VICTORY TUITION CENTRE

" It's all about daily, consistent action "

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MATHS FORMULAE

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10th	

Reg.No.	
Name	

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+ 1 MATHS

1 THEORY OF SETS

Operations on sets:

1) Union: AUB= combine and write all
2) Intersection AnB= common only
3) Set difference: A-B= write A (subtract B if any)
4) Symmetric difference: A Δ B = (A – B) U (B – A)
5) Complement of A' : Subtract A from U and write the remaining
6) Disjoint sets: AnB=∅

Properties of set Operations:

1) Commutative property: (i) A U B =B U A (ii) A n B = B n A

2) Associative: (i) A U (BUC)= (AUB) UC (ii) A n(BnC) = (AnB) n C

3) Distributive: (i) An(BUC)= (AnB) U (AnC) (ii) A U (BnC) = (A U B) n (A U C)

4) Identity: (i) A U ∅ = A (ii) A n U=A

5) Idempotent: (i) A U A =A (ii) A n A =A

6) Absorption: (i) A U (A n B) = A (ii) A n (AUB) =A

De Morgan' s law of set difference:

(i) A\(BUC) = (A\B) n (A\C) (ii) A\(BnC) = (A\B) U (A\C)

De Morgan's laws of set complementation

(i) (AUB)' = A' n B' (ii) (A n B)' = A ' U B'

Important results:

1) n(AUB)= n(A)+n(B)-n(AnB) 2) n(AUBUC)=n(A) + n(B) + n(C) + n(AnB)+n(BnC)+n(Anc)-n(AnBnC)

Relations: 1) Reflexive: aRa 2) Symmetric: aRb=>bRa 3) Transitive: aRb and bRc => aRc

4) Equivalence: reflexive, symmetric, transitive

Note: (i) The universal relation is always an equivalence relation

(ii) An empty relation can be considered as symmetric and transitive

(iii) If a relation contains a single element, that is transitive

Function: Every element has unique image

1) one-to-one function: Different elements have different images
2) Onto function: Every element in the Co-domain has pre image
3) One-one and onto function(Bijective): Both one -one and onto
4) Not a function: (i) More than one image (ii) No image

Graph: 1) **Reflection:** (i) y=-f(x) is the reflection of the graph of f about x axis

(ii) y =f(-x) is the reflection of the graph of f about y axis

(iii) y =f^{-1}(x) is the reflection of the graph of f in y=x

2) **Translation:** (i) y=f(x+c) causes the shift to the left

(ii) y=f(x-c) causes the shift to the right

(iii) y=f(x)+d causes the shift to the upward

(iv) y=f(x)+d causes to the shift to the downward

3) **Dilation:** (i) x by >1 => graph moves away from x- axis

(ii) x by < 1 => graph moves towards x-axis

2 BASIC ALGEBRA

Numbers 1) Natural numbers: N={1,2,3…} 2) Whole numbers W={0,1,2,3,…}

3) Integers: Z={ …-3,-2,-1,0,1,2…} 4) Rational numbers Q={$\frac{p}{q}$; p∈ Z, q∈Z, q≠0

5) N⊂ $W \subset Z \subset Q$ 6) Irrational numbers: R-Q

6) Quadratic formula x=$\frac{-b \pm\sqrt{b^2-4ac}}{2a}$ 7) D=b^2-4ac 8) D> 0 (roots are real and unequal)

9) D=0 (roots are real and equal) 10) D<0 (roots are unreal)

11) $a^2-b^2=(a+b)(a-b)$ (12) $a^3+b^3=(a+b)(a^2-ab+b^2)$ (13) $a^3-b^3=(a+b)(a^2+ab+b^2)$

14) $(\alpha-\beta)^2 = (\alpha+\beta)^2 - 4\alpha\beta$ (15) $(\alpha+\beta)^2 = (\alpha-\beta)^2 + 4\alpha\beta$

16) $\frac{px+q}{(x-a)(x-b)} = \frac{A}{x-a} + \frac{B}{x-b}$ 17) $\frac{px+q}{(x-a)^2(x-b)} = \frac{A}{x-a} + \frac{B}{(x-a)^2} + \frac{C}{x-b}$

18) $\frac{px+q}{(x-a)(x^2+b)} = \frac{A}{x-a} + \frac{Bx+C}{x^2+b}$

EXPONENTS RULES: 1) $a^{x+y}=a^x a^y$ 2) $a^{x-y} = \frac{a^x}{a^y}$ 3) $(a^x)^y = a^{xy}$

4) $ab^x = a^x b^x$ 5) a^x =1 if and only x = 0

LOGRATHAMIC RULES: 1) $a^{\log_a x}$ =x, $\log_a a^y$ = y 2) $\log_a(xy) = \log_a x + \log_a y$

3) $\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$ 4) $\log_a x^r = r\log_a x$ 5) $\log_b x = \frac{\log_a x}{\log_a b}$

3 TRIGONOMETRY

Trigonometric Ratios			
$\sin\theta = \frac{opp}{hyp}$	$\cos\theta = \frac{adj}{hyp}$		$\tan\theta = \frac{opp}{adj}$
cosec $\theta = \frac{hyp}{opp}$	sec $\theta = \frac{hyp}{adj}$		cot $\theta = \frac{adj}{opp}$
tan $\theta = \frac{\sin\theta}{\cos\theta}$		cot $\theta = \frac{\cos\theta}{\sin\theta}$	
Trigonometric Identities			
$\sin^2\theta + \cos^2\theta = 1$	$1 + \tan^2\theta = \sec^2\theta$		$1 + \cot^2\theta = \mathrm{cosec}^2\theta$

Trigonometric values								
Radian	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	π	$\frac{\pi}{6}$	2π
Degree	0^0	30^0	45^0	60^0	90^0	180^0	270^0	360^0
sin θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	-1	0	1
tan θ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞	0	$-\infty$	0

1) 1 radian $= \left(\frac{180}{\pi}\right)^0$ (2) $1^0 = \frac{\pi}{180}$ radian (3) length of arc $s = r\theta$ (4) Area of sector $= \frac{r^2\theta}{2}$

Trigonometric Ratios						
$\sin(90^0 - \theta) = \cos\theta$		$\cos(90^0 - \theta) = \sin\theta$		$\tan(90^0 - \theta) = \cot\theta$		
$\sec(90^0 - \theta) = \mathrm{cosec}\theta$		$\mathrm{cosec}(90^0 - \theta) = \sec\theta$		$\cot(90^0 - \theta) = \tan\theta$		
	sinx	cosx	tanx	cosecx	secx	cotx
Period	2π	2π	π	2π	π	π
function	odd	even	odd	odd	even	odd

Results		
$\sin 15^0 = \cos 75^0 = \frac{\sqrt{3}-1}{2\sqrt{2}}$	$\cos 15^0 = \sin 75^0 = \frac{\sqrt{3}+1}{2\sqrt{2}}$	$\tan 15^0 = \cot 75^0 = \frac{\sqrt{3}-1}{\sqrt{3}+1}$
$\sin 18^0 = \cos 72^0 = \frac{\sqrt{5}-1}{4}$	$\cos 18^0 = \sin 72^0 = \frac{\sqrt{10+2\sqrt{5}}}{4}$	$\sin 54^0 = \cos 36^0 = \frac{\sqrt{5}+1}{4}$
Horizontal distance $R = \frac{u^2 \sin 2\alpha}{g}$		
$2^{10}\sin\left(\frac{x}{2^{10}}\right)\cos\left(\frac{x}{2}\right)\cos\left(\frac{x}{2^2}\right) \ldots \cos\left(\frac{x}{2^{10}}\right) = \sin x$		
$\cos A \cos 2A \cos 2^2A \cos 2^3A \ldots \cos 2^{n-1}A = \frac{\sin 2^n A}{2^n \sin A}$		

Principal Value: 1) sinθ lies in $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ (2) tanθ lies in $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ (3) cosθ lies in $[0,\pi]$

General solution 1) sinθ =0 => θ=nπ, n∈Z (2) cosθ =0 => θ=(2n+1)$\frac{\pi}{2}$, n∈Z

3) tanθ =0 => θ=nπ, n∈Z (4) sinθ =sin α => θ=nπ+$(-1)^n\alpha$, n∈Z

5) cosθ =cos α => θ=2n$\pi \pm \alpha$, n∈Z (6) tanθ =tan α => θ=nπ+α, n∈Z

1	$\sin^2\theta+\cos^2\theta=1$	$\sec^2\theta-\tan^2\theta=1$	$\mathrm{cosec}^2\theta-\cot^2\theta=1$
2	sin2A=2sinAcosA sin2A=$\frac{2tana}{1+tan^2A}$	cos2A= $\cos^2$A-$\sin^2$A cos2A= 1-2$\sin^2$A cos2A = 2$\cos^2$A-1 cos2A= $\frac{1-tan^2A}{1+tan^2A}$	tan2A=$\frac{2tanA}{1-tan^2A}$
3	sin3A= 3sinA-4$\sin^3$A	cos3A=4$\cos^3$A-3cosA	tan3A =$\frac{3tanA-tan^3A}{1-3tan^2A}$
4	$\sin^2$A=$\frac{1-cos2A}{2}$	$\cos^2$A=$\frac{1+cos2A}{2}$	
5	Sin(A+B)=sinAcosB+cosAsinB Cos(A+B)=cosAcosB-sinAsinB tan(A+B)=$\frac{tanA+tanB}{1-tanAtanB}$	sin(A-B) = sinAcosB-cosAsinB cos(A-B) = cosAcosB+sinAsinB tan(A-B) = $\frac{tanA-tanB}{1-tanAtanB}$	
6	sin(A+B)+sin(A-B)=2sinAcosB sin(A+B)-sin(A-B)=2cosAsinB	cos(A+B)+cos(A-B) =2cosAcosB cos(A+B)-cos(A-B) =-2sinAsinB	
7	sinC+sinD=2sin$\frac{C+D}{2}$ cos$\frac{C-D}{2}$ sinC-sinD=2cos$\frac{C+D}{2}$ sin$\frac{C-D}{2}$	cosC+cosD=2cos$\frac{C+D}{2}$ cos$\frac{C-D}{2}$ cosC-cosD=-2sin$\frac{C+D}{2}$ sin$\frac{C-D}{2}$	
8	$\tan^{-1}$x+$\tan^{-1}$y=$\tan^{-1}\frac{x+y}{1-xy}$	$\tan^{-1}$x+$\tan^{-1}$y=$\tan^{-1}\frac{x+y}{1-xy}$	
9	Sine formula a=2RsinA	Cosine formula $a^2=b^2+c^2$-2bc cosA	
10	Projection formula a=bcosC+c cosB	Area formula Δ= $\frac{1}{2}$ absinC	
11	Sin0,sinπ,sin2π,sin3π,...=0 sin$\frac{\pi}{2}$, sin$\frac{5\pi}{2}$,sin$\frac{9\pi}{2}$,..=1 sin$\frac{3\pi}{2}$, sin$\frac{7\pi}{2}$, sin$\frac{11\pi}{2}$,...= -1	cos$\frac{\pi}{2}$, cos$\frac{3\pi}{2}$, cos$\frac{5\pi}{2}$ ...=0 cos0, cos2π, cos4π,...=1 cosπ, cos3π, cos5π,...=-1	

1) 1 Radian = $\frac{180}{\pi}$ 2) 10 = $\frac{\pi}{180}$ radian 3) 1' = $\frac{\pi}{180x60}$ radian

5) 1"= $\frac{\pi}{180x60x60}$ radian 5) Length of arc s= rθ 6) Area of sector =$\frac{r^2\theta}{2}$

Sine formula		
$\frac{a}{sinA}=\frac{b}{sinB}=\frac{c}{sinC}= 2R$		
a=2RsinA	b=2RsinB	c=2RsinC
Napier's Formula		
$\tan\frac{A-B}{2}=\frac{a-b}{a+b}\cot\frac{C}{2}$	$\tan\frac{B-C}{2}=\frac{b-c}{b+c}\cot\frac{A}{2}$	$\tan\frac{C-A}{2}=\frac{c-a}{c+a}\cot\frac{B}{2}$
Cosine Formula		
$\cos A=\frac{b^2+c^2-a^2}{2bc}$	$\cos B=\frac{c^2+a^2-b^2}{2ca}$	$\cos C=\frac{a^2+b^2-c^2}{2ab}$
$a^2=b^2+c^2-2bc\cos A$	$b^2=c^2+a^2-2ca\cos B$	$c^2 = a^2+b^2-2ab\cos C$
Projection Formula		
a=b cosC + c cosB	b= c cosA + a cosC	c = a cosB + b cosC
Area of Δ Formula		
$\Delta=\frac{1}{2}\,ab\,sinC$	$\Delta=\frac{1}{2}\,bc\,sinA$	$\Delta=\frac{1}{2}\,ca\,sinA$
Half – Angle Formula		
$\sin\frac{A}{2}=\sqrt{\frac{(s-b)(s-c)}{bc}}$	$\cos\frac{B}{2}=\sqrt{\frac{s(s-a)}{bc}}$	$\tan\frac{A}{2}=\sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$
$s=\frac{a+b+c}{2}$	$\sin A=\frac{2}{bc}\sqrt{s(s-a)(s-b)(s-c\_}$	
Heron's Formula		
$\Delta=\sqrt{s(s-a)(s-b)(s-c)}$		
Results		
acosA+b cosB+c cosC=2a sinB sinC		
Area of the segment $=\frac{1}{2}r^2(\theta-sin\theta)$		
The equilateral triangle has the maximum area $\frac{s^3}{3\sqrt{3}}$ for a fixed perimeter 2S		

4. COMBINATORICS AND MATHEMATICAL INDUCTION

Fundamental Principals of counting:

1) Sum Rule: M+N ways
2) Product Rule: MxN ways

Factorials: 1) 0! = 0, 1!=1, 2!=2 x1, 3!=3x2x1 2) n!=1x2x3x…x n 3) (n+1)! =(n+1)n!

Permutations: 1) $n_{p_r}=\frac{n!}{(n-r)!}$ 2) n_{p_n} = n! 3) n_{p_0} = 1 4) $n_{p_n}=n_{p_{n-1}}$

5) n_{p_r} = n X $(n-1)_{p_{(r-1)}}$ 6) $n_{p_r}=(n-1)_{p_r}+r\ X\ (n-1)_{p_{(r-1)}}$

7) Objects always together: m! X (n-m+1)! 8) No two things together: m! X $(m+1)_{p_k}$

9) Permutations if two kinds: $\frac{n!}{p!}$ 10) Permutations of different kinds: $\frac{n!}{p_1!X\ p_2!X\ldots X\ p_k\,!}$

11) sum of all r-digits numbers (excluding 0): $(n-1)_{p_{(r-1)}}$ X sum of digits X 111 …1(r times)

12) sum of all r-digits numbers (including 0):
$\{(n-1)_{p_{(r-1)}}$ X sum of digits X 111 …1(r times)} -$\{(n-2)_{p_{(r-2)}}$ X sum of digits X 111 …1(r-1 times)}

Combinations: 1)) $n_{p_r} = n_{c_r}$ X r! 2)) $n_{c_r} = \frac{n!}{r!(n-r)!}$ 3) n_{c_0} =1: n_{c_n} =1

4) $n_{c_r} = \frac{n(n-1)(n-2)\ldots(n-r+1)}{r!}$ 5) $n_{c_r} = n_{c_{n-r}}$ 6) $n_{c_r} + n_{c_{r-1}} = n+1_{C_r}$ 7) $n_{c_r} = \frac{n}{r}$ X $n-1_{C_{r-1}}$

Mathematical Induction:

Step1: verify P(1) is true step2: Prove P(k+1) is true whenever P(k) is true

Step3: ∴ P(n) is true for all n ∈N

5 BINOMIAL THEOREM, SEQUENCES AND SERIES

1) $(a+b)^n = a^n + n_{c_1} a^{n-1}b + \ldots + n_{c_r} a^{n-r} b^r + \ldots + b^n$
2) $(1+x)^n = 1 + n_{c_1} x + \ldots + n_{c_r} x^r + \ldots + x^n$
3) Arithmetic Progression (AP): a, a+d, a+2d …
4) Geometric Progression (GP): a,ar, ar^2 …
5) Arithmetico- geometric Progression (AGP): a, (a+d)r, $(a+2d)r^2$ …
6) Harmonic Progression(HP) $\frac{1}{a}, \frac{1}{a+d}, \frac{1}{a+2d} \ldots$
7) n^{th} term of AP = a+(n-1)d 8) n^{th} term of GP = $ar^{(n-1)}$ 9) n^{th} term of AGP = $[a+(n-1)d]r^{(n-1)}$
10) Arithmetic Mean : AM =$\frac{a+b}{2}$ 11) Geometric Mean: GM =$\sqrt{ab}$ 12) Harmonic Mean: HM = $\frac{2ab}{a+b}$
13) AM$\geq GM \geq$ HM 14) AM X HM = $(GM)^2$
15) sum of AP: sn =$\frac{n}{2}$(a+l) 16) Sum of AP: Sn = $\frac{n}{2}$[2a+(n-1)d]
17) Sum of GP: Sn= $\frac{a(1-r^n)}{1-r}$ if r>1 18) Sum of GP: Sn= $\frac{a(r^n-1)}{r-1}$ if r<1
19) Sum of AGP: Sn = $\frac{a-[a+(n-1)d]r^n)}{1-r}$ + dr $[\frac{1-r^{n-1}}{(1-r)^2}]$
20) Sum of n natural numbers = $\frac{n(n+1)}{2}$ 21) Sum of cubes of n natural numbers $\left[\frac{n(n+1)}{2}\right]^2$
22) sum of n odd natural numbers = n^2 23) sum of squares of n natural numbers = $\frac{n(n+1)(2n+1)}{6}$
24) $(1+x)^n = 1+nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 \ldots$
25) $(1+x)^{-1} = 1 - x + x^2 - x^3 \ldots$ 26) $(1-x)^{-1} = 1 + x + x^2 + x^3 \ldots$
27) $(1+x)^{-2} = 1 - 2x + 3x^2 - 4x^3 \ldots$ 28) $(1-x)^{-2}$ = 1+-2x +3 x^2 +4 x^3 . . .
29) $e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} \ldots$ 30) $e^{-x} = 1 - \frac{x}{1!} + \frac{x^2}{2!} - \frac{x^3}{3!} \ldots$
31) $\frac{e^x+e^{-x}}{2} = 1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \frac{x^6}{6!} \ldots$ 32) $\frac{e^x-e^{-x}}{2} = \frac{x}{1!} + \frac{x^3}{3!} + \frac{x^5}{5!} + \ldots$
33) $\log(1+x) = x - \frac{x^2}{2!} + \frac{x^3}{3!} - \frac{x^4}{4!} \ldots$ 34) $\log(1-x) = -x - \frac{x^2}{2!} - \frac{x^3}{3!} - \frac{x^4}{4!} \ldots$
35) $\log\left(\frac{1+x}{1-x}\right) = 2[x + \frac{x^3}{3} + \frac{x^5}{5} + \frac{x^7}{7} \ldots]$

6 TWO DIMENSIONAL ANALYTICAL GEOMETRY

1) Distance between points = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
2) Midpoint = $\left(\frac{x_2+x_1}{2}, \frac{y_2+y_1}{2}\right)$ 3) centroid = $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$
4) Point of division (Internally) = $\left(\frac{lx_2+mx_1}{l+m}, \frac{ly_2+my_1}{l+m}\right)$
5) Point of division (Externally) = $\left(\frac{lx_2-mx_1}{l-m}, \frac{ly_2-my_1}{l-m}\right)$

Equation of straight lines:

6)Two point form: $\frac{y-y_1}{y_2-y_1}=\frac{x-x_1}{x_2-x_1}$ 7) Intercept form: $\frac{x}{a}+\frac{y}{b}=1$

8)Normal form: $x\cos\alpha + y\sin\alpha = p$ 9) Parametric form $\frac{y-y_1}{\sin\theta}=\frac{x-x_1}{\cos\theta}=r$

10)General form: ax+by+c=0

11) Angle: $\theta=\tan^{-1}\left|\frac{m_1-m_2}{1+m_1m_2}\right|$ 12) Lines are parallel $m_1=m_2$

13)Lines are perpendicular : $m_1m_2=-1$ 14)Distance between point and line: $\left|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right|$

15) Distance between parallel line: $\left|\frac{c_2-c_1}{\sqrt{a^2+b^2}}\right|$

16) The foot ⊥ point : $\frac{x-x_1}{a}=\frac{y-y_1}{b}=-\frac{ax_1+by_1+c}{a^2+b^2}$

17) The image of the point: : $\frac{x-x_1}{a}=\frac{y-y_1}{b}=-\frac{2(ax_1+by_1+c)}{a^2+b^2}$

Pair of Straight lines:

18) Equation of pair of lines: $ax^2+2hxy+by^2+2gx+2fy+c=0$

19) Pair of lines intersecting at the origin: $ax^2+2hxy+by^2=0$

20) sum: $m_1+m_2=-\frac{2h}{b}$, product: $m_1m_2=\frac{a}{b}$

21) Angle: $\theta=\tan^{-1}\left|\frac{2\sqrt{h^2-ab}}{a+b}\right|$

22) Lines parallel: $h^2-ab=0$, Lines are perpendicular: a+b=0

24) The condition to represent a pair of lines $abc+2fgh-af^2-bg^2-ch^2=0$

25) Equation of bisectors: $\frac{x^2-y^2}{a-b}=\frac{xy}{h}$

26) point of intersection: P $\left(\frac{hf-bg}{ab-h^2}, \frac{gh-af}{ab-h^2}\right)$

27) Two lines are parallel if $\frac{a}{h}=\frac{h}{b}=\frac{g}{f}$ or $bg^2=af^2$

28) Distance between the parallel lines: $2\sqrt{\frac{g^2-ac}{a(a+b)}}$

7 MATRICES AND DETERMINANTS

1) Matrix: Rectangular array of numbers arranged in rows and columns
2) Row Matrix: Only one row
3) Column Matrix: Only one column
4) Square matrix: Equal number of rows and columns
5) Null Matrix: Each element is zero
6) Diagonal matrix : Square matrix with at least one non-zero number in its principal diagonal & all the other elements zero

7) Scalar Matrix: Diagonal elements are same in diagonal matrix
8) Unit Matrix: Diagonal elements are 1 in scalar matrix
9) Transpose matrix: Interchange rows and columns and denoted by A^T
10) Symmetrix Matrix: $A^T = A$
11) Skew symmetric matrix: $A^T = -A$
12) Reversal law $(AB)^T = B^T A^T$
13) Order of matrix: No. of rows and columns present
14) Order of AB: (No.of rows of A)x (No.Of columns)
15) The Value of determinant remains unchanged when its rows and columns are interchanged
16) If two rows(or columns) of a determinant are interchanged, then the sign of the determinant is changed, but its numerical value is unaltered
17) If two rows(or columns) of determinant are identical(or proportional) then the value of the determinant is zero.
18) If each element of a row (or column) is expressed as the sum of two numbers, then the determinant can be expressed as the sum of two determinant of the same order.
19) If each element of a row (or column) is multiplied by a non-zero constant k, then the value of the determinant is multiplied by k
20) The value of a determinant is unaltered if, when to each element of a row (or column) are added those of several other rows(or columns) multiplied respectively by fixed non-zero numbers.
21) Expansion of Determinants:

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = a_1\begin{vmatrix} b_1 & c_2 \\ b_3 & c_3 \end{vmatrix} - b_1\begin{vmatrix} a_2 & c_2 \\ a_3 & c_3 \end{vmatrix} + c_1\begin{vmatrix} a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$$

$$= a_1(b_2c_3 - b_3c_2) - b_1(a_2c_3 - a_3c_2) + c_1(a_2b_3 - a_3b_2)$$

22) FACTOR THEROEM: Suppose the elements of a determinant are polynomial in x, put x=a, then
1) If two rows or columns are identical, ie $\Delta = 0$, then (x-a) is a factor
2)If 3 rows or columns are identical, ie, ie $\Delta = 0$, then $(x-a)^2$ is a factor

Required factor(m)	Result
0	K
1	K(a+b+c)
2	$K(a^2+b^2+c^2)+l(ab+bc+ca)$

23)The product of two determinants of order n is a determinant of the same order n.

24)We can follow the row-by-row multiplication rule(or) the column-by-row multiplication rule(or) column-by-column multiplication rule.

25) IMPORTANT RESULTS:

(I) Singular matric|A|=0, Non-Singular matrix: $|A| \neq 0$.

(ii) A(adjA)=(adj A) =|A|I (iii) co-fac $\Delta = \Delta^2$

7 VECTOR ALGEBRA -I

1) $\vec{a}+\vec{b}=\vec{b}+\vec{a}$ 2) $(\vec{a}+\vec{b})\overrightarrow{+c}=\vec{a}+(\vec{b}+\vec{c})$

3) $\vec{a}+\vec{0}=\vec{0}+\vec{a}=\vec{a}$ 4) $\vec{a}+(-\vec{a})=(-\vec{a})+\vec{a}=0$

5) $m(\vec{a}+\vec{b})=m\vec{a}+m\vec{b}$ 6) $\overrightarrow{AB}=\overrightarrow{OB}-\overrightarrow{OA}$

7)Section formula $\vec{r}=\frac{m\,\vec{b}+n\vec{a}}{m+n}$ 8) Midpoint $=\frac{\vec{a}+\vec{b}}{2}$ 9) centroid: $\overrightarrow{OG}=\frac{\vec{a}+\vec{b}+\vec{c}}{3}$

10) $\vec{a}=m\vec{b}\ \Rightarrow\ \vec{a}$ and $\vec{b}$ are parallel or collinear

11) $\vec{a}=m\vec{b}+n\vec{c}\ \Rightarrow\ \vec{a},\vec{b},\vec{c}\ are coplanar$

12) In any $\Delta\ ABC,\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CA}=\vec{0}$

13) In any $\Delta\ ABC,\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{CA}$

14) Unit vector: $\pm\,\vec{a}=\ \pm\frac{\vec{a}}{|\vec{a}|}$

15) If $\vec{r}=x\hat{\imath}+y\hat{\jmath}+z\hat{k}$ then $|\vec{r}|=\sqrt{x^2+y^2+z^2}$

16)Direction Ratios =(x,y,z) 17) Direction cosines = $(\frac{x}{|\vec{r}|},\frac{y}{|\vec{r}|},\frac{z}{|\vec{r}|})$

18) $\vec{a}.\vec{b}=ab\cos\theta$ 19) $\vec{a}.\vec{b}=a_1b_1+\ a_2b_2+a_3b_3$

20) $\vec{a}.\vec{b}=\vec{b}.\vec{a}$ 21) $\vec{a}.\vec{b}=0\ \Rightarrow\ \vec{a}\ \perp\vec{b}$ 22) Projection of $\vec{a}$ on $\vec{b}$ $\frac{\vec{a}.\vec{b}}{|\vec{b}|}$

23) $\hat{\imath}.\hat{\imath}=\hat{\jmath}.\hat{\jmath}=\hat{k}.\hat{k}=1$ 24) $\hat{\imath}.\hat{\jmath}=\hat{\jmath}.\hat{k}=\hat{k}.\hat{\imath}=0$

25) $\vec{a}\ X\ \vec{b}=ab\sin\theta\ \hat{n}$ 26) $|\vec{a}\ X\ \vec{b}|=|\vec{a}|\,|\vec{b}|\sin\theta$

27) $\vec{a}X\vec{b}\ =\begin{vmatrix}\hat{\imath} & \hat{\jmath} & \hat{k}\\ a_1 & a_2 & a_3\\ b_1 & b_2 & b_3\end{vmatrix}$ 28) $\vec{a}X\vec{b}\ =-\vec{b}\,X\vec{a}$

29) $\vec{a}\ X\vec{b}=0\ \Rightarrow\ \vec{a}\ ||\ \vec{b}\ \ (or)collinear$ 30) unit vector: $\hat{n}=\pm\frac{\vec{a}\ X\ \vec{b}}{|\vec{a}\ X\ \vec{b}|}$

31) $\hat{\imath}\ X\hat{\imath}=\hat{\jmath}\ X\ \hat{\jmath}\ =\ \hat{k}X\hat{k}=0$ 32) $\hat{\imath}\ X\hat{\jmath}=\ \hat{k}\ ,\hat{\jmath}X\hat{k}=\hat{\imath},\ \hat{k}X\hat{\imath}=\hat{\jmath}$

9 DIFFERENTIAL CALCULUS- LIMITS AND CONTINUITY

1) $\lim_{x\to a}\frac{x^n-a^n}{x-a}$ = n a^{n-1} 2) $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1$

3) $\lim_{x\to 0}\frac{e^x-1}{x}=1$ 4) $\lim_{x\to 0}\frac{\log(1+x)}{x}=1$

5) $\lim_{x\to a}\frac{a^x-1}{x}$ = log a 6) $\lim_{x\to\infty}(1+\frac{1}{x})^x$ = e

7) $\lim_{x\to 0}(1+x)^{\frac{1}{x}}$ =e

Continuous Functions
Constant Function, Polynomial Function, Rational Function, Identity Function, x^n, e^x, logx, sinx, cosx, tanx

Differentiation Formulae

S.No.	y	$\frac{dy}{dx}$	S.No.	y	$\frac{dy}{dx}$
1.	C	0	6.	e^x	e^x
2.	x	1	7.	e^{mx}	me^x
3.	x^2	2x	8.	$log_e x$	$\frac{1}{x}$
4.	x^n	nx^{n-1}	9.	$log_a x$	$\frac{1}{x} log_a e$
5.	$\frac{1}{x}$	$-\frac{1}{x^2}$	10.	a^x	a^x log a
11	$\frac{1}{x^2}$	$-\frac{1}{x^3}$	21.	cotx	$cosec^2x$
12	$\sqrt{x}$	$\frac{1}{2\sqrt{x}}$	22.	$sin^{-1}x$	$\frac{1}{\sqrt{1-x^2}}$
13.	$\frac{1}{\sqrt{x}}$	$-\frac{1}{2x\sqrt{x}}$	23.	$cos^{-1}x$	$-\frac{1}{\sqrt{1-x^2}}$
14.	a^{-x}	$-a^{-x}$ loga	24.	$tan^{-1}x$	$\frac{1}{1+x^2}$
15.	u^v	$u^v[\frac{v}{u} u' +(\log u)v']$	25.	$cot^{-1}x$	$-\frac{1}{1+x^2}$
16.	sinx	cosx	26.	$sec^{-1}x$	$\frac{1}{x\sqrt{1-x^2}}$
17.	cosx	-sinx	27.	$cosec^{-1}x$	$-\frac{1}{x\sqrt{1-x^2}}$
18.	tanx	sec^2x	28.	uv	vu’+uv’
19.	secx	secxtanx	29.	$\frac{u}{v}$	$\frac{vu'-uv'}{v^2}$
20.	cosecx	-cosecxcotx	30.	uvw	u’vw+v’uw+w’uv

INTEGRATION FORMULAE

S.No.	Function	Integration	S.No.	Function	Integration
1.	$\int dx$	x+c	2.	$\int xdx$	$\frac{x^2}{2}$ +c
3.	$\int a\,dx$	ax+c	4.	$\int x^2dx$	$\frac{x^3}{3}$ +c
5.	$\int x^3dx$	$\frac{x^4}{4}$ +c	6.	$\int x^ndx$	$\frac{x^{n+1}}{n+1}$ +c
7.	$\int (ax+c)^ndx$	$\frac{(ax+b)^{n+1}}{a(n+1)}$ +c	8.	$\int e^xdx$	e^x +c
9.	$\int e^{mx}dx$	$\frac{e^{mx}}{m}$ +c	10.	$\int \frac{1}{x}dx$	logx+c
11.	$\int \frac{1}{x^2}dx$	$-\frac{1}{x}$ +c	12.	$\int \frac{1}{x^3}dx$	- $\frac{1}{x^2}$ +c
13.	$\int \frac{1}{x^n}dx$	$-\frac{1}{(n-1)x^{n-1}}$ +c	14.	$\int \sqrt{x}dx$	- $\frac{1}{x}$
15.	$\int \frac{1}{\sqrt{x}}dx$	$2\sqrt{x}$ + c	16.	$\int sinx\,dx$	-cosx+c
17.	$\int cosx\,dx$	sinx+c	18.	$\int tanxdx$	logsecx+c
19.	$\int cotxxdx$	logsinx +c	20.	$\int secxdx$	log(secx+tanx)+c
21.	$\int cosecx\,dx$	log(cosecx-cotx)+c	22.	$\int sec^2xdx$	tanx+c
23.	$\int cosec^2x\,dx$	- cotx +c	24.	$\int secxtanxdx$	secx+c
25.	$\int cosecx\,cotxdx$	- cosecx +c	26.	$\int \frac{f'(x)}{f(x)}x$	log f(x) +c
27.	$\int \frac{f'(x)}{\sqrt{f(x)}}dx$	$2\sqrt{f(x)}$ +c	28.	$\int a^xdx$	$\frac{a^x}{loga}$ +c
29.	$\int a^{-x}dx$	$\frac{a^{-x}}{-loga}$ +c	30.	$\int udv$	$uv-u'v_1+u''v_2$
31.	$\int \frac{dx}{\sqrt{1-x^2}}$	$sin^{-1}x$+c	32.	$\int \frac{dx}{\sqrt{a^2-x^2}}$	sin-1($\frac{x}{a}$) +c

33.	$\int \frac{dx}{1+x^2}$	$\tan^{-1}x + c$	34.	$\int \frac{dx}{a^2+x^2}$	$\frac{1}{a}\tan^{-1}(\frac{x}{a})+c$
35.	$\int \frac{dx}{x\sqrt{x^2-1}}$	$\sec^{-1}x+c$	36.	$\int \frac{dx}{\sqrt{a^2+x^2}}$	$\log(x+\sqrt{a^2+x^2})+c$
37.	$\int \frac{dx}{\sqrt{x^2-a^2}}$	$\log(x+\sqrt{x^2-a^2})+c$	38.	$\int \frac{dx}{x^2-a^2}$	$\frac{1}{2a}\log\frac{x-a}{x+a}+c$
39.	$\int \frac{dx}{a^2-x^2}$	$\frac{1}{2a}\log\frac{a+x}{a-x}+c$			
40.	$\int \sqrt{a^2+x^2}$	$\frac{x}{2}\sqrt{a^2+x^2}+\frac{a^2}{2}log(x+\sqrt{a^2+x^2})+c$			
41.	$\int \sqrt{x^2-a^2}$	$\frac{x}{2}\sqrt{x^2-a^2}-\frac{a^2}{2}log(x+\sqrt{x^2-a^2})+c$			
42.	$\int \sqrt{a^2-x^2}$	$\frac{x}{2}\sqrt{a^2-x^2}+\frac{a^2}{2}\ sin^{-1}(\frac{x}{a})+c$			
43.	$\int e^{ax} sinbx\ dx$	$\frac{e^{ax}}{a^2+b^2}[asinbx-bcosbx]+c$			
44.	$\int e^{ax} cos\ bx\ dx$	$\frac{e^{ax}}{a^2+b^2}[acosbx+bcosbx]+c$			

12 INTRODUCTION TO PROBABILITY THEORY

(1) P(A) = $\frac{n(A)}{n(S)}$ (2) $0 \leq P(A) \leq 1$ (3) P(S)=1

(4) Mutually Exclusive events : AnB=∅

(5) A and B are mutually exclusive: P(AUB)= P(A)+P(B)

(6) P(∅) =1 (7) P($\overline{A}$)= 1-P(A) (8) P(An$\bar{B}$) = P(A)-P(AnB)

(9) P($\bar{A}\ n\ B$) =P(B)-P(AnB) (10) P(AUB)=P(A)+P(B)-P(AnB)

(11) P(AUBUC)= P(A)+P(B)+P(C)-P(AnB)- P(BnC) – P(CnA) +P(AnBnC)

(12) P(AnB)=P(A).P(B/A) (13) P(AnB)= P(B).P(A/B)

(14) A and B are independent: P(AnB)= P(A).P(B)

(15) $P(B)=P(A_1).P(B/A_1) + P(A_2).P(B/A_2)+\ldots +P(A_n).P(B/A_n)$

(16) P(Ai/B) = $\frac{P(A_i).P(B/A_i)}{P(A_1).P(\frac{B}{A_1})+P(A_2).P(\frac{B}{A_2})+\cdots+P(A_n).P(\frac{B}{A_n})}$

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