

Cross Sections of Prisms and Pyramids

Grade 7 math · Lesson · Standards: 7.G.A.3

Quick answer: A cross section is the shape formed where a plane slices a solid. Slices of a rectangular prism are rectangles. For a rectangular pyramid, a cut parallel to the base gives a smaller rectangle, a vertical cut through the apex gives a triangle, and a vertical cut that misses the apex gives a trapezoid.

Standards: 7.G.A.3 · **Level:** Grade 7

What is a cross section?

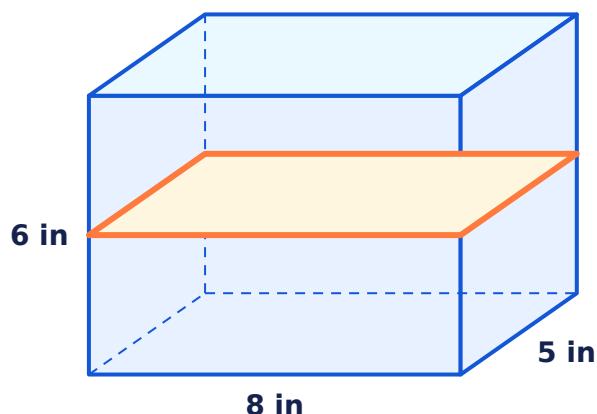
Slice a solid with one flat sheet of glass, and the outline left on the glass is a cross section. Cut a block of cheese straight through and the fresh face you see has that shape.

Cross section

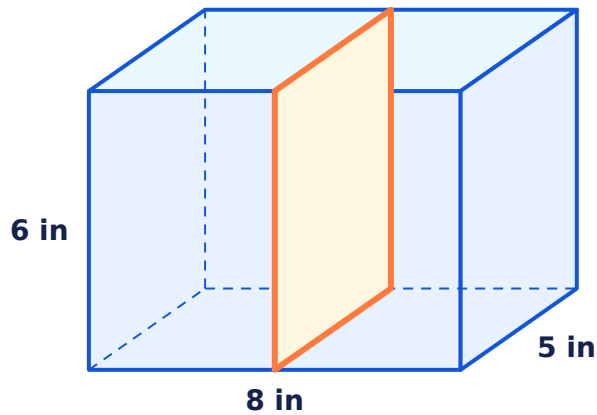
The two-dimensional figure shared by a solid and a cutting plane. Grade 7 cuts are either **parallel** or **perpendicular** to the bottom face of a box-shaped prism or a pyramid with a rectangular base.

What do slices of a rectangular prism look like?

A prism has the same shape from bottom to top, so its slices are always rectangles. A slice parallel to the base copies the base exactly. A slice perpendicular to the base has the prism's height as one side.



A slice parallel to the base is a rectangle with the same dimensions as the base: 8 in by 5 in.

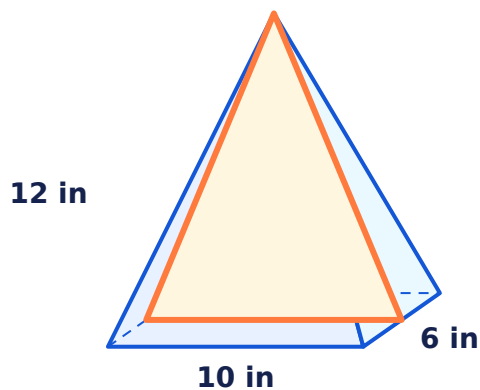


A slice perpendicular to the base is a rectangle whose sides are the height and one base edge: 5 in by 6 in.

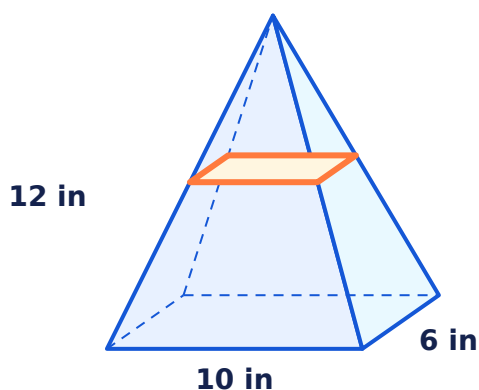
What do slices of a rectangular pyramid look like?

A pyramid tapers to a point, so the shape of the slice depends on where and how the cut is made.

Cut	Cross section
Level cut, parallel to the base	a smaller rectangle with the same proportions as the base
Upright cut that passes through the apex	a triangle
Upright cut that passes beside the apex	a trapezoid



A vertical slice through the apex is a triangle with base 10 in and height 12 in.



A slice parallel to the base is a smaller rectangle: halfway up gives 5 in by 3 in.

How do you find the dimensions of a cross section?

Method

1. Draw the solid and mark where the cut goes.
2. Match the cut to a row of the table above.
3. For a prism slice parallel to the base, copy the base; for a pyramid slice parallel to the base, multiply the base sides by (distance from apex) $\div$ (pyramid height).
4. Multiply the sides, or use the triangle or trapezoid formula, to get the area.

Worked example

A pyramid has a 10 in by 6 in base and a height of 12 in. A plane parallel to the base cuts it 6 in below the apex. The scale factor is $6 \div 12 = \frac{1}{2}$, so the rectangle is 5 in by 3 in, with area **15 square inches**.

Not every slice is a triangle

A triangle shows up only when the cut passes through the apex of a pyramid. A level cut gives a rectangle, and an upright cut beside the apex gives a trapezoid.

Mathbot's tip

Imagine pressing a block of clay against a sheet of glass: the patch of clay touching the glass is the cross section.

Key points to remember

- A cross section is the two-dimensional face where a plane meets a solid.
- Every parallel or perpendicular slice of a rectangular prism is a rectangle.

- A pyramid slice parallel to its base is a rectangle similar to the base, scaled by distance from the apex $\div$ height.
- A vertical pyramid slice is a triangle through the apex and a trapezoid otherwise.

Cross Sections of Prisms and Pyramids: frequently asked questions

What shape is a slice parallel to the base of a prism?

It is a rectangle congruent to the base, because the prism has the same dimensions at every height. A prism with a square base gives a square.

Can a slice of a rectangular prism be a triangle?

Not with a plane that is parallel or perpendicular to the base. Such cuts always give rectangles. Tilted planes can give other shapes, but they are outside grade 7.

How do I find the size of a pyramid slice parallel to the base?

Multiply each base side by the ratio of the slice's distance from the apex to the pyramid's height. A slice halfway up has sides half as long as the base.

Why is the vertical slice of a pyramid sometimes a trapezoid?

If the plane misses the apex, the slice has two parallel sides, one on the base and one lower than the apex, with slanted sides along the faces. That is a trapezoid.

How are cross sections used in the real world?

Architects and engineers draw floor plans and section views, and doctors read scans as cross sections of the body. Each shows the inside of a solid as a flat shape.