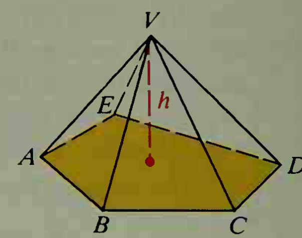
12-2 *Pyramids*

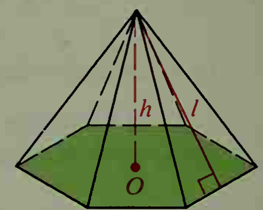


The diagram shows the pentagonal **pyramid** $V\text{-}ABCDE$. Point V is the **vertex** of the pyramid and pentagon $ABCDE$ is the **base.** The segment from the vertex perpendicular to the base is the **altitude** and its length is the *height*, h, of the pyramid.

The five triangular faces with V in common, such as $\triangle VAB$, are **lateral faces.** These faces intersect in segments called **lateral edges.**

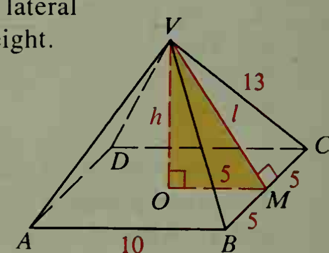
Most of the pyramids you'll study will be **regular pyramids.** These are pyramids with the following properties:

(1) The base is a regular polygon.
(2) All lateral edges are congruent.
(3) All lateral faces are congruent isosceles triangles. The height of a lateral face is called the **slant height** of the pyramid. It is denoted by l.
(4) The altitude meets the base at its center, O.



Regular hexagonal pyramid

Example 1 A regular square pyramid has base edges 10 and lateral edges 13. Find **(a)** its slant height and **(b)** its height.

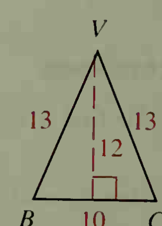


Solution Use the Pythagorean Theorem.

a. In rt. $\triangle VMC$,
$$l = \sqrt{13^2 - 5^2} = 12.$$

b. In rt. $\triangle VOM$,
$$h = \sqrt{12^2 - 5^2} = \sqrt{119}.$$

Example 2 Find the lateral area of the pyramid in Example 1.



Solution The four lateral faces are congruent.

area of $\triangle VBC = \frac{1}{2} \cdot 10 \cdot 12 = 60$

lateral area = area of 4 lateral faces
$= 4 \cdot$ area of $\triangle VBC$
$= 4 \cdot 60 = 240$

Example 2 illustrates a simple method for finding the lateral area of a regular pyramid. It is Method 1, summarized below.

To find the lateral area of a **regular** pyramid with n lateral faces:

Method 1 Find the area of one lateral face and multiply by n.

Method 2 Use the formula L.A. $= \frac{1}{2}pl$, stated as the next theorem.