DR. AMBEDKAR COLLEGE, DEEKSHA BHOOMI, NAGPUR

Department of Mathematics

Activity: Bridge Course

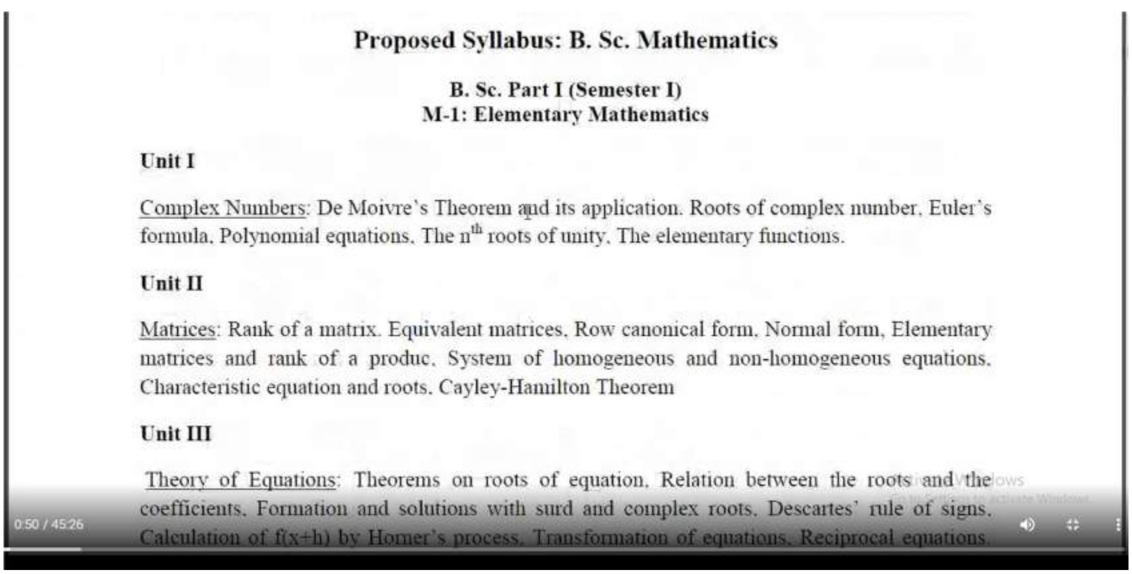
Session: 2021-22

Report:

The Department of Mathematics, Dr. Ambedkar College, Deekshabhoomi, Nagpur conducted Bridge Course During the months of September-October 2021 for the students of B.Sc. Sem I. In this activity most of the topics covered during 12^{th} Class and are required as basics for B.Sc. Mathematics syllabus were discussed namely, Functions, Limits and continuity, differentiation, Integration, Differential Equations, Matrices, Complex numbers, etc.

This activity helps the newly inducted students of B.Sc. Sem. I to clear their doubts of the previous education in Mathematics and helps to build a solid base for further studies in B.Sc.

Prof. S.M. Pawar, Head, Department of Mathematics and Dr. Jitesh Tripathi, Assistant professor, Department of Mathematics conducted the program.



Proposed Syllabus: B. Sc. Mathematics

B. Sc. Part I (Semester I)
M-1: Elementary Mathematics

Unit I

Complex Numbers: De Moivre's Theorem and its application. Roots of complex number. Euler's formula. Polynomial equations. The n^{th} roots of unity. The elementary functions.

Unit II

Matrices: Rank of a matrix. Equivalent matrices. Row canonical form. Normal form. Elementary matrices and rank of a produc. System of homogeneous and non-homogeneous equations. Characteristic equation and roots. Cayley-Hamilton Theorem

Unit III

Theory of Equations: Theorems on roots of equation. Relation between the roots and the coefficients. Formation and solutions with surd and complex roots. Descartes' rule of signs. Calculation of f(x+h) by Horner's process. Transformation of equations. Reciprocal equations.

Wednesday, September 22, 2021 12:53 PM

Bridge Course

C.

Bridge Course

Complex Numbers:

A number of the form $z = a + ib$, $a, b \in \mathbb{R}$ & $i = \sqrt{-1}$ is known as a complex no.

Real number line:

$\ldots -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \ldots$

$(0,1) = \text{infinity} = \infty$

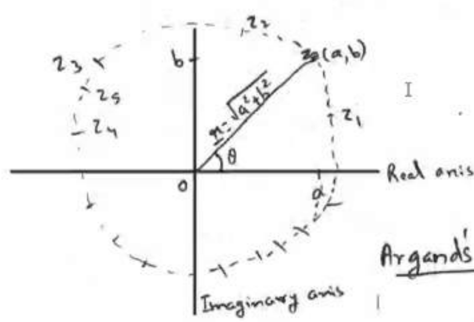
dist(House, college) = kms

dist(House, Sun) = kms $= \infty$ Huge

$= 0$

$(0,1) = \text{infinity} = \infty$

$= 0$ $= \infty$ Huge



modulus $= |z| = r$

argument $= \theta = \tan^{-1}\left(\frac{b}{a}\right)$

Argand's Plane

Imaginary axis

Argands Plane

Difference Real & Complex no:

$a, b \in R$ $\qquad$ $1, 3 \in R$

$N = \{1, 2, 3, \dots\}$ enumeration method

$W = \{0, 1, 2, 3, \dots\}$

$Z = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$

$Q = \{x \mid x = \frac{p}{q},\ p, q \in Z,\ q \neq 0\}$ → set builder form

$(0, 1)$

tell me the next number after 0 $= 0.001 = \frac{1}{1000}$

$= 0.00000000001$

Difference Real & Complex no:

$a, b \in R$ $\qquad$ $2, 3 \in R$

$0, \sqrt{2}, \pi, 9, 7, 3 \in R$

$0, \sqrt{2}, 3, \pi, 7, 9$ → Ascending order. $\pi = 3.1428\dots$

$2i, 2, \quad 2+3i, \quad 3+2i \in C$ $\qquad$ $i = \sqrt{-1}$

$2, 2i, 2+3i, 3+2i$ → Ascending order.

$2, 3 \in R, \quad 2 < 3.$ $\qquad$ $2+3i, 3+2i \in C$

$N = \{1, 2, 3, \dots\}$ enumeration method

$W = \{0, 1, 2, 3, \dots\}$

$Z = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$

$Q = \{x \mid x = \frac{p}{q},\ p, q \in Z,\ q \neq 0\}$ → set builder form

$Q' = \bar{Q} = Q^c = \{x \mid x \notin Q\}$

$R = Q \cup Q'$

$r_1 = \sqrt{4+9} = \sqrt{13}$

$r_2 = \sqrt{9+4} = \sqrt{13}$

Imaginary axis

Argands Plane

Difference Real & Complex no:

$a, b \in R$ $\qquad$ $2, 3 \in R$

$0, \sqrt{2}, \pi, 9, 7, 3 \in R$

$0, \sqrt{2}, 3, \pi, 7, 9$ → Ascending order. $\pi = 3.1428\dots$

$2i, 2, \quad 2+3i, \quad 3+2i \in C$ $\qquad$ $i = \sqrt{-1}$

$2, 2i, 2+3i, 3+2i$ → Ascendingo

$N = \{1, 2, 3, \dots\}$ enumeration method

$W = \{0, 1, 2, 3, \dots\}$

$Z = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$

$Q = \{x \mid x = \frac{p}{q},\ p, q \in Z,\ q \neq 0\}$ → set builder form

$Q' = \bar{Q} = Q^c = \{x \mid x \notin Q\}$

$R = Q \cup Q'$

$2i, 2, 2+3i, 3+2i$

$2, 2i, 2+3i, 3+2i \rightarrow$ Ascending order.

$r_1 = \sqrt{4+9} = \sqrt{13}$

$r_2 = \sqrt{9+4} = \sqrt{13}$

$2, 3 \in \mathbb{R}, \; 2 < 3.$ $\quad 2+3i, 3+2i \in \mathbb{C}$

Complex number $\rightarrow$ order relation is not defined.

Applications:-

$x^2 + 1 = 0 \Rightarrow x^2 = -1 \Rightarrow x = \pm\sqrt{-1} = \pm i$ $\quad j$

electrons e^-

Mag +ve

e^-

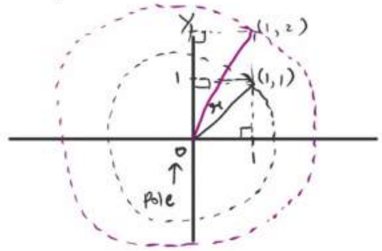
Mag +ve

Circle: $x^2 + y^2 = r^2$ $\quad z = x + iy$

$|z| = r \Rightarrow \sqrt{x^2+y^2} = r \Rightarrow x^2 + y^2 = r^2$

Bridge Course:

Representation of a Complex no. in Polar form:

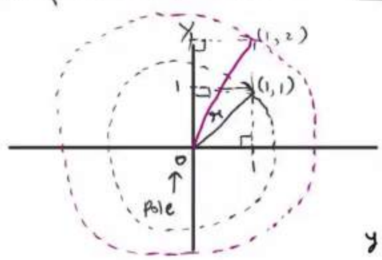


2 D Geometry ✓

Cartesian Geometry ✓

Rectangular Geometry ✓

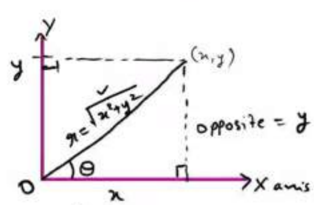
Representation of a Complex no. in Polar form:



2 D Geometry ✓

Cartesian Geometry ✓

Rectangular Geometry ✓



$\sin\theta = \frac{y}{r}$

$\Rightarrow y = r\sin\theta.$

$\cos\theta = \frac{x}{r}$

$\Rightarrow x = r\cos\theta.$

Dist. betn pts $(0,0)$ & (x,y)

$= \sqrt{(x-0)^2 + (y-0)^2} = \sqrt{x^2+y^2}$

$\Rightarrow \theta = \frac{\pi}{4}$

Add sugar to coffee

$\theta = \frac{\pi}{4}, -\frac{\pi}{4}, \frac{7\pi}{4}$.

Sin +ve cos −ve	All +ve Sin +ve cos +ve
Sin −ve cos −ve	Sin −ve cos +ve

③ Write $1 - i$ in polar form:

$1 - i = x + iy \Rightarrow x = 1, y = -1$

$r = \sqrt{1^2 + (-1)^2} = \sqrt{2}$

Substitute $x = r\cos\theta, y = r\sin\theta$.

$1 - i = r\cos\theta + i\, r\sin\theta$.

$r\cos\theta = 1$, $r\sin\theta = -1$

$\cos\theta = \frac{1}{\sqrt{2}}$ ✓, $\sin\theta = \frac{-1}{\sqrt{2}}$ ✓ $\Rightarrow \theta = ?$

OneNote for Windows 10 jiteshtripathimaths@gmail...
Home Insert Draw View Help
Shapes Ink to Shape Ink to Text

② Express $(1+i)^{10} + (1-i)^{10}$ in standard form:

$r = \sqrt{2}$

$1 + i = \sqrt{2}\left(\frac{1}{\sqrt{2}} + i\frac{1}{\sqrt{2}}\right) = \sqrt{2}\left(\cos\pi/4 + i\sin\pi/4\right) = \sqrt{2}\, e^{i\pi/4}$

$1 - i = \sqrt{2}\, e^{-i\pi/4}$

$(\sqrt{2})^{10} = (2^{1/2})^{10} = 2^5$

$(1+i)^{10} + (1-i)^{10}$

$= (\sqrt{2}\, e^{i\pi/4})^{10} + [\sqrt{2}\, e^{-i\pi/4}]^{10}$

$= 2^5 \left[e^{i\, 5\pi/2} + e^{-i\frac{5\pi}{2}} \right]$

$= 2^5 \left[\cos\frac{5\pi}{2} + \cancel{i\sin\frac{5\pi}{2}} + \cos\frac{5\pi}{2} - \cancel{i\sin\frac{5\pi}{2}}\right]$

$= 2^5 \cdot 2\cos\frac{5\pi}{2}$.

$= 2^6 \cos\frac{5\pi}{2}$

OneNote for Windows 10 jiteshtripathimaths@gmail...
Home Insert Draw View Help
Shapes Ink to Shape Ink to Text

Mathvyas

$= 2^6 \cos\frac{5\pi}{2}$

Bridge Course

Matrices:

Matrix: It is a rectangular arrangement of nos. in rows & columns.

$$A = \begin{array}{c} \begin{array}{ccc} C_1 & C_2 & C_3 \end{array} \\ \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \end{array} \begin{array}{l} \to R_1 \\ \to R_2 \end{array}$$

2×3

$$\begin{bmatrix} -2 & 0 & -5 \\ 3 & 5 & 0 \end{bmatrix} \rightarrow \text{is a skew-symm. matrix.}$$

Applications of matrices: Quantum mechanics, Data representation.

Solve AC network eqns,

arrays.

Linear Algebra → matrices. →

Data

Qualitative data   Quantitative data