

Grade 7 · Cross Sections of 3D Figures · Lesson

Common Core 7.G.A.3 · mathovore.fr

A cross section is the flat shape you see when a plane slices through a solid. Slicing a rectangular prism parallel to its base gives a rectangle the same size as the base. Slicing a rectangular pyramid parallel to its base gives a smaller rectangle, and a vertical slice through its apex gives a triangle.

Grade 7 Common Core: 7.G.A.3

Key facts:

- A cross section is the two-dimensional shape where a plane meets a solid.
- Any slice of a right rectangular prism that is parallel or perpendicular to the base is a rectangle.
- A slice of a right rectangular pyramid parallel to the base is a smaller rectangle.
- A slice of a right rectangular pyramid perpendicular to the base is a triangle if it passes through the apex, and a trapezoid if it does not.
- The area of a cross section is found with the usual area formula for its shape.

What is a cross section of a 3D figure?

Imagine slicing a loaf of bread with a straight knife. The cut surface is flat, and its outline is the cross section. In geometry the knife is a plane, and the cross section is the 2D figure where the plane meets the solid.

Cross section

The two-dimensional shape formed when a plane slices through a three-dimensional figure. In Grade 7 the plane is either **parallel** to the base or **perpendicular** to the base.

What are the cross sections of a rectangular prism?

A right rectangular prism has rectangular faces, so every slice parallel or perpendicular to the base is a rectangle. A slice parallel to the base is a copy of the base. A vertical slice has the height of the prism as one side.

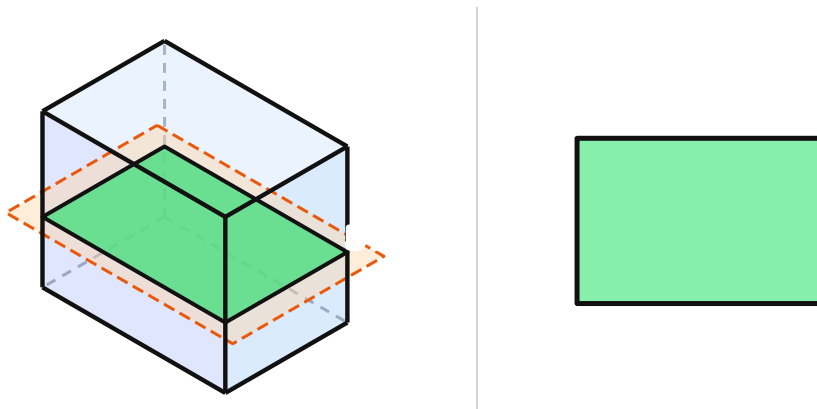


Figure 1. A slice parallel to the base of a prism is a rectangle congruent to the base.

A vertical slice through two opposite corners of the base is still a rectangle, but it is longer than the sides of the base.

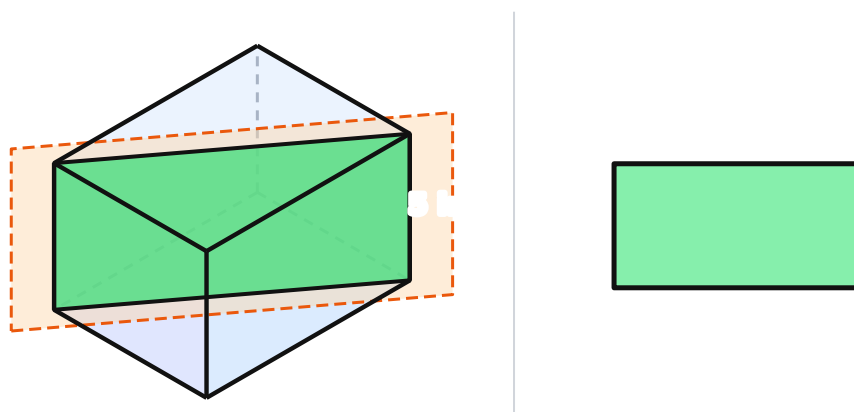


Figure 2. A vertical slice across the base diagonal is a 10 in. by 5 in. rectangle.

What are the cross sections of a rectangular pyramid?

A right rectangular pyramid narrows to a point called the apex. The shape of the slice depends on where the plane cuts.

Plane	Cross section
Parallel to the base	Rectangle smaller than the base
Perpendicular to the base, through the apex	Triangle
Perpendicular to the base, parallel to a base edge, not through the apex	Trapezoid

Higher slices parallel to the base are smaller. Each side shrinks by the same fraction, so the slice keeps the shape of the base.

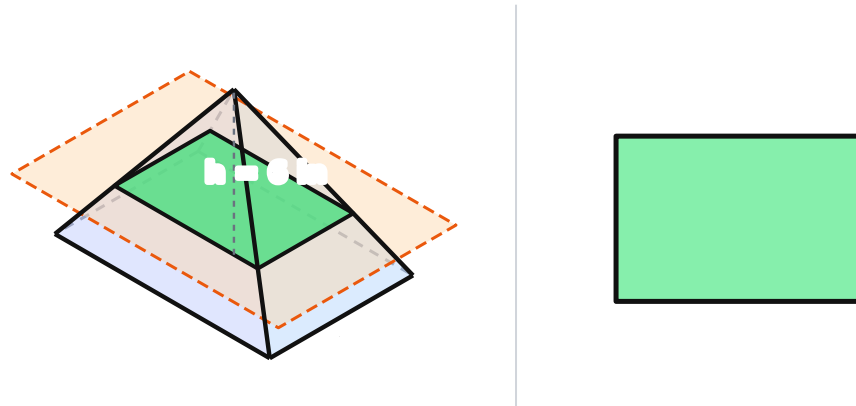


Figure 3. A slice parallel to the base of a pyramid is a smaller rectangle.

A vertical slice through the apex cuts the pyramid down the middle and leaves a triangle.

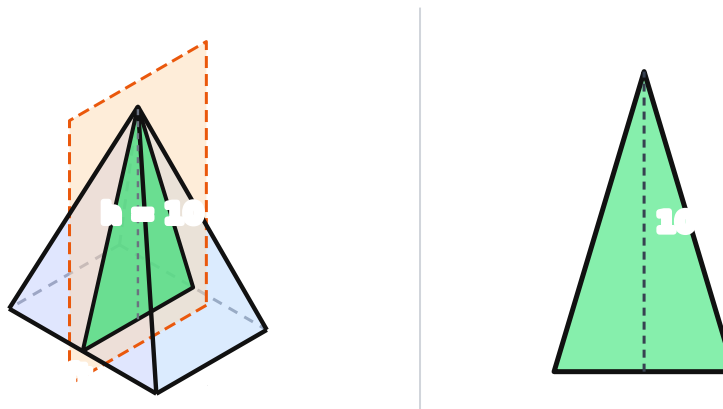


Figure 4. A vertical slice through the apex is a triangle.

A vertical slice that misses the apex has parallel top and bottom edges but slanted sides, so it is a trapezoid.

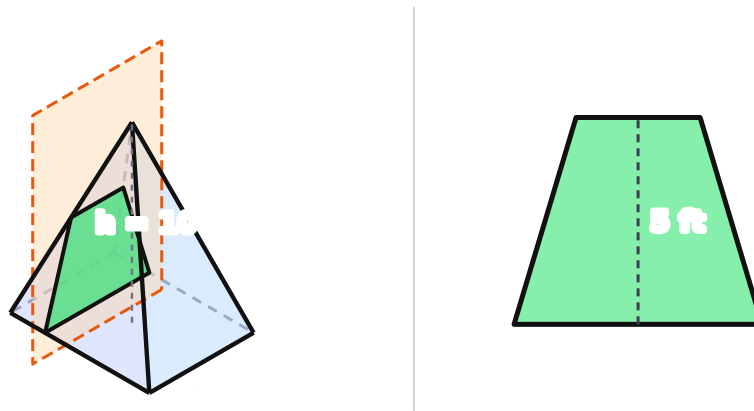


Figure 5. A vertical slice that misses the apex is a trapezoid.

How do you find the size and area of a cross section?

Worked method: slice parallel to the base

A pyramid has a 9 in. by 6 in. base and a height of 6 in. A plane parallel to the base cuts it 2 in. above the base. Find the area of the cross section.

1. Name the shape. A slice parallel to the base is a rectangle.
2. Find the fraction of the height left above the cut: $\frac{6-2}{6} = \frac{2}{3}$.
3. Multiply each base side by that fraction: $9 \times \frac{2}{3} = 6$ and $6 \times \frac{2}{3} = 4$.
4. Find the area: $6 \times 4 = 24 \text{ in.}^2$.

Cross Sections of 3D Figures: frequently asked questions

What is a cross section in geometry?

A cross section is the 2D shape that appears where a plane slices through a 3D solid. For a rectangular prism cut parallel to its base, the cross section is a rectangle that matches the base.

What shape is a slice of a rectangular prism perpendicular to the base?

It is always a rectangle. One side of the rectangle is the height of the prism, and the other side is the length of the cut across the base.

Which cross sections can a rectangular pyramid have?

With a plane parallel to the base, the cross section is a rectangle. With a plane perpendicular to the base, it is a triangle when the plane passes through the apex and a trapezoid when it

does not.

Why is a slice parallel to the base of a pyramid smaller than the base?

The pyramid gets narrower as it rises toward the apex. The higher the cut, the smaller the rectangle, and at the apex it shrinks to a single point.

How do you find the area of a cross section?

First name the shape, then find its side lengths, then use the area formula. A rectangle uses length times width, a triangle uses $\frac{1}{2} \times \text{base} \times \text{height}$, and a trapezoid uses $\frac{1}{2}(b_1 + b_2)h$.