

Fundamental of single variable calculus

1. Find $\lim_{x \rightarrow 1} \frac{x^4 - 7x^3 + 8x^2 - 3x + 1}{3x^4 - 5x^3 + 6x^2 - 10x + 6}$.
2. If $f(x) = x^4 - 5x^2 + 12x - 3$ then find $f'(x)$.
3. If $f(x) = 1 + x + x^2 + x^3 + \dots + x^{99} + x^{100}$ then find $f'(-1)$.
4. If $f(x) = \frac{3x+2}{2x+1}$ then find $f'(x)$ at $x = 1$.
5. If $f(x) = 3x^5 + 4x^4$ then find $f'''(x)$.
6. If $f(x) = 5 \sin^2 x - 2 \cos^3 x$ then find $f''(x)$.
7. Find $I = \int (x^3 + 5x - 3) dx$.
8. Find $I = \int (x^e + e^x + e^e) dx$.
9. Find $I = \int (8x^3 + 3x^2 + 6x) dx$
10. Find $I = \int \left(\frac{x^{24}}{x^{25}} \right) dx$.

Linear Equation

11. By using elementary row operations, find the inverse of the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 7 \end{bmatrix}$.
12. By using elementary row operations, find the inverse of the matrix $A = \begin{bmatrix} 2 & 3 \\ 1 & 6 \end{bmatrix}$.
13. By using elementary row operations, find the inverse of the matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$.
14. Solve the system of equation by matrix method $5x+7y+2=0$, $4x+6y+3=0$.
15. Solve the system of equation by matrix method $x+2y+3z=4$, $x+4y+9z=6$,
 $x+y+z=3$.
16. For what value of k the system has non-trivial solution $x+2y+3z=0$, $2x+3y+kz=0$,
 $7x+13y+19z=0$.
17. Reduce the following matrices into row-reduced echelon form and find their ranks.
(i) $\begin{bmatrix} 1 & 3 & 4 & 5 \\ 3 & 9 & 12 & 9 \\ 1 & 3 & 4 & 1 \end{bmatrix}$.

$$(ii) \begin{bmatrix} 6 & 5 & 1 & 3 \\ 0 & 3 & 2 & 2 \\ -6 & -5 & -1 & 4 \end{bmatrix}.$$

Graph and Tree

18. Define with example: Node, Edge, Directed Graph, Multi Graph, Null Graph, Degree of a vertex, Pendent vertex.
19. Define with example: Incident vertex, Loop, Parallel edges, Directed Edges, Undirected edges and distinct edges.
20. Draw the undirected graph $G = (V, E)$ where $V = \{a, b, c, d, e\}$ and $E = \{e_1, e_2, e_3, e_4, e_5, e_6, e_7\}$ and its incidence relation given as: $e_1=(a,b)$, $e_2=(a,b)$, $e_3=(b,c)$, $e_4=(c,d)$, $e_5=(b,b)$, $e_6=(a,d)$, $e_7=(e,d)$.
21. Draw the directed graph $G = (V, E)$ where $V = \{a, b, c, d, e, f, g\}$ and $E = \{e_1, e_2, e_3, e_4, e_5, e_6, e_7, e_8\}$ and its incidence relation given as: $e_1=(b,a)$, $e_2=(d,a)$, $e_3=(b,c)$, $e_4=(d,c)$, $e_5=(c,f)$, $e_6=(f,f)$, $e_7=(e,c)$, $e_8=(c,e)$.
22. Draw the undirected graph G corresponding to adjacency matrix $A =$

$$\begin{bmatrix} 1 & 2 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}.$$