

COMUNICACIONES DEL CIMAT

85

FACES, VERTICES AND EDGES.

NO
EN

ARMANDO M. MARTINEZ CRUZ

JOVITA DE GPE. LERMA RICO.

ENVIADO A: PROJECTS TO ENRICH SCHOOL MATHEMATICS LEVEL I,
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS.

JOVITA LERMA RICO REALIZO LAS ACTIVIDADES CON UN GRUPO DE SEXTO DE PRIMARIA. ESTO COLABORO A DAR UNA FORMA DEFINITIVA AL TRABAJO.

CENTRO DE INVESTIGACION EN MATEMATICAS

Apartado Postal 402

Guanajuato, Gto.

México

Tels. (473) 2-25-50

2-02-58

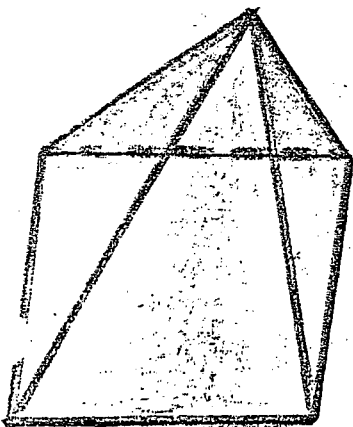
FACES, VERTICES AND EDGES.

Solids such as cube, tetrahedron, squared pyramid, octahedron (double pyramid), triangular prism, squared prism, etc. Student handouts.

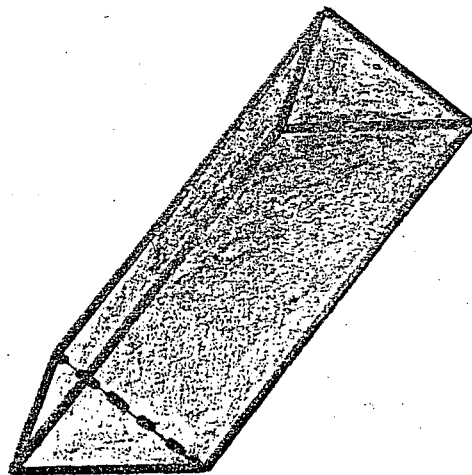
INTRODUCTION: Concepts such as face, vertex and edge are basic terms when dealing with geometric solids. In this activity you will use a chance to enhance the concepts that are familiar to you and to learn the unfamiliar concepts.

In this activity you will manipulate solids. They are named according to the shape of its faces. A special solid is the prism: it is a solid of which two faces are polygons and the others are rectangles.

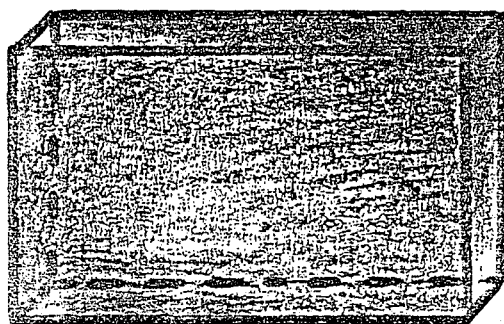
Here are some useful figures of them.



SQUARED PYRAMID



TRIANGULAR PRISM



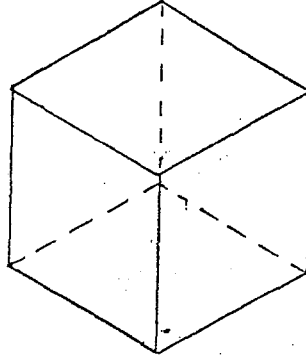
RECTANGULAR PRISM

ACTIVITY

1. COUNTING FACES, VERTICES, AND EDGES.

Count the faces, vertices and edges of the cube shown by teacher.

A cube looks like a die.



When you should get the results of the first row.

Fill out the next table.

SOLID	FACES	VERTICES	EDGES
CUBE	6	8	12
SQUARED PYRAMID			
DOUBLE PYRAMID			
TRIANGULAR PRISM			
PENTAGONAL PRISM			
RECTANGULAR PRISM			
HEXAAGONAL PRISM			
TETRAHEDRON			

II SECTION. SOLVING PROBLEMS.

Computing the total area of a solid is a problem that can be solved using a simpler solving problem strategy: computing the areas of the faces and adding them.

Now, compute the total area of the square pyramid. Its sizes are: Each triangle has basis equals 10 cm and height equals 5 cm. The square's size is 10 cm each side.

Each entry of the next table is found according to these instructions:

- a) Solid's name.
- b) Count the number of faces of the solid.
- c) Group faces according to shape.
- d) Compute one face area in each group.
- e) Multiply one face area times the number of such faces.
- f) Add the areas obtained before.

Fill out the next table.

SOLID	FACES	SHAPE OF FACES	SIZES	AREA	TOTAL AREA
SQUARE PYRAMID	5	4 TRIANGLES 1 SQUARE	HEIGHT = 5 cm BASIS = 10 cm SIDE = 10 cm	$4 \cdot (10 \cdot 5) / 2$ = 50 cm $1 \cdot 100 = 100$ cm	50 + 100 = 150 cm
CUBE			SIDE = 10 cm		
RECTANGULAR PRISM			HEIGHT = 5 cm BASIS = 3 cm HEIGHT = 12 cm		
TRIANGULAR PRISM			HEIGHT = 2 cm BASIS = 3 cm HEIGHT = 15 cm		

III SECTION. PATTERN RECOGNITION.

Fill out the next table, according to the solids shown by teacher.

The last column is obtained by adding FACES plus VERTICES.

SOLID	FACES	VERTICES	EDGES	FACES + VERTICES
DOUBLE PYRAMID	8	6	12	14
CUBE				
TETRAHEDRON				
TRIANGULAR PRISM				
SQUARED PRISM				
PENTAGONAL PRISM				
HEXAGONAL PRISM				
DOUBLE PYRAMID				

Ask the next questions in relation to the last two columns:

- a) Are the numbers even in both columns?
- b) Which one is bigger?
- c) How much is bigger?
- d) Compute the difference between corresponding entries in the last two columns.
- e) Do you notice a relation between these columns?
- f) Can you write out the numerical relation between these numbers?

TEACHER NOTES

FACES, VERTICES AND EDGES.

(Grade 6)

KEY WORDS: Face, vertex, edge.

MATHEMATICAL SKILLS: Problem solving, pattern recognition.

PREREQUISITES: Counting, adding, computing polygon areas:
triangles, squares, rectangles, etc.

RATIONALE: Solving problems and inquiring mind are skills that the students must acquire and develop. Manipulatives are used to reach this objective.

PREPARE ENOUGH SOLIDS AND THE THREE TABLES USED IN ACTIVITY.

I SECTION. COUNTING FACES, VERTICES, AND EDGES.

Teacher activity. Review the notions of face, vertex and edge.

Introduce the needed concepts.

II SECTION. SOLVING PROBLEMS.

Teacher activity. Review the notions of perimeter and area.

The strategy used in activity is very useful, insist on each step made by students.

III SECTION. PATTERN RECOGNITION.

Teacher activity. In this section, more teacher guidance is required. It must be emphasized that it is looking for a numerical relation between the sum of vertices plus faces and edges.

Conclusions:

The three concepts of face, vertex and, edge perhaps may be familiar to the students, maybe not. The first section is devoted to enhance and/or introduce them.

These concepts of face, vertex and, edge are very useful in

geometry. In the second section two basic properties are used: commutativity and associative law for addition.

The formula obtained in third section is known as Euler's formula and is

$$F(\text{aces}) + V(\text{ertexes}) - 2 = E(\text{dges}).$$

Extensions:

Let the students find out problems that can be solved with the strategy shown in second section, for example: painting a room (thinking of it as a closed box), computing the classroom area, etc.

References.

Curiosities of the cube. Ranucci, E. and Rollins, W. Thomas Y. Crowell Co. USA.

How to solve it. Polya, G. Princeton Univ. Press. USA.

Mathematics through paper folding. Olson, P. NCTM. USA.

Paper folding for the mathematics class. Johnson, D. NCTM. USA.

Polyhedron models for the classroom. Wenninger, M. NCTM. USA.

Spherical Models. Wenninger, M. Cambridge Univ. Press. USA.