NAME:
ENROL. NO.:
TUTORIAL BATCH:

MAI-101:Mathematics I (QUIZ-1, Autumn Semester 2024-25)

Time: 20 minutes SET-B Total marks: 10

Note: Fill in the blanks within the space mentioned on this sheet only.

1. Let A be a matrix with characteristic polynomial $(\lambda-1)^3(\lambda-2)^2$, and $\text{rank}(A-I)=2$. If A is not diagonalizable, then the sum of all possible value(s) of rank $(A-2I)$ is 4

2. Let A be a 5×5 matrix such that $\text{rank}(A)=2$. If a linear system $AX=b$ is inconsistent and rank of augmented matrix $(A|b)$ is r, then the value of r is .3

3. Let M be a 2×2 matrix having eigenvalues 1 and -2 with the corresponding eigenvectors $(1,\ -1)^T$ and $(1,\ 1)^T$, respectively. Then, the sum of all elements of M is -4

4. A matrix B is obtained by applying elementary row operations $R_2\to R_2+R_1$ followed by $R_2\leftrightarrow R_1$ in a 3×3 matrix A. If $A=P^{-1}B$, then the trace of the matrix P is .2

5. Let $u=\cos^{-1}\left(\dfrac{x+2y}{\sqrt{x^9+y^9}}\right)$. If $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y}=\alpha\ f(u),\quad \alpha\in\mathbb{R}$, then the value of $\left(\alpha f(\frac{\pi}{6})\right)^2$ is .147/4

6. If $x=u^2+v^2$ and $y=2uv$, then the value of $\left(\dfrac{\partial(u,v)}{\partial(x,y)}\right)^2$ at $(x,y)=(3,2)$ is ..1/80

7. Let $f:\mathbb{R}^2\to\mathbb{R}$ be defined as $f(x,y)=\begin{cases}\dfrac{3x^3y}{x^2+y^2}; & (x,y)\neq(0,0)\\ \xi; & (x,y)=(0,0).\end{cases}$ If the function f is continuous on $\mathbb{R}^2$, then the value of $\dfrac{\partial(f_y)}{\partial x}$ at $(0,0)$ is ..3

8. Let $L(x,y)$ be the linear approximation of the function $f(x,y)=\log_e(x/y)$ at $(1,1)$ in a rectangle R containing the point $(1,1)$. Then, the value of $L(3,2)$ is ...1

9. Let $z=z(s,t),\ s=3u+5v,\ t=3u-5v$, and $z_{st}=z_{ts}$. If $\dfrac{\partial^2 z}{\partial v^2}+\alpha\dfrac{\partial^2 z}{\partial s\partial t}=\beta\dfrac{\partial^2 z}{\partial s^2}+\gamma\dfrac{\partial^2 z}{\partial t^2}$, $\alpha,\beta,\gamma\in\mathbb{R}$, then the value of $\alpha+\beta+\gamma$ is ...150

10. Let $f(x,y)=\alpha x^2+\beta y^2+\gamma x+4y+6, \alpha,\beta,\gamma\in\mathbb{R}$, has a saddle point at $(1,2)$. If $(-\infty,\ m)$ is the largest interval for the values of $\beta+\gamma$, then m is equal to .-1