Diploma Mathematics formulae(25SC11T)

MATRICES

A matrix is a rectangular arrangement of numbers in rows and columns.

Order of a matrix = (Number of rows) × (Number of columns). $(m \times n)$

Example: A (2×3) matrix has 2 rows and 3 columns.

Example:

$A = \begin{bmatrix} 2 & 1 & 4 \\ 3 & 1 & 5 \end{bmatrix}$ is a 2×3 matrix.

Types of Matrices:

Row Matrix: Only one row.

Example: [1 2 3]

Column Matrix: Only one column.

Example: $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$

Zero (Null) Matrix: All elements are zero.

Example: $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

Square Matrix: Rows = Columns.

Example: $\begin{bmatrix} 1 & 2 \\ 0 & 4 \end{bmatrix}$

Diagonal Matrix: Non-diagonal elements are zero. Example: $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 3 & 4 \end{bmatrix}$

Scalar Matrix: Diagonal elements equal.

Example: $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$

Unit (Identity) Matrix:

Diagonal elements = 1, others = 0.

Example: $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Algebra of Matrices:

Scalar Multiplication: k × A = Each element multiplied by k.

Example: $2 \times \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} 2 & 8 \\ 4 & 6 \end{bmatrix}$

Transpose of a Matrix (A^T): Rows become columns, columns become rows.

Example: $A = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 2 & 5 \end{bmatrix} \rightarrow A^T = \begin{bmatrix} 2 & 1 \\ 3 & 2 \\ 4 & 5 \end{bmatrix}$

Addition & Subtraction (2×2 matrices):

If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 5 & 3 \\ 2 & 1 \end{bmatrix}$ then:

$A + B = \begin{bmatrix} 6 & 5 \\ 5 & 5 \end{bmatrix}$

$A - B = \begin{bmatrix} -4 & -1 \\ 1 & 3 \end{bmatrix}$

Multiplication of 2×2 matrices:

If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$, then:

$$A \times B = \begin{bmatrix} (1\times3)+(2\times5) & (1\times1)+(2\times2) \\ (3\times3)+(4\times5) & (3\times1)+(4\times2) \end{bmatrix}$$

$$= \begin{bmatrix} 3+7 & 1+4 \\ 9+20 & 3+8 \end{bmatrix}$$

$$= \begin{bmatrix} 10 & 5 \\ 29 & 11 \end{bmatrix}$$

DETERMINANTS

A determinant is a scalar value calculated from a square matrix.

2×2 Determinant:

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then:

det(A) = ad – bc (Product of Principle diagonals) × (Product of secondary diagonals)

Example:

If $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$, then

$\det(A) = \Delta = \begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix}$

= (2×5) - (3×4)

= 10 – 12

= -2

Crammer's Rule

$a_1x + a_2y = c_1$

$b_1x + b_2y = c_2$

Then formula find the x and y

Steps to find x and y

Step 1 : find $\Delta = \begin{vmatrix} a_1 & a_2 \\ b_1 & b_2 \end{vmatrix}$

Step 2 : find $\Delta_x = \begin{vmatrix} c_1 & a2 \\ c_2 & b_2 \end{vmatrix}$

Step 3 : find $\Delta_y = \begin{vmatrix} a_1 & c_1 \\ b_1 & c_2 \end{vmatrix}$

Step 4 : Find x and y by using the formula

$$x = \frac{\Delta_x}{\Delta} \text{ and } y = \frac{\Delta_y}{\Delta}$$

Finding the adjoint of a matrix

For the matrix

$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

Step 1 : Interchange the Principle diagonal elements

adjA = $\begin{bmatrix} 4 & \\ & 1 \end{bmatrix}$

Step 2 : change the sign of the secondary diagonal elements

adjA=$\begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix}$

Inverse of a matrix

$A^{-1} = \dfrac{adjA}{|A|}$

Characteristic Equation

If A is the square matrix, then Characteristic Equation is defined as

$|A - \lambda I| = 0$

CE can be obtained by

$\lambda^2 - (traA)\lambda + \Delta = 0$

Vectors

Vectors representation

$\vec{a} = a_1\hat{\imath} + a_2\hat{\jmath} + a_3\hat{k} = (a_1, a_2, a_3)$

$\vec{b} = b_1\hat{\imath} + b_2\hat{\jmath} + b_3\hat{k} = (b_1, b_2, b_3)$

Modulus of a Vector

$|\vec{a}| = \sqrt{a_1^2 + a_2^2 + a_3^2}$

Unit vector

$\hat{a} = \dfrac{\vec{a}}{|\vec{a}|} = \dfrac{\vec{a}}{\sqrt{a_1^2 + a_2^2 + a_3^2}}$

Addition of two vectors

If $\vec{a} = a_1\hat{\imath} + a_2\hat{\jmath} + a_3\hat{k} = (a_1, a_2, a_3)$

$\vec{b} = b_1\hat{\imath} + b_2\hat{\jmath} + b_3\hat{k} = (b_1, b_2, b_3)$ then

$\vec{a} + \vec{b} = (a_1 + b_1, a_2 + b_2, a_3 + b_3)$

Similarly

$\vec{a} - \vec{b} = (a_1 - b_1, a_2 - b_2, a_3 - b_3)$

Position vector of a Point

$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$

$\overrightarrow{BC} = \overrightarrow{OC} - \overrightarrow{OB}$

$\overrightarrow{AC} = \overrightarrow{OC} - \overrightarrow{OA}$

Dot Product or Scalar Product

If $\vec{a} = a_1\hat{\imath} + a_2\hat{\jmath} + a_3\hat{k} = (a_1, a_2, a_3)$

$\vec{b} = b_1\hat{\imath} + b_2\hat{\jmath} + b_3\hat{k} = (b_1, b_2, b_3)$ then

$\vec{a}.\vec{b} = a_1b_1 + a_2b_2 + a_3b_3$

If $\vec{a}.\vec{b} = 0$ then the two vectors are said to be orthogonal or Perpendicular

Projection of a vector on the other vector

Projection of a vector $\vec{a}$ on $\vec{b}$

is defined as $= \dfrac{\vec{a}.\vec{b}}{|\vec{b}|}$

Projection of a vector $\vec{b}$ on $\vec{a}$

Is defined as $= \dfrac{\vec{a}.\vec{b}}{|\vec{a}|}$

Cosine of the angle between the two vectors defined as

$cos\theta = \dfrac{\vec{a}.\vec{b}}{|\vec{a}|\,|\vec{b}|}$

Work done is defined as

$w = \vec{f}.\vec{s}$

Where f is the force and S is the displacement

Trigonometric formulae

Radian to degree conversion and vice versa

$x\ radian = x\frac{180}{\pi}\ degree$		$x\ degree = \frac{\pi}{180} \times x\ radians$	
$\frac{\pi}{2}$	$\frac{\pi}{2} \times \frac{180^0}{\pi} = 90^0$	90^0	$90^0 \times \frac{\pi}{180} = \frac{\pi}{2}$
$\frac{\pi}{4}$	45^0	45^0	$\frac{\pi}{4}$
$\frac{\pi}{12}$	15^0	15^0	$\frac{\pi}{12}$
$\frac{5\pi}{12}$	75^0	75^0	$\frac{5\pi}{12}$

T - Values of standard angles

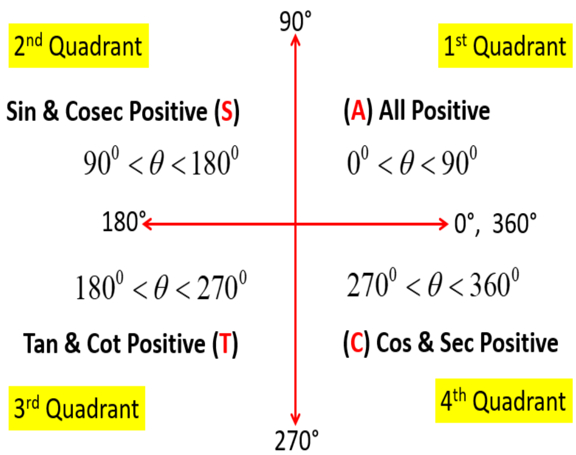
	0^0	30^0	45^0	60^0	90^0	180^0	270^0	360^0
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	1	0	1
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞	0	$-\infty$	0
cot	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	∞	0	∞
sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞	1	∞	1
cosec	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1	∞	-1	∞

Trigonometric ratios of Allied angles (without proof)

Trigonometric ratios of allied angles, when the sum or difference of two angles is either zero or a multiple of 90°. For example 30° and 60° are allied angles because their sum is 90°.

The angles $-\theta, 90° \pm \theta, 180° \pm \theta, 360° \pm \theta$ etc. are angles allied to the angle θ, if θ is measured in degrees. However, if θ is measured in radians, then the angles allied to θ are $-\theta, \frac{\pi}{2} \pm \theta, \pi \pm \theta$, $2\pi \pm \theta$ etc.

Using trigonometric ratios of allied angles we can find trigonometric ratios of angles of any magnitude.



Note:

Easy steps to find the allied angle

Step 1(Negativiting)

If it's a t ratio of negative angle change it to positive by using the following table

$\sin(-\theta) = -sin\theta$	$\text{cosec}(-\theta) = -cosec\theta$
$\cos(-\theta) = +cos\theta$	$\sec(-\theta) = sec\theta$
$\tan(-\theta) = -tan\theta$	$\cot(-\theta) = -cot\theta$

Step 2(Splitting)

Express the given angle as $90 \pm \theta, 180 \pm \theta, 270 \pm \theta$ and $360 \pm \theta$,Check which group does it belongs to (we have divided into two groups 1. Odd group($90 \pm \theta$ and $270 \pm \theta$) and 2. Even group ($180 \pm \theta, 360 \pm \theta$)

Step 3(Grouping)

If it

Angle/ Function	$-\theta$	$90°-\theta$ or $\frac{\pi}{2}-\theta$	$90°+\theta$ or $\frac{\pi}{2}+\theta$	$180°-\theta$ or $\pi-\theta$	$180°+\theta$ or $\pi+\theta$	$270°-\theta$ or $\frac{3\pi}{2}-\theta$	$270°+\theta$ or $\frac{3\pi}{2}+\theta$	$360°-\theta$ or $2\pi-\theta$	$360°+\theta$ or $2\pi+\theta$
Sine	$-\sin\theta$	$\cos\theta$	$\cos\theta$	$\sin\theta$	$-\sin\theta$	$-\cos\theta$	$-\cos\theta$	$-\sin\theta$	$\sin\theta$
Cosine	$\cos\theta$	$\sin\theta$	$-\sin\theta$	$-\cos\theta$	$-\cos\theta$	$-\sin\theta$	$\sin\theta$	$\cos\theta$	$\cos\theta$
tangent	$-\tan\theta$	$\cot\theta$	$-\cot\theta$	$-\tan\theta$	$\tan\theta$	$\cot\theta$	$-\cot\theta$	$-\tan\theta$	$\tan\theta$
cotangent	$-\cot\theta$	$\tan\theta$	$-\tan\theta$	$-\cot\theta$	$\cot\theta$	$\tan\theta$	$-\tan\theta$	$-\cot\theta$	$\cot\theta$
secant	$\sec\theta$	$\text{cosec}\,\theta$	$-\text{cosec}\,\theta$	$-\sec\theta$	$-\sec\theta$	$-\text{cosec}\,\theta$	$\text{cosec}\,\theta$	$\sec\theta$	$\sec\theta$
cosecant	$-\text{cosec}\,\theta$	$\sec\theta$	$\sec\theta$	$\text{cosec}\,\theta$	$-\text{cosec}\,\theta$	$-\sec\theta$	$-\sec\theta$	$-\text{cosec}\,\theta$	$\text{cosec}\,\theta$

Table : 4.1

belongs to even group T function doesn't changes

If it belongs to odd group T ratio changes ($sin\theta \leftrightarrow cos\theta, cosec\theta \leftrightarrow sec\theta, tan\theta \leftrightarrow cot\theta$

Step 4(Quadranting)

To assign the sign for the obtained value ,follow the ASTC rule

Compound Angles Formulae:

Addition Formulae:

1. $\sin(A+B) = \sin A \cos B + \cos A \sin B$
2. $\cos(A+B) = \cos A \cos B - \sin A \sin B$
3. $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

Subtraction Formulae:

1. $\sin(A-B) = \sin A \cos B - \cos A \sin B$
2. $\cos(A-B) = \cos A \cos B + \sin A \sin B$

3. $\tan(A-B) = \frac{\tan A - \tan B}{1+\tan A \tan B}$

Multiple Angles

1. sin2A=2sinAcosA
2. $\sin 2A = \frac{2\tan A}{1+\tan^2 A}$.
3. $\cos 2A = \cos^2 A - \sin^2 A$.
4. $\cos 2A = 2\cos^2 A - 1$.
5. $\cos 2A = \frac{1-\tan^2 A}{1+\tan^2 A}$.
6. $\tan 2A = \frac{2\tan A}{1-\tan^2 A}$
7. $\sin 3A = 3\sin A - 4\sin^3 A$
8. $\cos 3 = 4\cos^3 A - 3\cos A$.
9. $\tan 3 = \frac{3\tan A - \tan^3 A}{1-3\tan^2 A}$

Transformation of sum or difference into product

1. $\sin C + \sin D = 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$
2. $\sin C - \sin D = 2\cos\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$
3. $\cos C + \cos D = 2\cos\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$
4. $\cos C - \cos D = -2\sin\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$

Transformation of product into sum or difference

1. $\sin A\cos B = \frac{1}{2}[\sin(A+B)+\sin(A-B)]$
2. $\cos A\sin B = \frac{1}{2}[\sin(A+B)-\sin(A-B)]$
3. $\cos A\cos B = \frac{1}{2}[\cos(A+B)+\cos(A-B)]$
4. $\sin A\sin B = \frac{1}{2}[\cos(A-B)-\cos(A+B)]$

Complex Numbers

Definition

A complex number is of the form $z = a + ib$, where:

a = Real part Re(z)

b = Imaginary part Im(z)

$i = \sqrt{-1}$

Example:

$z = 3 + 4i \rightarrow Re(z) = 3, Im(z) = 4$

Main values of i

$i = \sqrt{-1}$

$i^2 = -1$

$i^3 = -i$

$i^4 = 1$

Addition and Subtraction

$(a+ib)+(c+id) = (a+c)+i(b+d)$

$(a+ib)-(c+id) = (a-c)+i(b-d)$

Example: $(3+4i)+(1+2i) = 4+6i$

Multiplication

$(a+ib)(c+id)$

$= (ac-bd)+i(ad+bc)$

Example: $(2+3i)(1+4i)$

$= 2+8i+3i+12i^2$

$= -10+11i$

Conjugate of a Complex Number

if $z = a + ib$ then its

Conjugate: $\bar{z}$ = a - ib

Example: If z = 3 + 4i → $\bar{z}$ = 3 - 4i

Modulus and Amplitude

Modulus: $|z| = \sqrt{a^2 + b^2}$

Amplitude (Argument): $\alpha = \tan^{-1}\left(\left|\frac{b}{a}\right|\right)$

But changes on different quadrants

Sign	Quadrant	
$(+,+)$	I	$\theta = \alpha$
$(-,+)$	II	$\theta = \pi - \alpha$
$(-,-)$	III	$\theta = -(\pi - \alpha)$
$(+,-)$	IV	$\theta = -\alpha$

Example: *For* $z = 3 + 4i \rightarrow$

$|z| = \sqrt{3^2 + 4^2} = 5,$

$\theta = \tan^{-1}(4/3)$

LIMITS

1. Constants and Variables

Constant: A fixed value (e.g., 5, -2, π).

Variable: A symbol that can take different values (e.g., x, y).

Function: A rule that assigns each input a unique output. Example: f(x) = x² + 1.

2. Concept of Limits

The limit of f(x) as x approaches a is written as:

$$\lim_{x \to a} f(x) = L$$

This means as x gets closer to a, f(x) gets closer to L.

3. Limits by Factorization Method

Steps: Factorize numerator/denominator and cancel common terms.

$$\lim_{x\to a}\frac{f(x)}{g(x)}$$

$$=\lim_{x\to a}\frac{(x-a)k}{(x-a)m}$$

Example: $lim_{x\to1}\frac{(x^2-1)}{(x-1)}$

$= lim_{x\to1}\frac{(x-1)(x+1)}{(x-1)}$

$= 2$

4. Limits by Rationalization Method

Multiply numerator and denominator by conjugate to simplify.

$$\lim_{x\to a}\frac{\sqrt{f(x)}-\sqrt{g(x)}}{x-a}$$

Multiply by $\sqrt{f(x)}+\sqrt{g(x)}$.

Example:

$$\lim_{x\to4}\frac{\sqrt{x}-2}{x-4}$$

Multiply numerator & denominator by $(\sqrt{x}+2)$:

$$=\lim_{x\to4}\frac{x-4}{(x-4)(\sqrt{x}+2)}$$

$$=\frac{1}{\sqrt{4}+2}=\frac{1}{4}$$

5. Limits at Infinity

When x → ∞,

divide numerator and denominator by highest power of x.

Rule:

If degree(num) < degree(den) → Limit = 0

If degree(num) = degree(den) → Limit = ratio of coefficients

If degree(num) > degree(den) → Limit = ∞

Example:

$$\lim_{x\to\infty}\frac{3x^2+5}{2x^2-7}=\frac{3}{2}$$

6.Standard limits

a) $\lim_{x\to a}\left(\frac{x^n-a^n}{x-a}\right)$ = na^{n-1},where $\boldsymbol{n}$ is rational

b) $\boldsymbol{lim}_{\theta\to0}\left(\frac{\sin\theta}{\theta}\right)=\mathbf{1}$, where $\boldsymbol{\theta}$is in radians

c) $\boldsymbol{lim}_{\theta\to0}\left(\frac{\tan\theta}{\theta}\right)=\mathbf{1}$where $\boldsymbol{\theta}$ is in radians

d) $\boldsymbol{lim}_{x\to0}\left(\frac{e^x-1}{x}\right)=\mathbf{1}$

Co - ordinate geometry

1. Slope of a straight line $m = tan\theta$
2. Slope of line joining two points $m=\frac{y_2-y_1}{x_2-x_1}$
3. General form of equation of straight line $ax+by+C=0$
4. Slope of a straight line $=-\frac{a}{b}$
   $X - intercept = -\frac{c}{a}$
   $Y - intercept = -\frac{c}{b}$
5. Slope intercept form y=mx+C
6. Two point form of a straight line
   $\frac{y-y_1}{x-x_1}=\frac{y_2-y_1}{x_2-x_1}$
7. Slope point form of a straight line
   $y-y_1=m(x-x_1)$
8. Intercept form of the straight line
   $\frac{x}{a}+\frac{y}{b}=1$
9. Equation of the straight line which is parallel to line $ax+by+c=0$ and passing through the point $(x_1\ ,y_1\ )$ is
   $ax_1+by_1+K=0$
10. Equation of the straight line which is perpendicular to the line $ax+by+c=0$ and passing through the point $(x_1\ ,y_1\ )\ is\ bx_1-ay_1+k=0$
11. Angle between two lines is given by
   $tan\theta = \left|\frac{m_2-m_1}{1+m_1m_2}\right|$

DIFFERENTIAL CALUCLUS

Derivatives of algebraic functions

1. $\frac{d}{dx}(x)=1$
2. $\frac{d}{dx}(x^2)=2x$
3. $\frac{d}{dx}(x^3)=3x^2$
4. $\frac{d}{dx}(x^n)=nx^{n-1}$ where n€R
5. $\frac{d}{dx}\left(\frac{1}{x^n}\right)=-\frac{n}{x^{n+1}}$ where n€R
6. $\frac{d}{dx}\left(\frac{1}{x}\right)=-\frac{1}{x^2}$
7. $\frac{d}{dx}\left(\frac{1}{x^2}\right)=-\frac{1}{x^3}$
8. $\frac{d}{dx}(k)=0$ where k is constant
9. $\frac{d}{dx}(1)=0$

10. $\frac{d}{dx}(\sqrt{x}) = \frac{1}{2\sqrt{x}}$

11. $\frac{d}{dx}\left(\frac{1}{\sqrt{x}}\right) = -\frac{1}{2x\sqrt{x}}$

12. $\frac{d}{dx}(ku) = k\left(\frac{d}{dx}\right)$

Derivatives of trigonometric functions

13. $\frac{d}{dx}(sinx) = cosx$

14. $\frac{d}{dx}(cosx) = -sinx$

15. $\frac{d}{dx}(tanx) = \sec^2 x$

16. $\frac{d}{dx}(cotx) = -cosec^2x$

17. $\frac{d}{dx}(secx) = secx\ tanx$

18. $\frac{d}{dx}(cosecx) = -cosecx\ cotx$

Derivatives of Inverse trigonometric functions

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

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

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

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

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

24. $\frac{d}{dx}(cosec^{-1}x) = -\frac{1}{x\sqrt{x^2-1}}$

Derivatives of exponential functions

25. $\frac{d}{dx}(a^x) = a^x\ loga$

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

Derivatives of logarithmic functions

27. $\frac{d}{dx}(logx) = \frac{1}{x}$

Sum rule

Note: u, v, w are the functions of 'x'

28. $\frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{dv}{dx}$

29. $\frac{d}{dx}(u+v+w) = \frac{du}{dx} + \frac{dv}{dx} + \frac{dw}{dx}$

Product rule

30. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$

31. $\frac{d}{dx}(uvw) = uv\frac{dw}{dx} + vw\frac{du}{dx} + wu\frac{dv}{dx}$

Quotient rule

32. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{vu^1-uv^1}{v^2}$ **or**

$\frac{d}{dx}\left(\frac{Nr}{Dr}\right) = \frac{\left(Dr\frac{d(Nr)}{dx} - Nr\frac{d(Dr)}{dx}\right)}{Dr^2}$

where Nr→ $numerator$,$Dr \rightarrow denominator$

33. Slope of a tangent to the curve $y = f(x)$ at the point $p(x_1, y_1)$ is $m = \left(\frac{dy}{dx}\right)$

34. Equation of tangent to the curve $y = f(x)$ at the point p(x1,y1) is $y - y_1 = m(x - x_1)$ where m is slope of a tangent

35. Slope of a normal to the curve $y = f(x)$ at the point $p(x_1, y_1)$ is $= -\frac{1}{m} = -\frac{1}{\left(\frac{dy}{dx}\right)}$

36. Equation of normal to the curve $y = f(x)$ at the point $p(x_1, y_1)$

$$y - y_1 = -\frac{1}{m}(x - x_1)$$

INTEGRAL CALUCLUS

1. $\int 0dx = C$
2. $\int 1\, dx = x + C$
3. $\int k\, dx = kx + C$
4. $\int x^n\, dx = \frac{x^{n+1}}{n+1} + C\ ;\ n \neq 1$
5. $\int \frac{1}{x^n} dx = -\frac{1}{(n-1)x^{n-1}} + c\ ;\ n \neq 1$
6. $\int \frac{1}{x}\, dx = ln\,|x| + C$
7. $\int \frac{1}{x^2}\, dx = -\frac{1}{x} + C$
8. $\int \frac{1}{\sqrt{x}} dx = 2\sqrt{x} + C$
9. $\int \sqrt{x}\, dx = \frac{2}{3}x^{\frac{3}{2}} + C$
10. $\int a^x\, dx = \frac{a^x}{loga} + C\ ;\ a > 0,\ a \neq 1$
11. $\int e^x\, dx = e^x + C$
12. $\int sin\,x\, dx = -\,cos\,x + C$
13. $\int cos\,x\, dx = sin\,x + C$
14. $\int tanx\, dx = logsecx + c$
15. $\int cotx\, dx = logcosx + c$
16. $\int secx\, dx = \log\,(secx + tanx) + c$
17. $\int cosecx\, dx = \log\,(cosecx - cotx) + c$
18. $\int \sec^2 x\, dx = tan\,x + C$
19. $\int cosec^2x\, dx = -cot\,x + C$

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

21. $\int cosec\,x\,(\,cot\,x)\,dx = -\,cosec\,x + C$

22. $\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + C$

23. $\int \frac{1}{1+x^2} dx = \tan^{-1} x + C$

24. $\int \frac{1}{x\sqrt{x^2-1}} dx = \sec^{-1} x + C$

25. $\int -\frac{1}{\sqrt{1-x^2}} dx = \cos^{-1} x + C$

26. $\int -\frac{1}{1+x^2} dx = \cot^{-1} x + C$

27. $\int -\frac{1}{x\sqrt{x^2-1}} dx = \text{cosec}^{-1} x + C$

28. $\int sin\,(ax+b)\,\,dx = -\frac{\cos(a\,x+b)}{a} + C$

29. $\int cos\,(ax+b)\,\,dx = \frac{\sin(a\,x+b)}{a} + C$

30. $\int e^{ax+b}\,\,dx = \frac{e^{ax+b}}{a} + C$

31. $\int\,(ax+b)^n\,\,dx = \frac{(\text{ax+b})^{\text{n+1}}}{a(n+1)} + C$

32. $\int \frac{1}{ax+b} dx = \frac{\log(ax+b)}{a} + C$

Sum rule

33. $\int (f(x)+g(x))\,dx = \int f(x)dx + \int g(x)dx$

Difference rule

34. $\int (f(x)-g(x))dx = \int f(x)dx - \int g(x)dx$

Product rule

35. $\int uv\,dx = u\int vdx - \int (\int vdx)\frac{du}{dx}\,dx$

where ‘u’ and ‘v’ are the functions of x

Definite integral

36. If $\int$ f(x)dx = ∅(x) then

$$\int_a^b \mathbf{f(x)dx} = [\emptyset(\mathbf{x})](\mathbf{b}-\mathbf{a}) = \emptyset(\mathbf{b}) - \emptyset(\mathbf{a})$$

37. The area bounded by the curve y = f(x) ,x-axis between the co-ordinates x = a and x = b is

$$\textbf{Area} = \int_a^b \mathbf{ydx} = \int_a^b \mathbf{f(x)dx}$$

38. The area bounded by the curve y = f(x) ,y-axis between the co-ordinates y = a and y = b is

$$\textbf{Area} = \int_a^b \mathbf{xdy} = \int_a^b \mathbf{g(y)dy}$$

39. Volume of solid generated about x-axis is:

$$\textbf{Volume} = \pi\int_a^b \mathbf{y^2dx}$$

40. Volume of solid generated about y-axis is:

$$\textbf{Volume} = \pi\int_a^b \mathbf{x^2dy}$$