

Inaugural Address to Govt. Arts & Science College

on 22/10/65

Introduction - Arts & Science - original idea of Physics - Defn of Maths - some of logic unsuitable - Elementary particles of Physics would take too much time - Second defn of maths (using easy words for hard ideas) - Names in Mathematics - & biological sciences (Latin names)
looked up Concise Oxford Dictionary & choosing 26 words.

(1) Associates & Association - Integral domain (India & Pakistan) - Defn of associates eg of $\mathbb{Z}[\sqrt{5}]$
- laws of association - Non associative algebras - commutative rule & non - Commutative algebras in R.M.

(2) Bee-cell - Isoperimetric problem of sphere (given area, least vol) - Description of ~~bee~~ bee-cell (Honeycomb, hexagonal pattern, base of cell), width w , area a of bottom base, v = volume of one cell, $wa = 2v$ - The two isoperimetric problems (3 rhombi) & (2 hexagons and two rhombi).

(3) cycle (circle with arrow) - Given 30° there are 8 circles touching them all, but for 3 cycles only one such cycle - paths-circle in logic of anions - clock (emphasise one pt) used in complex variables (meromorphic & holomorphic functions).

(4) Differentiate - Differentiation.

(5) Evolution - Herbert Spencer's definition in philosophy as "an integration of matter and dissipation of motion from an indefinite, incoherent homogeneity to a definite coherent inhomogeneity" - In maths extracting sq. roots & cube roots.


(6) Function - most imp't. idea in whole of mathematics - field (wait for group)

(7) Group [Ring is an abelian group under addition & closed under an operation of multiplication which is associative & distributive w.r.t. multiplication
field is an integral domain (9 laws) with inverse element]

Googol - 10^{100} - No. of raindrops falling over Bayalan in a century < googol - No. of grains of sand in Rajasthan deserts in the world < googol - divorce being million billion billion & 8 times that his love - no. of electrons in Universe $\sim 10^{79}$ (Einstein was Relativity) - Googolplex - time to wait for both ring of its own accord between googol & googolplex. no of years - Turns of trajectory of elementary particles $< \frac{1}{9999}$ sec.
googol

(8) Hexagon - mention lecture - hexahedron [

(9) Indeterminate eq^{ns} - Ex. of 5 sailors & a monkey & a pile of coconuts $[N = 5A + 1, 4A = 5B + 1,$
 $\dots 4E = 5F + 1 \rightarrow 1024N = 15625F + 11529; 1024 = 2^{10}, 15625 = 5^6, 11529 = 5^6 - 2^{12}$
 $2^{10}(N+4) = 5^6(F+1)$ - Negative coconut soln of $N = -4, F = -1$, General soln is $(N+4) = K \cdot 5^6$ &
 $F+1 = K \cdot 2^{10}$ for $K=1, N = 15621$. (Gem-diamond) - antiparticles in nature

- (10) Join of subgroups S and T is $S \cup T$ is least subgroup containing both S & T .
- (11) Knots (Bow-knot, sq. knot, granny's knot, Porter's knot, surgeon's knot, true lover's knot) - Knots shown with knot strips
- (12) Linear programming (OR) - minimize $p_1x_1 + p_2x_2$ subject to $a_{11}x_1 + a_{12}x_2 \geq b_1$, $a_{21}x_1 + a_{22}x_2 \geq b_2$ (vitamins)
- (13) Maps - coloring problems - 5 color theorem - 7 color theorem on anchored map - 4 color theorem not proved
- (14) Norm (of coset, a halftone) - Equal to $(a+b\sqrt{d})(a-b\sqrt{d})$ - Normal subgroup (self-conjugate $a^{-1}xa = \text{conj } x$)
- (15) operator - All physical quantities are treated as operators in Q.M. - O.R.
- (16) Prime - Prime Minister etc - Prime no - Test of primality - No. of primes ∞ (Euclid's proof $2 \cdot 3 \cdot \dots \cdot 13 + 1 = 59 \times 509$)
- Prime basis - Primes in an A.P. - Waring's problem (every +ve integer = sum of at most 4 prime squares, \mathbb{Q}^2 re. cubes, 4th powers & so on) - Fermat's last theorem $x^n + y^n = z^n$ (no soln for $n > 2$), Euler's proof for $n = 3$ & 4, recently proved for all n being a prime $p < 253,747,889$ by Lehmer using ~~some~~ electronic digital computers.
- (17) Queue - Queuing theory in O.R. - Relationship between mean length of waiting line and degree of randomness of arrival & disposal - Eq. of air craft arriving at airport & circling in the air (stack).
- (18) Ring and Radical (delay of 250 years before quintic can be solved - quintic not solvable by radicals, use of $\sqrt[n]{\quad}$ or $\sqrt{\quad}$ ex: $x^5 + x = a$, $x = \sqrt[5]{a}$ or \sqrt{a}).
- (19) Simple - Simple curve - simple group (one without self-conj subgroups)
- (20) Turbine  used in theory of continuous groups
- Transcendental - Kant's transcendental epistemology - transcendental no. $[0.1234 \dots 101112 \dots \overline{1234}]$
- (21) Uncertainty Principle in Q.M.
- (22) Vertex - Euler's theorem $V - E + F = 2 \rightarrow$ only 5 regular polyhedra.
- (23) Waves & particles in Q.M.
- (24) X - Xylol, Xylo Xanthine, Xanthium, Xanthoxin, Xylol, etc but X will do
- (25) Y would do
- (26) Z would do, $Z = x + iy$ - Zero - Zoog elem particles: neutrino

(1) Association - Society of persons joined together to promote some object. (Stat)

Associate (i) If in an integral domain $b \mid a$ & $a \mid b$, then a & b are associates (Integral domain is where addition & multiplication laws hold) (Pakistan & India)

eg. In $J[\sqrt{5}]$, $1-\sqrt{5}$ and $3+\sqrt{5}$ are associates. (B & M. Ex 11, p. 74)

Let $1-\sqrt{5} = (a+b\sqrt{5})(3+\sqrt{5})$
 $= 3a+5b+(a+3b)\sqrt{5}$

$(9+4\sqrt{5})(1-\sqrt{5}) = 9-20-5\sqrt{5} = -11-5\sqrt{5}$
 $= -5(3+\sqrt{5})+4$

$3a+5b=1$
 $a+3b=-1$
 $3a+9b=-3$

$(9+4\sqrt{5})(3+\sqrt{5}) = 47+21\sqrt{5} = 21(1-\sqrt{5})+68$

$-4b=4, b=0-1$
 $a=2$
 $3+5 = (c+d\sqrt{5})(1-\sqrt{5})$
 $e-5d=3, d-c=1$
 $-4d=4, d=-1$
 $c=-2$

(ii) Associative laws: $a+(b+c) = (a+b)+c$
Laws of Association: $a(bc) = (ab)c$

Non-associative algebras. - mention commutative & non-commutative algebras in Q.M.

(2) Bee-hive Bee-cells - Honeycomb of the bees is a loose tissue of wax forming a plane layer & has

hexagonal pattern on both sides. The hexagons are openings of prismatic vessels called bee-cells. The bottom of a cell consists of three rhombi each included at 120° to the other two. The bottoms of cells on opposite hexagons fill the space between two 11^{th} planes without intruding & intersecting. Bottom of cell is also called base. But 11^{th} planes of honeycomb is with width of the honeycomb

1st isoperimetric problem: of $w =$ width of ^{honeycomb} layer, $v =$ vol. of one of its cells, and $a =$ area of

the base of a cell, ~~then $wa = 2v$~~ - Among the polyhedra of volume v generating a honeycomb of width w , find that one of least area - Solⁿ exact solⁿ not yet found - two considerations give useful information (i) of all convex plane fillers of given area the regular hexagon has the least perimeter, (ii) Choosing hexagonal plane bases, the least surface area of the bottom (base figure is that given by the bee-cell

2nd problem - Among cells of volume v generating a honeycomb (of any width) find that one of least area - Solⁿ is obtained as that where the bottom has two hexagons and two rhombi (instead of 3 rhombi as the bees do) -

2nd solⁿ more economical than the 1st in surface area, but saving is less than 0.35% & also also trilocular style of bees is definitely simpler than in the second case.

[Isoperimetric problem re. sphere).

(3) cycle - As in Kesner pp. 63 - ~~para-cycle para-circle path-circle & clock.~~

(4) Differentiate - Differentiation

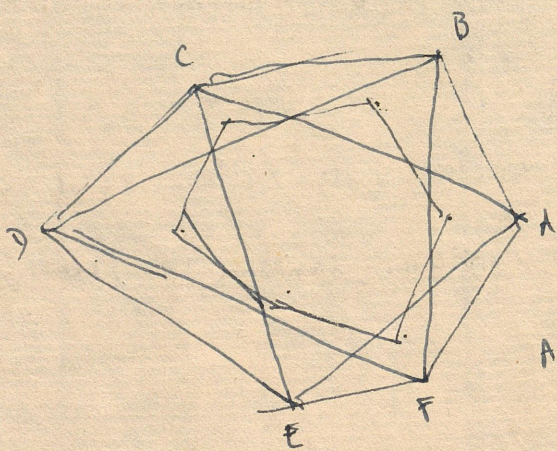
(5) Evolution - Kesner, p. 59.

(6) Function - Kesner, p. 58 - Field.

(7) Googol - Ibid, pp. 68-72. - Guggen & Gennis probability $< \frac{1}{\text{googolplex}}$ - Group (Relativity) (d. Group)

(8) hexagon - hexagon - Ibid pp. 65-66.

- (9) Indeterminate - Eq^{ns}, incident of sailors, coconuts & monkey - ~~Steel~~ (B & M, p-372) - Imaginary
- (10) Join of subgroups (B & M, p-141).
- (11) Kernel of homomorphism (B & M, p-151) - Knots (Bow-knot, Granny knot, Porters' knot, Square knot, Surgeon's knot, True love's knot)
- (12) Linear - algebras (B & M, p-240), spaces (p-162) - linear programming.
- (13) Maps - Colouring - 4 colour problem.
- (14) Norm - Normal (a rule, a pattern, an authoritative standard), (according to rule, regular, perpendicular) - (B & M, p-423, p-148 for normal subgroups).
- (15) Operator - in Q.M. & A.M., spin, parity, energy - Operations research (O.R).
- (16) Path - curves which in an affinely connected space which constitute a generalisation of geodesics of a Riemann space are called paths - (J.H.C. Whitehead - Curves & surfaces in the geometry of paths) - Prime no.
- (17) Queues - Queuing theory in O.R.
- (18) Ring and Radical (Kasner)
- (19) Simple (Kasner)
- (20) Turbine. (Kasner) - Transcendental (0.123456...) (Kasner)
- (21) Uncertainty - Uniformity - unity (primitive roots)
- (22) ~~was~~ Vertex - Euler's theorem & any $\bar{6}$ regular polyhedron
- (23) Waves - Quantum theory.
- (24) X - names in natural sciences plenty trees. Xylophia, Xylol, Xerophagy (on food long)
Xanthine (yellow colouring matter of flowers), Xanthium (weed) plant, xanthoma (disease)
- for maths X will do.
- (25) Y would do -
- (26) Zero - Zoo of elementary particles - None mention neutrino & photon ($m=0, e=0$) and $\bar{0} \neq 0$
or $Z = x + iy$ ($\frac{1}{2} + i$)



ABC, BCD, CDE, DEF, EFA, FAB