

Shadow of House

Keywords: space geometry, cabinet axonometry, lighting

Martin wants to set up a space on his canvas to draw a house on a sunny day. Therefore, he visualized a simple model of a house in a parallel (orthographic) projection, standing on a horizontal flat ground. House is formed by a rectangular cuboid with a simple hip roof. *Hip roof* is a roof formed by two isosceles triangles and two isosceles trapezoids. All four roof planes have the same slope. On a canvas next to the house, he placed a vertical rod and its shadow(see the figure).

To describe the solution, we will need the following terms:

- *The self shadow* of an object is the unlit part of the object's surface. A closed line on the surface of the object that separates the lit and the unlit parts is called *the boundary of the self shadow*.
- *The cast shadow* of an object is the projection of the object in the direction of the light rays onto the given plane. It holds that *the boundary of the cast shadow is the cast shadow of the boundary of the self shadow*

Exercise 1. Mark on the figure the self shadow of the house and the shadow of the house cast on the ground by the sun. (The distance from the Sun to the surface of the Earth is so great that we can consider the sun rays to be parallel to each other.)

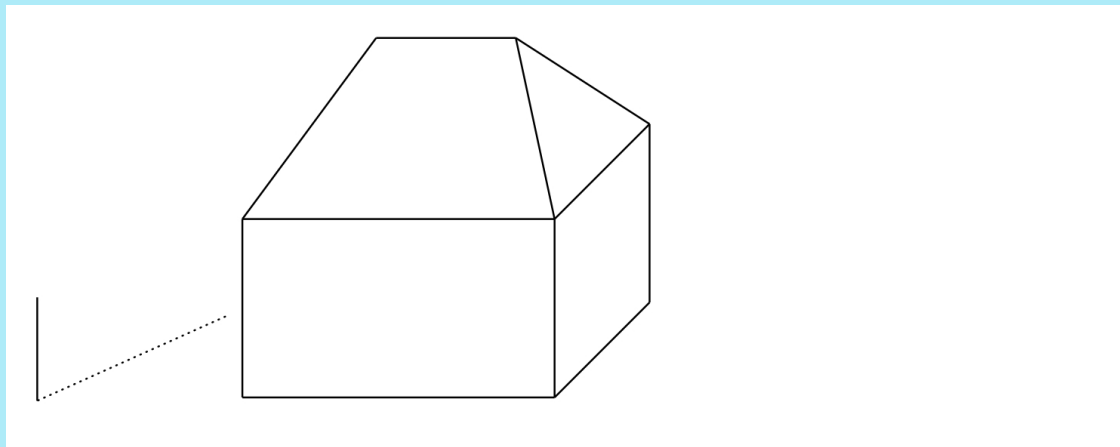


Figure 1: Model of a house with specified lighting

Exercise 2. Draw the cast shadow of the house if there is an opaque wall behind the house, which is parallel to the front and back walls of the house.

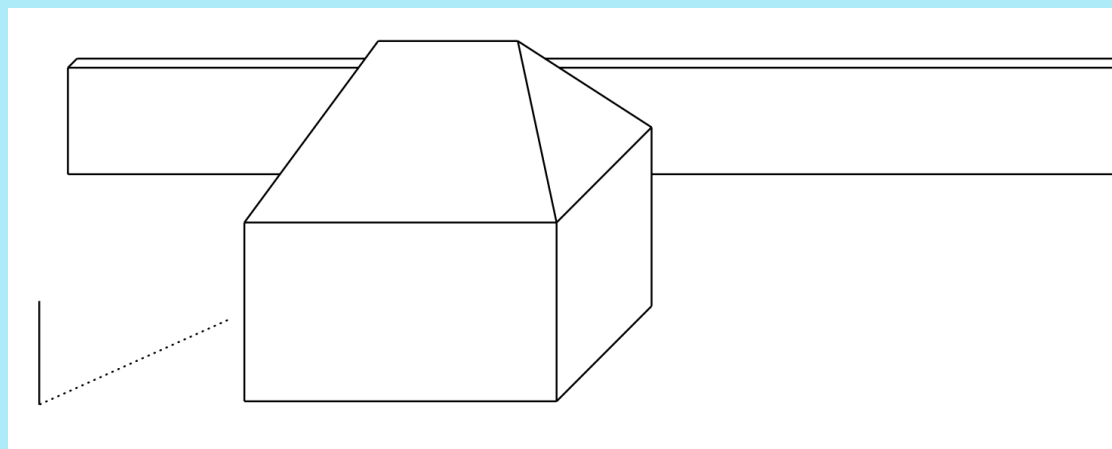


Figure 2: Model of a house with wall and lighting

Note. For better visualization, an interactive applet in GeoGebra may also help. In the applet, the direction of the sun's rays can be modified to a certain extent, see <https://www.geogebra.org/m/ecyqv4qg>

Exercise 3. Mark on the figure the self shadow of the house and the shadow of the house cast on the ground by the sun. (The distance from the Sun to the surface of the Earth is so great that we can consider the sun rays to be parallel to each other.)

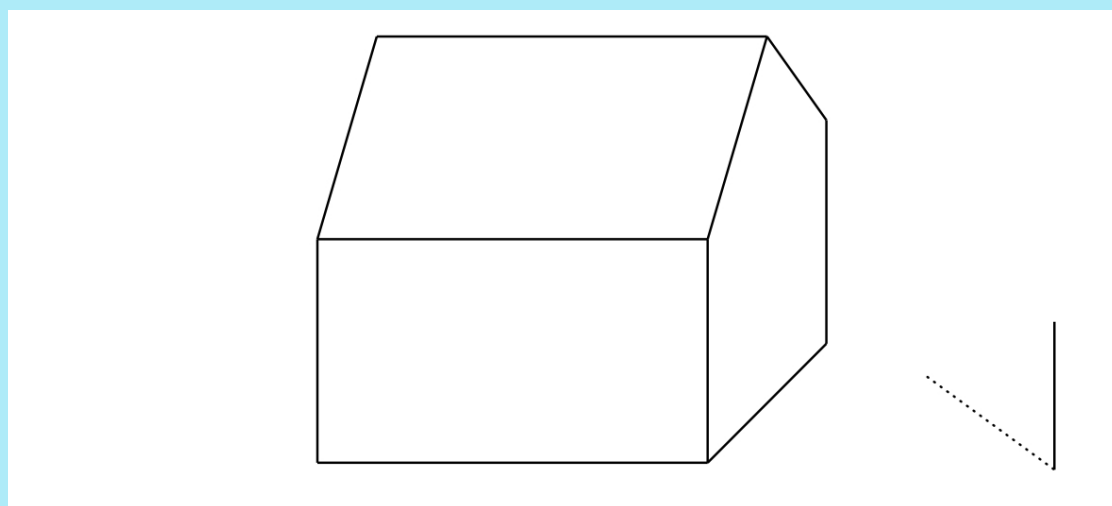


Figure 3: Model of a house with specified lighting

Literature

1. Pomykalová E. *Deskriptivní geometrie pro střední školy*. Prometheus. 2010. 106—107.