THE ANSWERS MUST BE ATTEMPTED ON THE ANSWER SHEET PROVIDED

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

(i) Find the domain and range of the function $f : \mathbb{R} \to \mathbb{R}$ where
$$f(x) = \frac{1}{\sqrt{4 - x^2}}.$$

(ii) Differentiate w.r.t. x if
$$y = x^2 \sin^2(2x^2).$$

(iii) Evaluate the integral:
$$\int x \cos(x)\, dx$$

(iv) Evaluate the integral:
$$\int \frac{\cos(t)}{3 + \cos(t)}\, dt.$$

(v) Find $\dfrac{dy}{dx}$, if
$$y^3 + x^3 - 9xy = 0.$$

(vi) Evaluate the indicated limit:
$$\lim_{x \to 0} \frac{\tan(3x)}{\sin(8x)}$$

Q.2.   Solve the following: (3x10=30)

(i) Find $\dfrac{dy}{dx}$ if $y = \sin\left(\arctan\left(\dfrac{x}{\sqrt{x^2 + 1}} \right) \right)$

(ii) Evaluate $\int e^x \sin(3x)\, dx$

(iii) For what value of m the following function is continous at $x = 3$.
$$f(x) = \begin{cases} x^2 - 1, & x \le 3 \\ 2ax, & x > 3 \end{cases}$$