Q.1.   Solve the following: (6x5=30)

i) Find the domain and range of the function $f(x) = \sqrt{1 - x^2}$

ii) Prove that if f is differentiable at a point $a \in Dom\ f$, then f is continuous at a

iii) Show that polar coordinates $P(3,0)$ and $Q(-3, \pi)$ represent the same point.

iv) Evaluate $\int \frac{dx}{x^2+3x+4}$

v) Find point of inflection of the curve $f(x) = \frac{2}{x} - \frac{4}{x^2}$

vi) Find area of the region bounded by $xy = c^2, x - axis, x = a, x = b$

Q.2.   Solve the following: (5x6=30)

i) Examine the continuity of $f(x)$ at $x = 0$ where $f(x) = \begin{cases} \frac{e^{\frac{1}{x}}-1}{e^{\frac{1}{x}}+1} & ; \text{if } x \neq 0 \\ 0 & ; \text{if } x = 0 \end{cases}$

ii) Evaluate $\int \sqrt{a^2 + x^2}\ dx$

iii) Find the area enclosed by the graph of the circle of radius r.

iv) Find reduction formula for $\int cot^n x\ dx$ and hence find $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} cot^4 x\ dx$

v) By using substitution $z = tan\frac{x}{2}$ show that $\int cosec\ x\ dx = \frac{1}{2}\ln\left|\frac{1-cosx}{1+cosx}\right|$