

# Virtual Lab as a teaching learning tool for Mathematics



*Date and Time*

**25 November, 2024**

from 10:00 AM to 11:00 AM, Monday



## Resource Persons

**Mr. Vaibhav Singh**

Project Manager  
Educational Technology Unit  
CDAC Mumbai

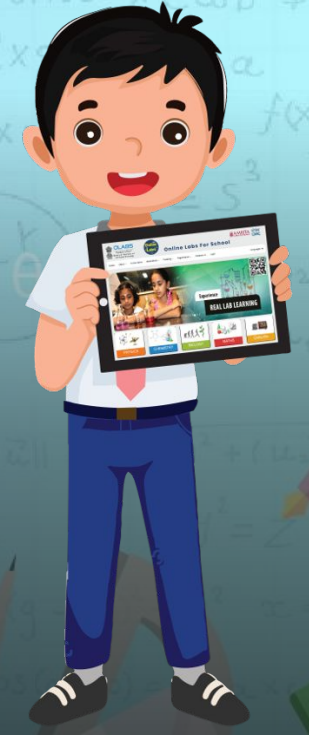
**Ms. Priyanka Monde**

Module lead  
Educational Technology Unit  
CDAC Mumbai





# VIRTUAL LAB AS A TEACHING LEARNING TOOL FOR MATHEMATICS



VAIBHAV SINGH, PRIYANKA MONDE- C-DAC Mumbai



# Background

*Laboratory a key component*

*School education in India faces many challenges*

- Lack of infrastructure including labs.
- *Students come out with little practical knowledge of the concepts they learn.*

# Approach – Virtual Labs



**Not meant to replace physical labs!**

But augment and amplify them.



**Virtual labs address deficiencies of physical labs.**

Infinite repetitions at no cost.



**It provides the ease and convenience of conducting experiments over the internet.**



**Aimed to bridge the constraints of geographical distances and time.**

**Technology can expand the boundaries of a physical Lab**



# Salient Features

Aligned to CBSE curriculum

Interactive 2D/3D simulations

Simulations model real life environment

Authentic content

Intuitive feedback and guidance

# Eco-system

Theory relevant to the lab

Understanding of the process  
and its implications

The core  
simulator

Auxiliary requirements: plot,  
measurement and recording,  
etc.

Review questions, references

# Effective usage of Virtual Labs ( Math) in your school



**Minimally, use it for  
demonstration in class**

To prepare students for the physical lab  
To reflect on the activities performed in the lab



Can get more by ensuring students are actively involved in the activity.



Active learning strategies can be interleaved with usual lecture

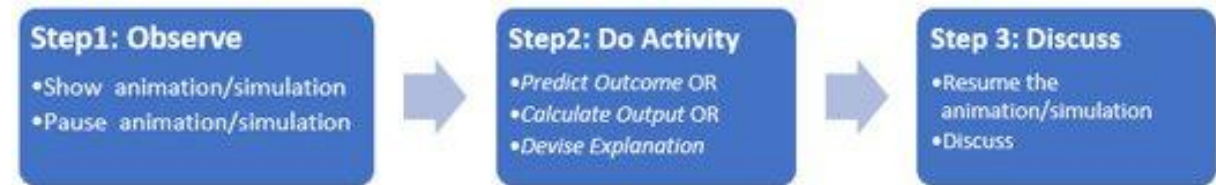


As Homework – Give inquiry-based activities



Encourage self-evaluation using “Viva-Voce” section of each lab.

# Proposed Active Learning Strategy for Virtual Labs (Math)



- Recommended time: 5-15 min
- Predict Outcome* - Ask students to make prediction: “What will happen if ...”
- Calculate Output* - Ask students to calculate next step or output.
- Devise explanation* - Ask students to devise reason for process
- Choose activity based on pedagogical purpose and learning objective of the Lab**



# Using Virtual Labs (Math) : Scenario

- **Teachers (In the classroom/Lab)**
  - Explain labs before performing the practical/lab session
  - Explain a procedure
  - Demonstrate a phenomenon
  - Set expectation about a lab
  - Can frame review questions with the lab as the backdrop (after Lab Session)

*Creative teachers and students can come up with many more innovative uses!*

# Usage Virtual Labs (Math)

## Students

- Familiarize with the Lab before physical lab session
- Try variations available in the lab
- Do revision
- Use Lab to reinforce the concepts, answer question they may have, etc.

# Mathematics Labs – Salient Features

- 3D representation for select labs
- Facilitates drawing geometric figures on workbench with given dimensions
- Tools provided relevant to lab
  - Show Scale
  - Cut triangle/rectangle
  - Rotate Clockwise
  - Rotate Anticlockwise
  - Drag/Drop
  - Superimpose

# Mathematics Labs – Salient Features

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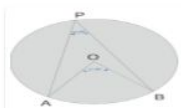
Instructions provided on each step

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Actions taken by student/system in ‘Workbench’, displayed in “Observations”.

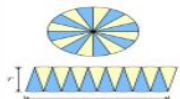
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**Detailed** inference and conclusion after completion of Lab. Also relevant illustration on workbench.



Angle at the centre

Go



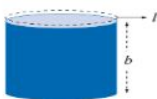
Area of Circle

Go



Right circular cone

Go



Right circular cylinder

Go



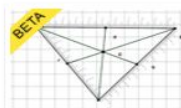
Area of Cylinder

Go



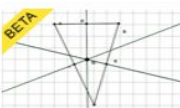
Arithmetic Progression

Go



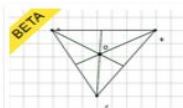
Centroid of Triangle

Go



Circumcentre of Triangle

Go



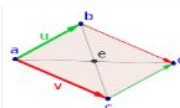
Incentre of Triangle

Go



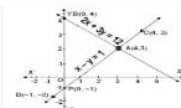
Least Common Multiple

Go



Properties of Parallelogram

Go



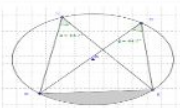
Simultaneous Equations

Go



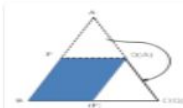
Volume of Cylinder

Go



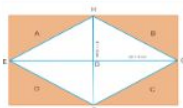
Angles in the same segment

Go



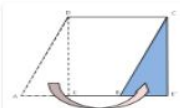
Mid-Point Theorem

Go



Area of Rhombus

Go



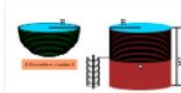
Area of Parallelogram

Go



Pythagoras theorem

Go



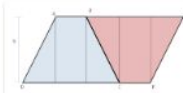
Surface area of sphere

Go



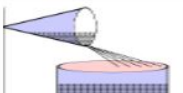
Area of Triangle

Go



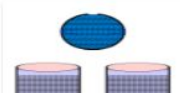
Area of Trapezium

Go



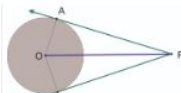
Volume of cone

Go



Volume of sphere

Go



Tangents to a circle

Go

Screenshots

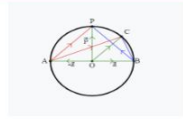
Lab List



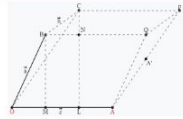
## Class 12



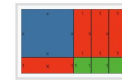
Perimeter of rectangle and area of square



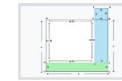
Angle in a semicircle



Distributive vector multiplication



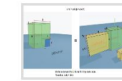
Factorization Of Polynomial



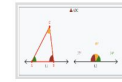
Algebraic Identity  $(a - b)^2$



Factorization of Polynomial  $2x^2 + 4x$



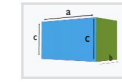
Algebraic Identity  $(a^3 - b^3)$



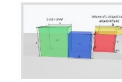
Angle sum property of triangle



Cube and its surface area

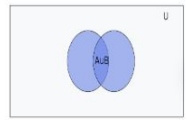


Cuboid and its total surface area

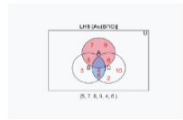


Algebraic Identity  $(a^2 + b^2)$

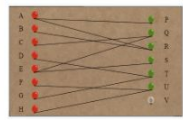
## Class 11



Set theoretic operations using Venn diagrams



Set Theory:  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$



Relation and Function



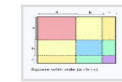
Frustum of a cone



Algebraic Identity  $(a - b)^3$



Surface area and volume of cone



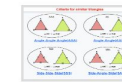
Algebraic Identity  $(a + b + c)^2$



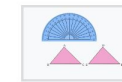
Algebraic Identity  $(a + b)^3$



Volume of a cuboid



Similarity of two triangles



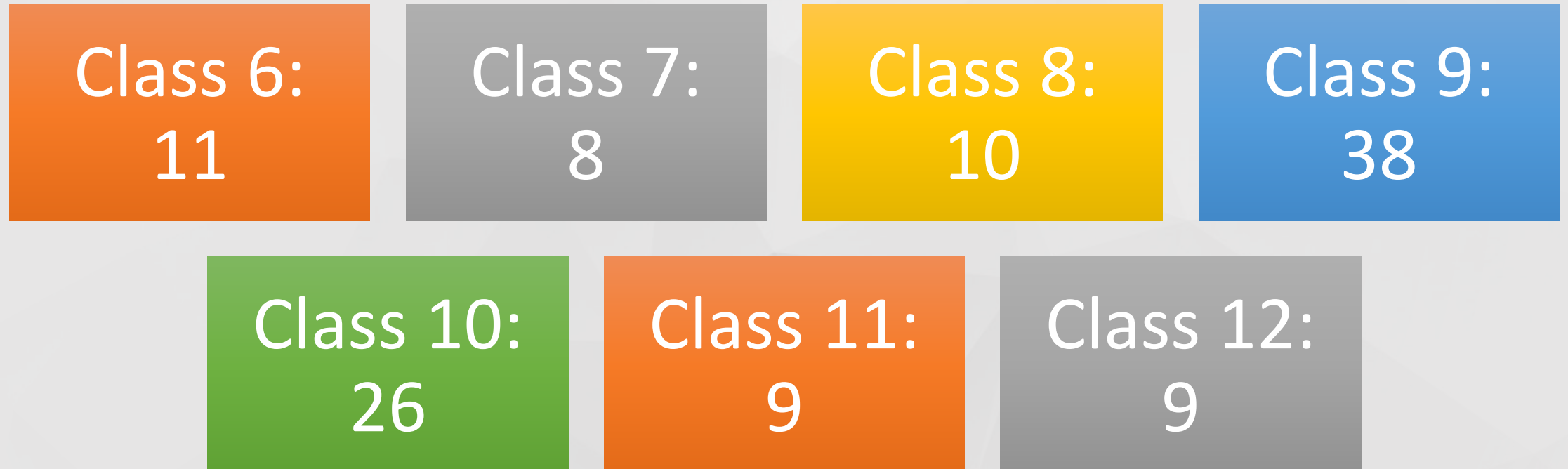
Congruence of triangles

# Screenshots

## Lab List

# Number of Mathematics available

**Total Number: 111**





# Demonstration of Mathematics Labs

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# List of Labs for Demo

## 3D Labs

- Volume of Cylinder
- Cube and Cuboids

## Geometry

- Cyclic Quadrilateral
- Area of Circle

## Algebra

- Algebraic Identity
- Polynomials
- Fractions



# Help us to help you....

1

Share the information to all fellow teachers...

2

Share your feedback on whatever you have explored in this regard.

3

Let us know if there are some concepts/topics on which you would like such a lab to be available.

## Thank You

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- For any information, please write to us at:
  - Educational Technology Unit, C-DAC Mumbai
  - support[at]olabs[dot]co[dot]in

## For more details

- Email id: [etu@cdac.in](mailto:etu@cdac.in), [vidyakashetu@gmail.com](mailto:vidyakashetu@gmail.com)
- Website: <http://olabs.edu.in/>
- Facebook: <https://www.facebook.com/onlinelabs/>
- Twitter: <https://twitter.com/cdacmumbai>
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