Note: Answer all questions. All questions carry equal marks.

1.(a) i) If $(x-y)\log_a 2 = (y-z)\log_b 2 = (z-x)\log_c 2$, then show that abc = 1.

ii) If $\tan 20^\circ = \lambda$, show that $\dfrac{\tan 250^\circ + \tan 340^\circ}{\tan 200^\circ - \tan 110^\circ} = \dfrac{1-\lambda^2}{1+\lambda^2}$.

OR

(b) i) If $a^x = b^y = c^z$ and $y^2 = xz$ then show that $\log_b a = \log_c b$.

ii) find the value of $\cos 5^\circ + \cos 24^\circ + \cos 175^\circ + \cos 204^\circ + \cos 300^\circ$.

2.(a) i) Find the derivative of the function $f(x) = \dfrac{x^3+1}{(x^2-1)(x^3-1)}$.

ii) If $f(x) = x \sin(1/x)$ when $x \neq 0$ and $f(0) = 0$, show that f is continuous but not derivable for x=0.

OR

(b) i) Find the maximum and minimum values of the polynomial function f is given by $f(x) = 8x^5 - 15x^4 + 10x^3$.

ii) if $u = \tan^{-1}(y/x)$, then show that $\dfrac{\partial^2 y}{\partial x^2} + \dfrac{\partial^2 y}{\partial y^2} = 0$.

3.(a) i) Evaluate $\int \dfrac{\cos x}{a + b\sin x}\,dx$.

ii) Evaluate $\int \dfrac{3x+7}{3x^2+14x-5}\,dx$.

OR

(b) i) Evaluate $\int \dfrac{\tan x}{1+\cos^2 x}\,dx$

ii) Evaluate $\int \dfrac{\cos 4x + 1}{\cos x - \tan x}\,dx$.

4.(a) i) Define symmetric and skew symmetric matrix.

If $A = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 3 & -1 \\ -3 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{bmatrix}$, find BA.

ii) Define determinant of a matrix. Find A^{-1} if $A = \begin{bmatrix} 2 & 0 & 3 \\ 6 & 2 & 1 \\ 3 & 1 & 4 \end{bmatrix}$.

OR

using the Gauss-elimination method.

5.(a) i) Derive the equation y = mx+c for a straight line and explain the importance of m and c and how to determine the value of m.

ii) Find Latus sectum, eccentricity from the equation $x^2+y^2-4x+4 = 0$.

OR

(b) i) Find the centre and radius of the circle $3x^2+3y^2+6x-12y-1 = 0$.

ii) Explain about linear and non-linear graphs and their importance in biological data representation and comparison.

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