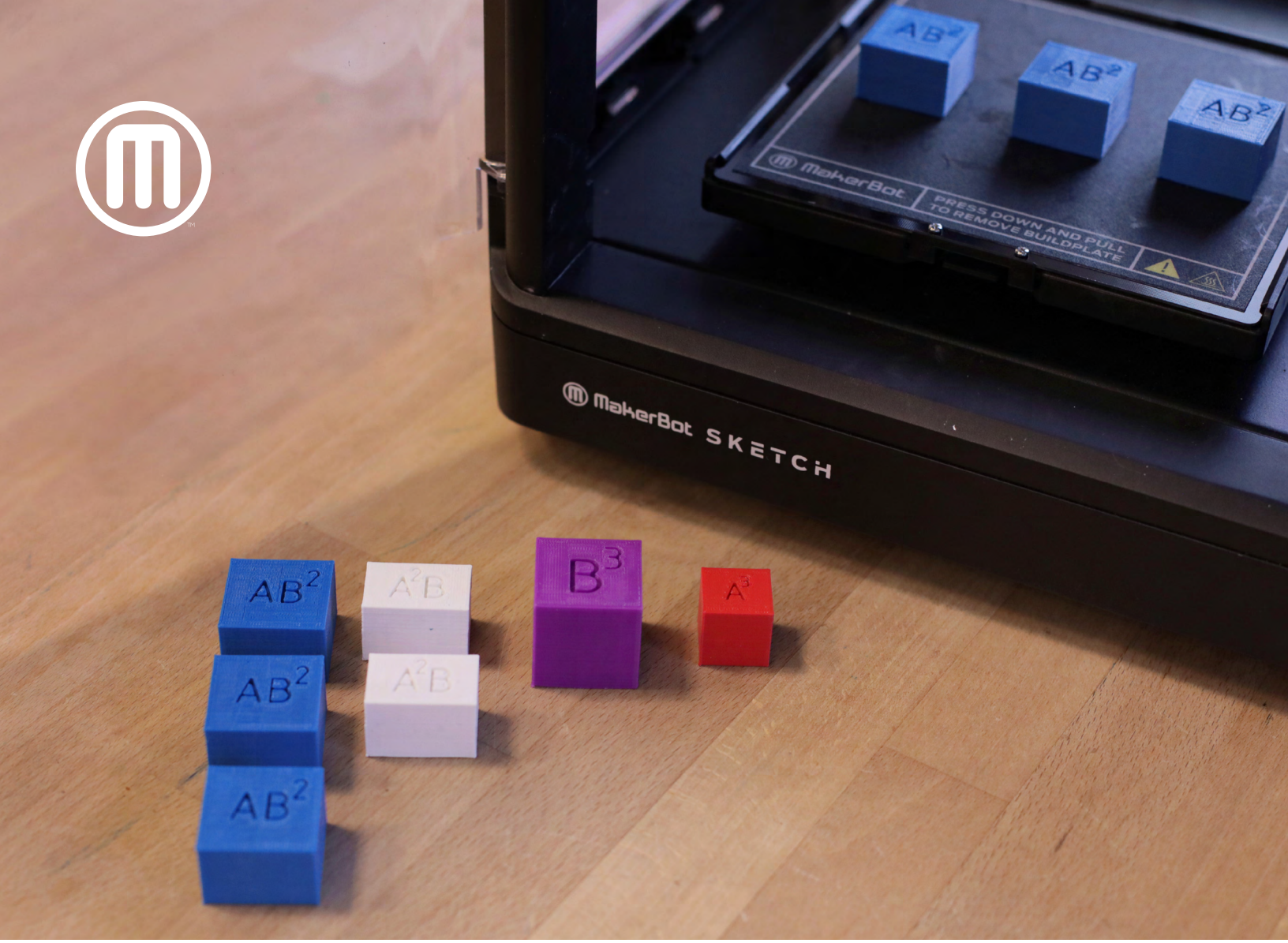


PROJECT TITLE

MATH EXPRESSION $(A+B)^3$

Basic Project Info

EDUCATOR

Venkateswaran

APPLICABLE SUBJECTS

Math, Technology

APPLICABLE GRADE LEVELS

7th, 8th, 9th

PROMPT

To verify $(A+B)^3$ as a mathematical expression based on physical measurement by modeling and 3D printing.

SKILLS NEEDED

The prior knowledge of the following concepts would aid for a quicker and faster hands-on session

- Pascal's Triangle
- Expansion of $(A+B)^3 = A^3+3A^2B+3AB^2+B^3$
- Measurement Units

Project Info

LEARNING OBJECTIVES

Apply the knowledge of modeling primitive shapes using TinkerCAD

- Utilize physical measurement and modeling technique to other complex mathematical expressions and formulae
- Explain the concept of Pascal's Triangle in an intuitive and novel approach
- Make use of technology to simplify the teaching approach for better and quicker understanding amongst students

STANDARDS

MS-ETS1-3 ENGINEERING DESIGN

Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

HS-ETS1-4 ENGINEERING DESIGN

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

CCSS.MATH.CONTENT.7.EE.A.1

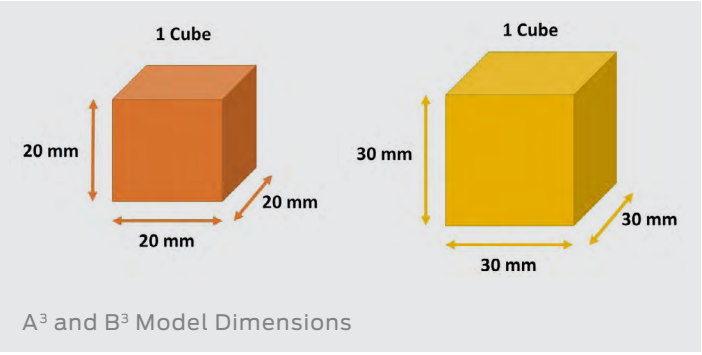
Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

CLASS INSTRUCTION

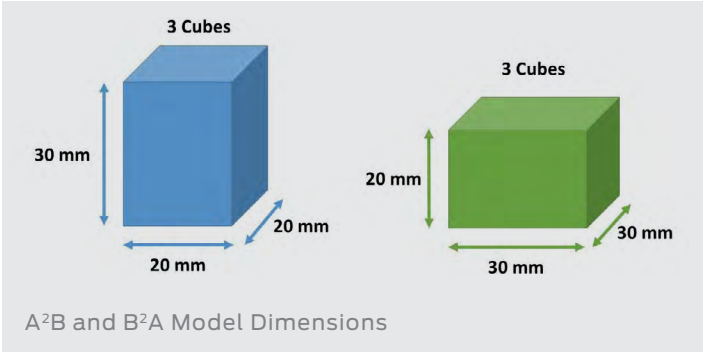
TEACHER INSTRUCTION

TinkerCAD software was used to design the cubes. The dimensions are provided in the images for reference. The side A was chosen to be 2cm and B was chosen to be 3cm. Rest of the calculations follow as per the equation

$(A+B)^3 = A^3+B^3+3A^2B+3B^2A$



A^3 and B^3 Model Dimensions



A^2B and B^2A Model Dimensions

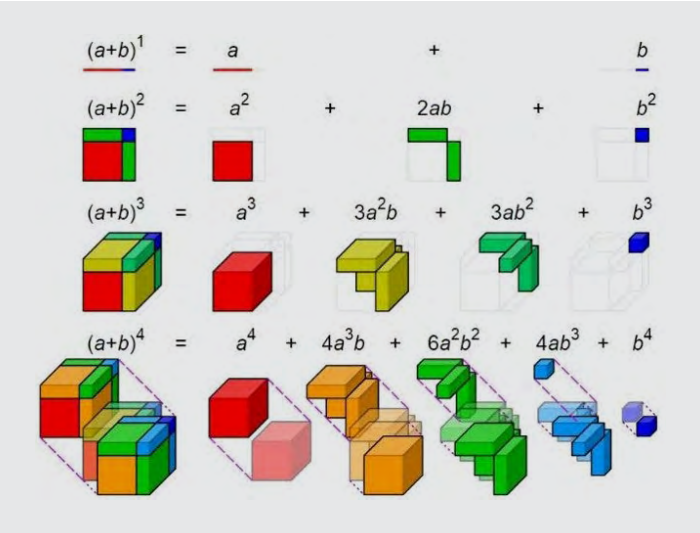
STUDENT INSTRUCTION

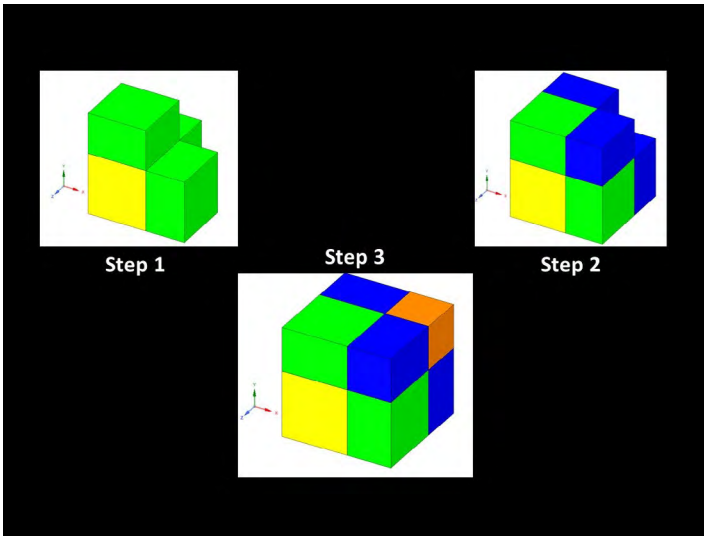
Theoretical Explanation of the Math Expression with 3D Models

Pascals Triangle:
1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
...

For example:

$(a+b)^0 = 1$
$(a+b)^1 = a^1+b^1 = a+b$
$(a+b)^2 = a^2+2ab+b^2$
$(a+b)^3 = a^3+3a^2b+3ab^2+b^3$
$(a+b)^4 = a^4+4a^3b+6a^2b^2+4ab^3+b^4$





KEY QUESTIONS TO ASK YOURSELF

- How will you apply this learning session in your classroom?
- What are the subject areas in Mathematics and Physical Measurement wherein this modus of operand will help the students grasp the concept?
- How will this technique help the students to apply it to their real life problems and applications?

Logistics

DURATION

One class session

PRINT TIME

Each cube takes about 2 hr 24 min to print

FILAMENT USAGE

~43 grams of filament per cube

MATERIALS

NA

SOFTWARE

TinkerCAD

BRIMS/RAFT INDICATOR

Padded Base

THINGIVERSE THING

#2517916

WORKSHEET INCLUDED?

No

AUTHOR NOTES

For a group of 30 Students, you may have to split them into a batch of 5 students each. So for each batch you would need one set of cubes without names engraved on them and one more set of cubes with name engraved in them. During the first 75% of the teaching pedagogy you would need only the cubes without the names engraved. After the printing of a cube is initiated, you may collect the cubes (without names) back and then hand over the cubes with names and teach them the mathematical expression and ask them to assemble.

The A^2B and B^2A models need to printed in quantities of 3 each. The A^3 and B^3 models need one quantity each. Also the A^2B and B^2A models need to printed in quantities of 3 each. The A^3 and B^3 models need one quantity each.

**Remember in order to print them in different colors, you will have to load them separately.