

**1. Differentiate each of the following:**

(a)  $\tan^{-1}(e^x)$  that is  $Arctan(e^x)$

(b)  $e^{\sin^{-1}(x)}$  that is  $e$  to the  $Arctan$

**2. Integrate each of the following:**

(a)  $\int \sin x \cos^3 x \, dx$

(b)  $\int \sin^2 x \, dx$

(c)  $\int x \sin(x) \, dx$

(d)  $\int Arctan(x) \, dx$

**3. For each of the following draw the graph. set up the integral and then use the integral to find the area:**

(a) Find the area of the region bounded by  $r = 2$

(b) Find the area of the region bounded by  $r = 2 + 2 \cos(\theta)$

(c) The region bounded *INSIDE*  $r = 2$  and *OUTSIDE*  $r = 2 \sin(\theta)$ .

**4. For each of the following sequences, discuss the convergence or lack thereof and give valid reasons to support your answer, not just answers.**

(a) Find  $\lim_{n \rightarrow \infty} \frac{(-1)^n}{2^n}$ .

(b) For  $a_n = (n - 1)/n$ , find  $\lim_{n \rightarrow \infty} a_n$  ?

5. For each of the following series determine if the series converges conditionally, converges absolutely or diverges.

(a)  $\sum_{n=1}^{+\infty} \frac{3^n}{n!}$

(b)  $\sum_{n=1}^{+\infty} \frac{(-1)^n n^2}{3^n}$

6. Consider the following .

(a) The power series for  $\sin(x)$  is given by  $\sum_{n=0}^{+\infty} (-1)^n \frac{x^{(2n+1)}}{(2n+1)!}$

i. write the first three terms of the series

ii. find the region of absolute convergence for the series.

iii. find the power series for  $\cos(x)$  by differentiating term by term.

(b) Find the power series for  $\frac{1}{x-1}$  Hint: Careful I wrote  $(x-1)$

i. write the first three terms of the series

ii. find the region of absolute convergence for the series.

iii. find the power series for  $\ln(x-1)$  by integrating term by term.

Hints:  $\sin^2 x = \frac{1 - \cos 2x}{2}$ ,  $\sin 2x = 2 \sin x \cos x$