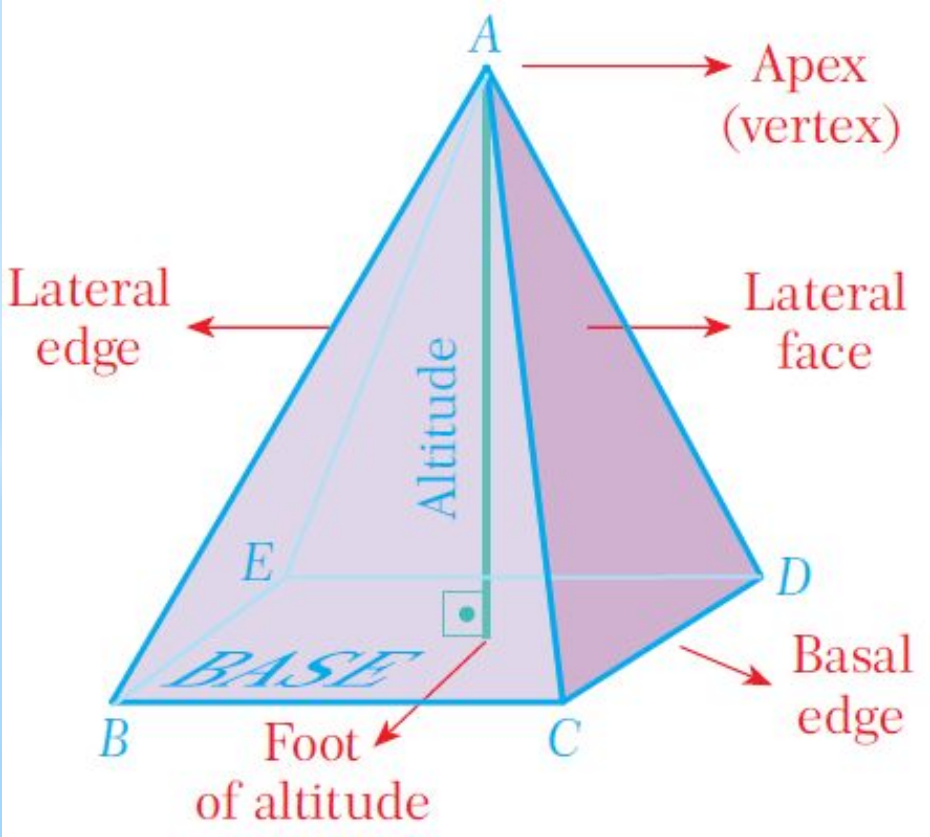
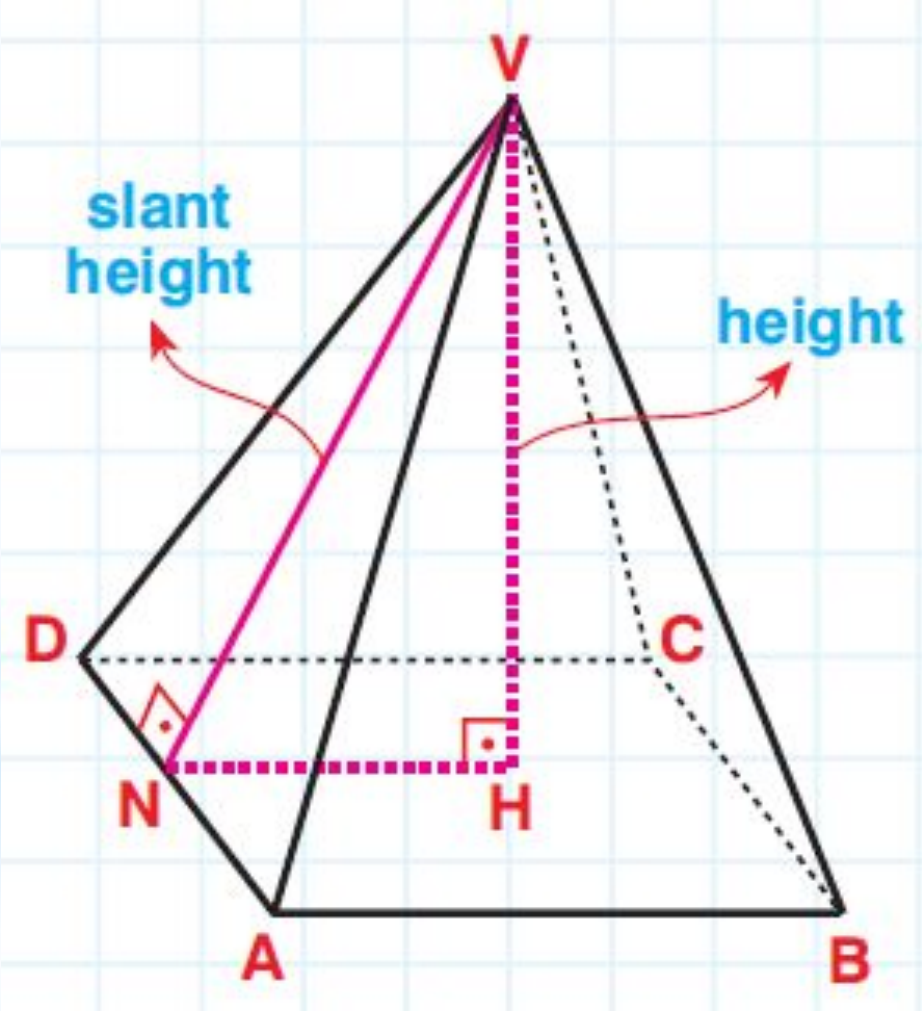
*Pyramid

Pyramid is a polyhedron with one polygon face (called the base). All the other faces are triangles which meet at the apex.

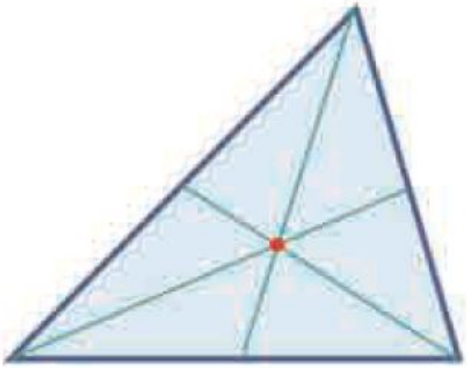


Apothem

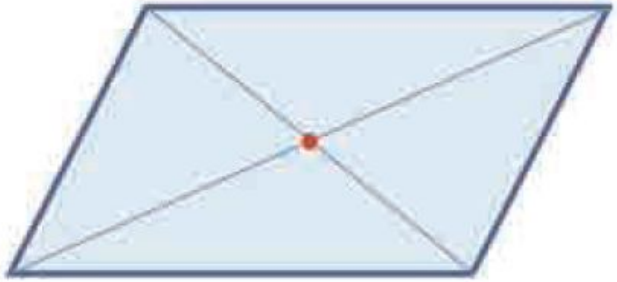


Centroid

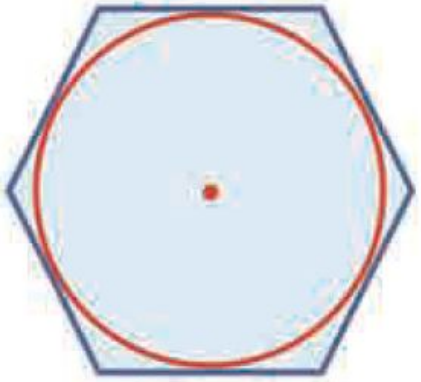
The **centroid** of a polygon is its geometric center. It is the average sum of the displacements of all the points in the polygon from a relative origin. The centroid of a plane figure is also its center of gravity. There are different methods which we can use to find the centroids of different shapes.



The centroid of a triangle is the intersection point of its medians.



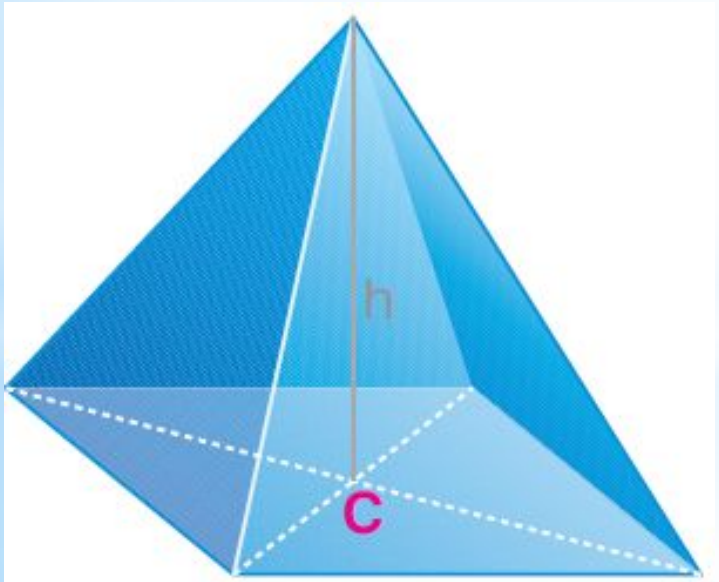
The centroid of a parallelogram is the intersection point of its diagonals.



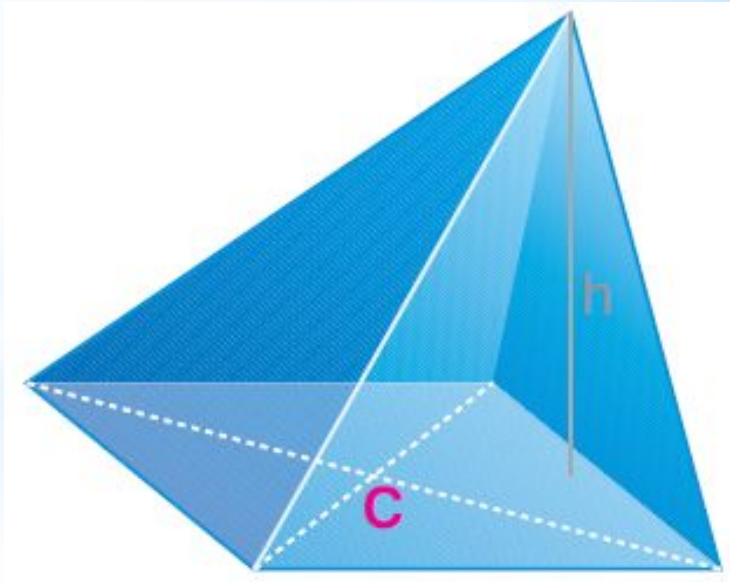
The centroid of a regular hexagon is the center of its incircle.

1. Right and Oblique Pyramids

In right pyramids, the foot of the altitude is at the centroid of the base. If a pyramid is not right, it is an oblique pyramid.



Right pyramid



Oblique pyramid

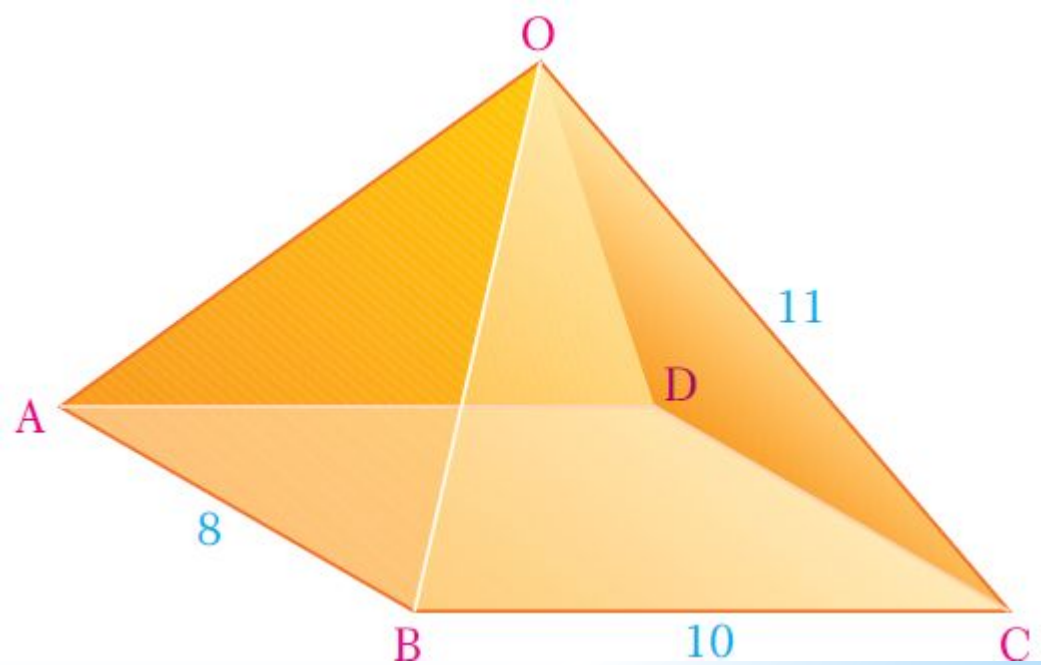
EXAMPLE:

A right pyramid has a rectangular base with sides 6 m and 10 m. The length of a lateral edge is 13 m.

a. Find the sum of the edge lengths of the pyramid.
b. Find the slant heights of the pyramid.

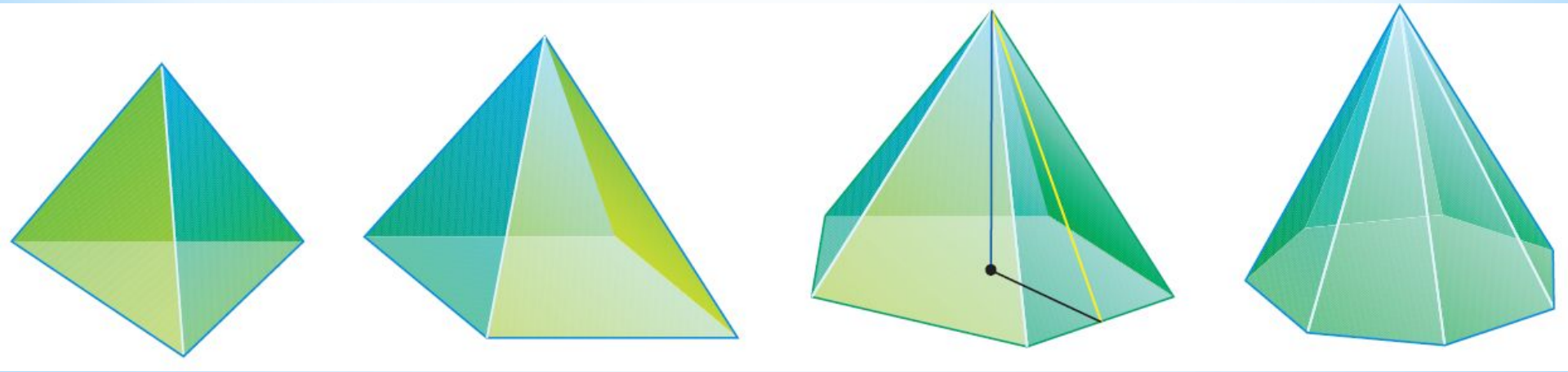
EXAMPLE:

In the adjacent rectangular right pyramid, the base dimensions are 8 cm and 10 cm and the lateral edge is 11 cm. What is the height of this pyramid?



2. Regular Pyramids

If the base of a right pyramid is a regular polygon, the pyramid is called a regular pyramid.

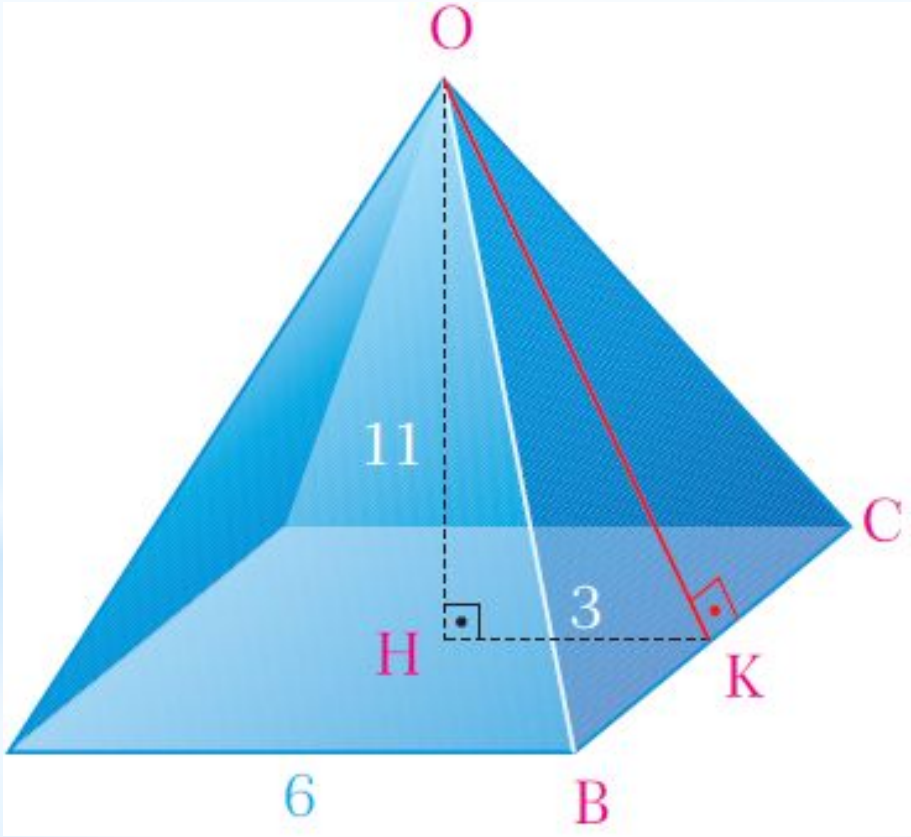


Properties of a regular pyramid

1. The lateral edges of a regular pyramid are congruent.
2. The lateral faces of a regular pyramid are identical isosceles triangles.
3. The slant heights(APOTHEM) of a regular pyramid are all equal.

EXAMPLE:

A square right pyramid has base edge 6 cm and height 11 cm. What is the apothem of the pyramid?

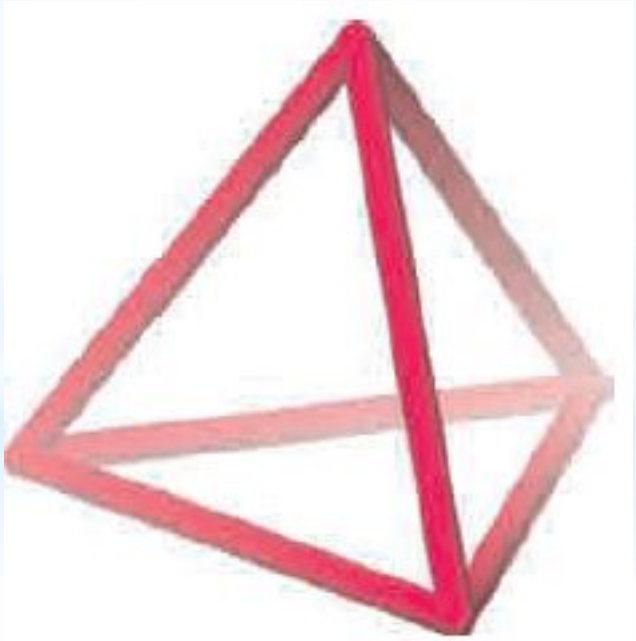


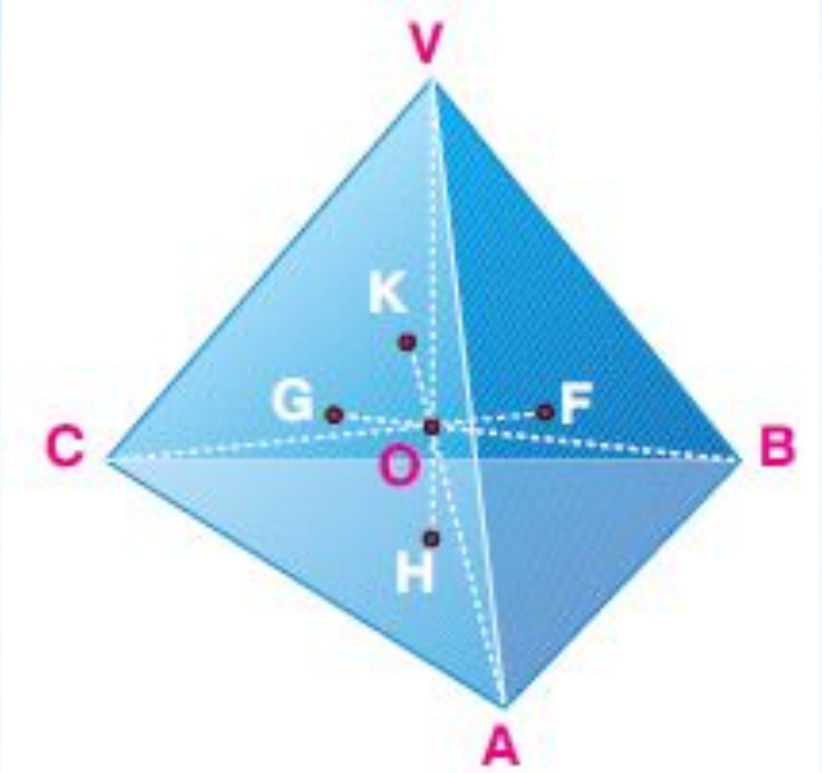
EXAMPLE:

The apothem of a regular pentagonal pyramid is 10 cm, and a lateral edge is 12 cm. Find the perimeter of the base.

3. Regular Tetrahedron

A regular tetrahedron is a triangular pyramid whose edges are all congruent. All the faces of a regular tetrahedron are equilateral triangles.





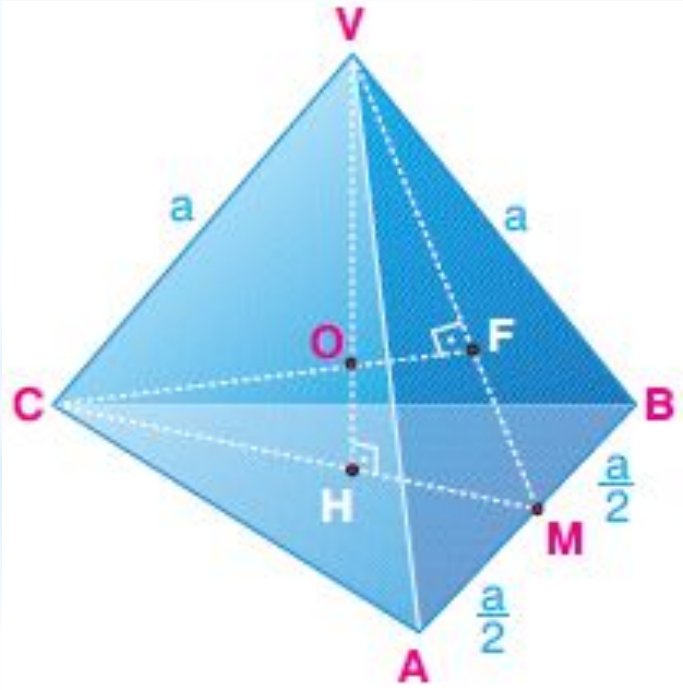
Centroid of a Tetrahedron

The centroid of a regular tetrahedron is a quarter height away from the centroid of each base. In the figure,

$$\frac{OH}{VH}=\frac{1}{4} \qquad \frac{OK}{AK}=\frac{1}{4} \qquad \frac{OG}{BG}=\frac{1}{4} \qquad \frac{OF}{CF}=\frac{1}{4}.$$

If the length of one edge of a regular tetrahedron is a, then

- its slant height is $h_a = \frac{a \cdot \sqrt{3}}{2}$.
- its altitude (median) is $h = \frac{a \cdot \sqrt{6}}{3}$.



EXAMPLE:

Find the slant height and median height of a regular tetrahedron with edge length 10 cm.

EXAMPLE:

What is the distance from the centroid to the base of a regular tetrahedron with edge length 12 cm?

4. Square Pyramid

A square pyramid is a pyramid with a square base and triangular sides.

EXAMPLE:

What is the height of a regular square pyramid whose edges are all congruent and 10 cm?

EXAMPLE:

find the lateral face area of a regular square based pyramid given that its base perimeter is 32 m and the lateral edge is 5 m?

5. Regular Octahedron

A regular octahedron is a solid composed of eight equilateral triangular faces. At each vertex, four of these faces meet.

EXAMPLE:

What is the total surface area of a regular octahedron if its edge length is 7 cm?

EXAMPLE:

For a rectangular right pyramid, the base dimensions are 6 cm and 12 cm and the lateral edge is 10 cm. What is the height of this pyramid?

EXAMPLE:

The apothem of a hexagonal regular pyramid is 11 m and the height of the pyramid is 9 m. What is the apothem of the base?

EXAMPLE:

The base perimeter of a regular octagonal pyramid is 64 cm and a lateral edge is 9 cm. Find the length of an apothem.

EXAMPLE:

What is the length of the median of a regular tetrahedron if one edge is 9 cm?

EXAMPLE:

Find the total surface area of a regular octahedron if every edge is 5 cm.