

Name.....J Number.....Score.....

Show All Work.

1. Find the integrals.(32)
  - (a)  $\int \frac{\sqrt{1-x^2}}{x} dx$ ;
  - (b)  $\int x \sin x dx$ ;
  - (c)  $\int \sin^2 x \cos^2 x dx$ ;
  - (d)  $\int \frac{x^2-x+3}{(x-1)(x^2+1)} dx$ .
2. Find the area of the region that is inside the cardioid  $r = 2 + 2 \cos \theta$  and outside the circle  $r = 3$ .(10)
3. A cylindrical tank of radius 3ft and height 10 ft is half full of water. How much work is performed in pumping all the water in the tank over the top edge? (10)
4. Find the volume of the solid generated when the region bounded by  $x = -2, x = 2\sqrt{3}, y = 0$  and  $y = \frac{1}{\sqrt{4+x^2}}$  is revolved about x-axis.(10)
5. Determine whether the series absolutely converges conditionally converges or diverges.(20)
  - (a)  $\sum_{k=1}^{\infty} \frac{1}{\sqrt[3]{k^4+3k}}$ ;
  - (b)  $\sum_{k=2}^{\infty} \frac{1}{k \ln^2 k}$ ;
  - (c)  $\sum_{k=1}^{\infty} (-1)^k \frac{\ln k}{k}$ ;
  - (d)  $\sum_{k=1}^{\infty} \left(1 + \frac{2}{k}\right)^k$ .
6. Find the function to which the series  $\sum_{k=1}^{\infty} \frac{x^{k+1}}{k}$  converges.(6)
7. Find the Taylor series about  $x = a$  for the given function; express your answer in sigma notation( $\Sigma$ ); then find its radius of convergence and the interval of convergence.(12)
  - (a)  $f(x) = \frac{1}{2+3x}$ , at 0;
  - (b)  $f(x) = \ln x$ , at 3.