Rithika Shishodia.

(1) for Reflexive → $(a,a) \in R \ \forall \ a \in A$

(2) for Symmetric → $(a,b) \in R \Rightarrow (b,a) \in R \ \forall \ a,b \in A$

(3) for transitive → $(a,b) \in R$ and $(b,c) \in R \Rightarrow (a,c) \in R \ \forall \ a,b,c \in A$

(4) $R \to$ real no, $W \to$ whole no, $R^+ \to$ positive real no, $R^- \to$ negative real no, $Z \to$ integer.

(5) for one-one function → $f(x_1) = f(x_2) \Rightarrow x_1 = x_2$ (different elements of domain have different f-image in codomain) (injective function)

(6) Onto → Separate x in L.H.S and given function is $y = f(x)$ (Surjective function)

(7) one-one and onto → (Bijective function)

(8) one-one and onto are invertible function and we can find inverse of that function. Then separate x is also called inverse.

(9) $\{fof\}(x) = f\{f(x)\}$, $\{fog\}(x) = f\{g(x)\}$

(10) $f: X \to Y$ then $gof = I_X$, $fog = I_Y$ then g is inverse of f.

(11) If $f(x)$ is given then we can find $g(x)$ by separating x in L.H.S.

(12) for Binary operation $\{+, -, \cdot, \div, \wedge, \vee\}$
$\wedge \to$ conjection (min), $\vee \to$ disjunction (max)

(13) for commutative → $a * b = b * a$

(14) for associative → $a*(b*c) = (a*b)*c$

(15) Identity → $a*e = a = e*a \ \forall \ a \in A$

(16) If $a*b = e = b*a$ then b is inverse of a

(17) Range → $\sin^{-1} \to [-\frac{\pi}{2}, \frac{\pi}{2}]$, $\cos^{-1} \to [0, \pi]$
$\tan^{-1} \to (-\frac{\pi}{2}, \frac{\pi}{2})$, $\cot^{-1} \to (0, \pi)$, $\sec^{-1} \to [0,\pi] - \{\frac{\pi}{2}\}$
$\operatorname{cosec}^{-1} \to [-\frac{\pi}{2}, \frac{\pi}{2}] - \{0\}$

(18) $\sin^{-1}(-x) = -\sin^{-1}x$, $\tan^{-1}(-x) = -\tan^{-1}x$, $\operatorname{cosec}^{-1}(-x) = -\operatorname{cosec}^{-1}x$
$\cos^{-1}(-x) = \pi - \cos^{-1}x$, $\sec^{-1}(-x) = \pi - \sec^{-1}x$, $\cot^{-1}(-x) = \pi - \cot^{-1}x$

(19) $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$, $\tan^{-1}x + \cot^{-1}x = \frac{\pi}{2}$, $\sec^{-1}x + \operatorname{cosec}^{-1}x = \frac{\pi}{2}$

(20) $2\tan^{-1}x = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$ (21) $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$, $xy < 1$.

(22) $\tan^{-1}x + \tan^{-1}y = \pi + \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ $xy > 1$, (23) $\tan^{-1}x - \tan^{-1}y = \tan^{-1}\left(\frac{x-y}{1+xy}\right)$

(24) $\sin^{-1}x + \sin^{-1}y = \sin^{-1}(x\sqrt{1-y^2} + y\sqrt{1-x^2})$ (25) $\sin^{-1}x - \sin^{-1}y = \sin^{-1}(xy\sqrt{1-y^2} - y\sqrt{1-x^2})$

(26) $\cos^{-1}x + \cos^{-1}y = \cos^{-1}(xy - \sqrt{1-x^2}\sqrt{1-y^2})$ (27) $\cos^{-1}x - \cos^{-1}y = \cos^{-1}(xy + \sqrt{1-x^2}\sqrt{1-y^2})$

(28) $\sin 2x = 2\sin x \cos x = \frac{2\tan x}{1+\tan^2 x}$ (29) $\cos 2x = \cos^2 x - \sin^2 x = 2\cos^2 x - 1 = 1 - 2\sin^2 x = \frac{1-\tan^2 x}{1+\tan^2 x}$

(30) $\tan 2x = \frac{2\tan x}{1-\tan^2 x}$ (31) $\sin 3x = 3\sin x - 4\sin^3 x$ (32) $\cos 3x = 4\cos^3 x - 3\cos x$

(33) $\tan 3x = \frac{3\tan x - \tan^3 x}{1-3\tan^2 x}$ (34) $\sin(A+B) = \sin A\cos B + \cos A \sin B$ (35) $\sin(A-B) = \sin A\cos B - \cos A \sin B$

(36) $\cos(A+B) = \cos A\cos B - \sin A \sin B$ (37) $\cos(A-B) = \cos A\cos B + \sin A \sin B$ (38) $\tan(A+B) = \frac{\tan A + \tan B}{1-\tan A \tan B}$

(39) $\tan(A-B) = \frac{\tan A - \tan B}{1+\tan A \tan B}$ (40) $\tan(\frac{\pi}{4}+x) = \frac{1+\tan x}{1-\tan x}$ (41) $\tan(\frac{\pi}{4}-x) = \frac{1-\tan x}{1+\tan x}$

(48)	
$90+\theta$, $180+\theta$	$90-\theta$, $360+\theta$ all (+)
Sin and Cosec (+)	
$180+\theta$, $270-\theta$	$360-\theta$ Cos and (−) Sec (+)
$270+\theta$	
tan and cot (+)	

(49) $\sin 30 = \frac{1}{2}$, $\sin 0 = 0$, $\sin 45 = \frac{1}{\sqrt{2}}$, $\sin 60 = \frac{\sqrt{3}}{2}$
$\sin\theta = 0$, $\sin 90 = 1$

(50) $\cos 0 = 1$, $\cos 30 = \sqrt{3}/2$, $\cos 45 = \frac{1}{\sqrt{2}}$,
$\cos 60 = \frac{1}{2}$, $\cos 90 = 0$, $\tan 0 = 0$,
$\tan 30 = \frac{1}{\sqrt{3}}$, $\tan 45 = 1$, $\tan 60 = \sqrt{3}$,
$\tan 90 = \infty$, $\frac{1}{0} = \infty$, $\frac{1}{\infty} = 0$

(51) $\sin^2\theta + \cos^2\theta = 1$, $\sec^2\theta - \tan^2\theta = 1$
$\sec^2\theta = 1 + \tan^2\theta$, $\tan^2\theta = \sec^2\theta - 1$
$\operatorname{cosec}^2\theta - \cot^2\theta = 1$, $\cot^2\theta = \operatorname{cosec}^2\theta - 1$,

(52) $1 + \sin 2x = (\sin x + \cos x)^2$

(53) $1 - \sin 2x = (\sin x - \cos x)^2$

(54) $\cos^2 x = \frac{1+\cos 2x}{2}$

(59) $\sin^2 x = \frac{1-\cos 2x}{2}$

(60) $1 + \cos x = 2\cos^2 x/2$ (61) $1 - \cos x = 2\sin^2 x/2$

(62) Construct 2×2 $\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$

Construct 3×3 $\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$

Construct 3×4 $\begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \end{bmatrix}$

(63) for addition → order should be same.

(64) for multiplication $[\ ]_{m\times n}\ [\ ]_{n\times p}$
No of columns of first matrix should be equal to no of rows of second matrix

(65) $I_{2\times 2} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(66) $Z_{3\times 3} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

$(AB)^{-1} = B^{-1}A^{-1}$

Scanned with CamScanner

(67) Transpose of $A = A^T$

(68) for Symmetric $A^T = A$

(69) for Skew Symmetric $A^T = -A$

(70) Sum of symmetric $= \frac{1}{2}(A + A^T)$

(71) Sum of skew symmetric $= \frac{1}{2}(A - A^T)$

(72) Sum of skew Symmetric $\frac{1}{2}(A - A^T)$

(73) $(A^T)^T = A$

(74) $(AB)^T = B^T A^T$

(75) Sum of symmetric and skew Symmetric $\frac{1}{2}(A + A^T) + \frac{1}{2}(A - A^T)$

(76) for Elementry Transformation $A = IA$

(77) for 3×3, $|KA| = K^3 |A|$

(78) when two rows or Columns of a determinant are equal then value of determinant is zero

(79) $\Delta = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$

(80) If $\Delta = 0$ then given points are collinear.

(81) $A_{ij} = (-1)^{i+j} M_{ij}$

(82) $a_{11} A_{11} + a_{12} A_{12} + a_{13} A_{13}$

(83) Transpose of cofactor is adjoint

(84) $A^{-1} = \frac{\text{adj } A}{|A|}$

(85) $(AB)^{-1} = B^{-1} A^{-1}$

(86) $X = A^{-1} B$

(87) If $|A| \neq 0$ then system is consistent with Unique soln.

(88) If $|A| = 0$ and $(\text{adj } A) \cdot B$ is non null matrix then system is inconsistent with No soln.

(89) If $|A| = 0$ and $(\text{adj } A) \cdot B$ is null matrix then system is consistent with infinite soln

(90) for Singular matrix, $|A| = 0$

for non singular matrix $|A| \neq 0$

(91) for 3×3 order then $|\text{adj } A| = |A|^{3-1}$

(92) for $\det(A^{-1}) = \frac{1}{\det A}$

(93) $f(x)$ is Continuous at $x = a$ if $L.H.L = R.H.L = f(a) = a$

(94) for L.H.L $x \to a^- f(x)$ put $x = a - h$ and $h \to 0$

for R.H.L $x \to a^+ f(x)$ put $x = a + h$ and $h \to 0$

(95) If $f(x)$ is Continuous then take $L.H.L = R.H.L$

(96) $Lf'(a) = \lim_{h \to 0} \frac{f(a-h) - f(a)}{-h}$

$Rf'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$

(97) $\frac{d}{dx}(c) = 0$

(98) $\frac{d}{dx}(x^n) = nx^{n-1}$

(99) $\frac{d}{dx}(cx^n) = c\frac{d}{dx}(x^n)$

(100) $\frac{d}{dx}(e^x) = e^x$

(101) $\frac{d}{dx}(a^x) = a^x \log_e a$

(102) $\frac{d}{dx}(\sin x) = \cos x$

(103) $\frac{d}{dx}(\cos x) = -\sin x$

(104) $\frac{d}{dx}(\tan x) = \sec^2 x$

(105) $\frac{d}{dx}(\cot x) = -\text{cosec}^2 x$

(106) $\frac{d}{dx}(\sec x) = \sec x \tan x$

(107) $\frac{d}{dx}(\text{cosec } x) = -\text{cosec } x \cot x$

(108) $\frac{d}{dx}\sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$

(109) $\frac{d}{dx}\cos^{-1} x = \frac{-1}{\sqrt{1-x^2}}$

(110) $\frac{d}{dx}\tan^{-1} x = \frac{1}{1+x^2}$

(111) $\frac{d}{dx}\cot^{-1} x = \frac{-1}{1+x^2}$

(112) $\frac{d}{dx}\sec^{-1} x = \frac{1}{x\sqrt{x^2-1}}$

(113) $\frac{d}{dx}\text{Cosec}^{-1} x = \frac{-1}{x\sqrt{x^2-1}}$

(114) $\frac{d}{dx}[f_1 x f_2] = f_1 \frac{d}{dx} f_2 + f_2 \frac{d}{dx} f_1$

(115) $\frac{d}{dx}\left(\frac{N}{D}\right) = \frac{D\frac{d}{dx}(N) - N\frac{d}{dx}(D)}{(D)^2}$

(116) $\frac{d}{dx}(\log x) = \frac{1}{x}$

(117) $\frac{d}{dx}\log_a x = \frac{1}{x}\log_a e$

(118) when power of variable is also variable then take log to both sides ex $y = x^x$

(119) when $y = x^x + (\tan x)^x$ then not take log direct to both sides

$u = x^x$ $v = (\tan x)^x$

(120) $\log(mn) = \log m + \log n$

(121) $\log\left(\frac{m}{n}\right) = \log m - \log n$

(122) $\log m^n = n \log m$

(123) $\log_m m = 1$

(124) $\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$

(125) $[a,b] \to a \leq x \leq b$ Closed Interval

$(a,b) \to a < x < b$ open Interval

$(a,b] \to a < x \leq b$ Half closed

$[a,b) \to a \leq x < b$ Half open Interval

(126) for Rolle's theorem

(i) $f(x)$ is Continuous on $[a,b]$

(ii) $f(x)$ is differentiable on (a,b)

(iii) If $f(a) = f(b)$ then there Exist atleast one real No but $x = c$ on (a,b) such that $f'(c) = 0$

for Lagrange's theorem C.L.M.V theorem

(i) $f(x)$ is Continuous on $[a,b]$

(ii) $f(x)$ is differentiable on (a,b) then there exists atleast one real number $x = c$ then $f'(c) = \frac{f(b) - f(a)}{b - a}$

(127) for circle $A = \pi r^2$, $C = 2\pi r$

(128) for sphere $V = \frac{4}{3}\pi r^3$, $S = 4\pi r^2$

(129) for cube $V = a^3$, $C = 4a^2$, $S = 6a^2$

(2)

$\lim_{x \to 0} \frac{\sin \frac{1}{x}}{\frac{1}{x}} = 0$

$\lim_{x \to 0} \frac{\sin x}{x} = 1$ so

every polynomial is continous

Scanned with CamScanner

(3)

5) for increasing – $f'(x) \geq 0$
for decreasing $f(x) \leq 0$

31) for ~~one~~ Strictly increasing $f'(x) > 0$
for strictly decreasing $f'(x) < 0$

(132) $\Delta y = \frac{dy}{dx} \cdot \Delta x$

(133) for cuboid –
$V = lbh$
$C = 2(l+b)h$
$S = 2(lb+bh+hl)$

(134) for cylinder
$V = \pi r^2 h$
$C = 2\pi rh$
$S = 2\pi r(h+r)$

(135) for Cone
$V = \frac{1}{3}\pi r^2 h$ ∴
$C = \pi r l$
$S = \pi r(l+r)$
$l = \sqrt{h^2+r^2}$

(136) for rectangle
$A = lb$
$P = 2(l+b)$

(137) for square
$A = a^2$
$P = 4a$

(138) for Trapezium
$A = \left(\frac{\text{sum of 11 sides}}{2}\right) \times \text{height}$

(139) for Triangle
Area of right angle $= \frac{1}{2} \times b \times h$
Area of Equilateral Triangle $= \frac{a^2\sqrt{3}}{4}$
Area of $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$
semiperimeter $s = \frac{a+b+c}{2}$

(140) $\sin\theta = P/H$, $\cos\theta = B/H$, $\tan\theta = P/B$

(141) $\sin\theta = \frac{1}{\operatorname{cosec}\theta}$, $\cos\theta = \frac{1}{\sec\theta}$, $\tan\theta = \frac{1}{\cot\theta}$

(142) $d^2 = x^2 + y^2$

(143) for maxima-minima – given – (1)
To show max-minima – (2)
Take help of (1) and put in (2)

(144) $y = f(x)$ – (1)
$\frac{dy}{dx} = f'(x)$ – (2)
put $dy/dx = 0$ find values of x
$\left(\frac{d^2y}{dx^2}\right)_{x=\cdots} = (-)$ then y is max.
$\left(\frac{d^2y}{dx^2}\right)_{x=\cdots} = (+)$ then y is min.

for max and min value put value of x in (1)
for Tangents and Normal →

(145) Slope of tangent $= \left(\frac{dy}{dx}\right)_{(x_1,y_1)}$

(146) Slope of Normal $= -\frac{1}{\left(\frac{dy}{dx}\right)_{(x_1,y_1)}}$

(147) when inclination is given then $m = \tan\theta$

(148) when st line is given then $m = -\frac{\text{coeff } y}{\text{coeff of } y}$

(149) when line passes through (x_1,y_1) and (x_2,y_2) then $m = \frac{y_2-y_1}{x_2-x_1}$

(150) Eqn of tangent at (x_1,y_1) is $y-y_1 = \left(\frac{dy}{dx}\right)_{(x_1,y_1)}(x-x_1)$

(151) Eqn of Normal is $y-y_1 = -\frac{1}{\left(\frac{dy}{dx}\right)_{(x_1,y_1)}}(x-x_1)$

(152) Two lines are parallel if $m_1 = m_2$

(153) Two lines are $\perp$ if $m_1 m_2 = -1$

(154) $\int x^{-1}dx = \log x + C$, $n=-1$

(155) $\int x^n dx = \frac{x^{n+1}}{n+1} + C$, $n \neq -1$

(156) $\int e^x dx = e^x + C$

(157) $\int a^x dx = \frac{a^x}{\log a} + C$

(158) $\int \sin x\,dx = -\cos x + C$

(159) $\int \cos x\,dx = \sin x + C$

(160) $\int \tan x\,dx = \log|\sec x| + C$

(161) $\int \cot x\,dx = \log|\sin x| + C$

(162) $\int \sec x\,dx = \log|\sec x + \tan x| + C$

(163) $\int \operatorname{cosec} x\,dx = \log|\operatorname{cosec} x - \cot x| + C$

(164) $\int \sec^2 x\,dx = \tan x + C$

(165) $\int \operatorname{cosec}^2 x\,dx = -\cot x + C$

(166) $\int \sec x \tan x\,dx = \sec x + C$

(167) $\int \operatorname{cosec} x \cot x\,dx = -\operatorname{cosec} x + C$

(168) $\int \frac{1}{\sqrt{1-x^2}}dx = \sin^{-1}x + C$

(169) $-\int \frac{1}{\sqrt{1-x^2}}dx = \cos^{-1}x + C$

(170) $\int \frac{dx}{1+x^2} = \tan^{-1}x + C$

(171) $-\int \frac{dx}{1+x^2} = \cot^{-1}x + C$

(172) $\int \frac{dx}{x\sqrt{x^2-1}} = \sec^{-1}x + C$

(173) $-\int \frac{dx}{x\sqrt{x^2-1}} = \operatorname{cosec}^{-1}x + C$

(174) $\int \frac{dx}{x^2-a^2} = \frac{1}{2a}\log\left(\frac{x-a}{x+a}\right) + C$

(175) $\int \frac{dx}{a^2-x^2}dx = \frac{1}{2a}\log\left(\frac{a+x}{a-x}\right) + C$

(176) $\int \frac{dx}{x^2+a^2} = \frac{1}{a}\tan^{-1}\frac{x}{a} + C$

(177) $\int \frac{dx}{\sqrt{x^2-a^2}} = \log\left[x + \sqrt{x^2-a^2}\right] + C$

(178) $\int \frac{dx}{\sqrt{x^2+a^2}} = \log\left[x + \sqrt{x^2+a^2}\right] + C$

(179) $\int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}\frac{x}{a} + C$

(180) $\int \sqrt{x^2-a^2}\,dx = \frac{x}{2}\sqrt{x^2-a^2} - \frac{a^2}{2}\log\left[x + \sqrt{x^2-a^2}\right]$

(181) $\int \sqrt{x^2+a^2}\,dx = \frac{x}{2}\sqrt{x^2+a^2} + \frac{a^2}{2}\log\left[x + \sqrt{x^2+a^2}\right]$

(182) $\int \sqrt{a^2-x^2}\,dx = \frac{x}{2}\sqrt{a^2-x^2} + \frac{a^2}{2}\sin^{-1}\frac{x}{a}$

(183) $\int x \sin x\,dx$ (I, II)

(184) $\int x \log x\,dx$ (II, I)

(185) $\int \sin^{-1}x \cdot 1\,dx$ (I, II)

(186) $\int \log x \cdot 1\,dx$ (II, I)

(187) $\int e^x \sin x\,dx$ (I, II)

(188) $\int x^2 e^x dx$ (I, II) $= \int x e^x dx$ …

using by parts
For first part.

(*) $F(x+\Delta x) = F(x) + \Delta x\, F'(x)$

(*) For absolute max min, one time diff-erentiate

(*) For local max, min differentiate two time.