbb{R}$
- $\cos x = \sum_{n=0}^{\infty} \frac{x^{2n}}{(2n)!} * (-1)^n, x \in \mathbb{R}$
- $\frac{1}{1-x} = \sum_{n=0}^{\infty} x^n, x \in \mathbb{R}\ \&\ |x| < 1$
- $\ln(1+x) = \sum_{n=0}^{\infty} \frac{x^{n+1}}{(n+1)} * (-1)^n,$
  $x \in \mathbb{R}\ \&\ |x| < 1$

Volumes

*For rotation about x-axis (switch for y-axis)

- <u>Disk</u>
  $\int_a^b \pi(R(x))^2 dx$
- <u>Washer</u>
  $\int_a^b \pi[R(x)^2 - r(x)^2] dx$

*For rotation about y-axis (switch for x-axis)

- <u>Shell</u>
  $\int_a^b 2\pi * r * h\, dx$

Integration by Parts

- $\int u dv = uv - \int v du$

Good to Know Formulas

- $\lim_{n\to\infty} \left(1 + \frac{a}{n}\right)^n = e^a$
- $\int_a^b (Top - Bot)\, dx = A$