1. (20%) Find the limit of the followings;

   (a) $\lim\limits_{x \to 1^+} \left(\frac{1}{x-1} - \frac{1}{\ln x} \right)$

   (b) $\lim\limits_{x \to 0^+} (x+1)^{\frac{1}{x}}$

   (c) $\lim\limits_{(x,y) \to (0,0)} \frac{2+y}{x+\cos y}$

   (d) $\lim\limits_{p \to (1,-1,e)} \ln |x + y + z|$

2. (20%) Evaluate the integrals;

   (a) $\int_1^e \frac{dx}{x\sqrt{x+(\ln x)^2}}$

   (b) $\int_0^1 \frac{dx}{\sqrt{4+x^2}}$

3. (10%) Solve the equation $x\frac{dy}{dx} = x^2 + 3y$, $x > 0$, given the initial condition $y(1) = 2$.

4. (15%) Find the maximum and minimum values of the function $f(x,y) = 3x + 4y$ on the circle $x^2 + y^2 = 1$.

5. (15%) Find the area of the region enclosed by the cardioid $r = 2(1 + \cos\theta)$.

6. (10%) Calculate $\int\int_R \frac{\sin x}{x} dA$
   where R is the triangle in the xy-plane bounded by the x-axis, the line $y = x$, and the line $x = 1$.

7. (10%) Integrate $f(x,y,z) = x - 3y^2 + z$ over the line segment C joining the origin and the point $(1,1,1)$.