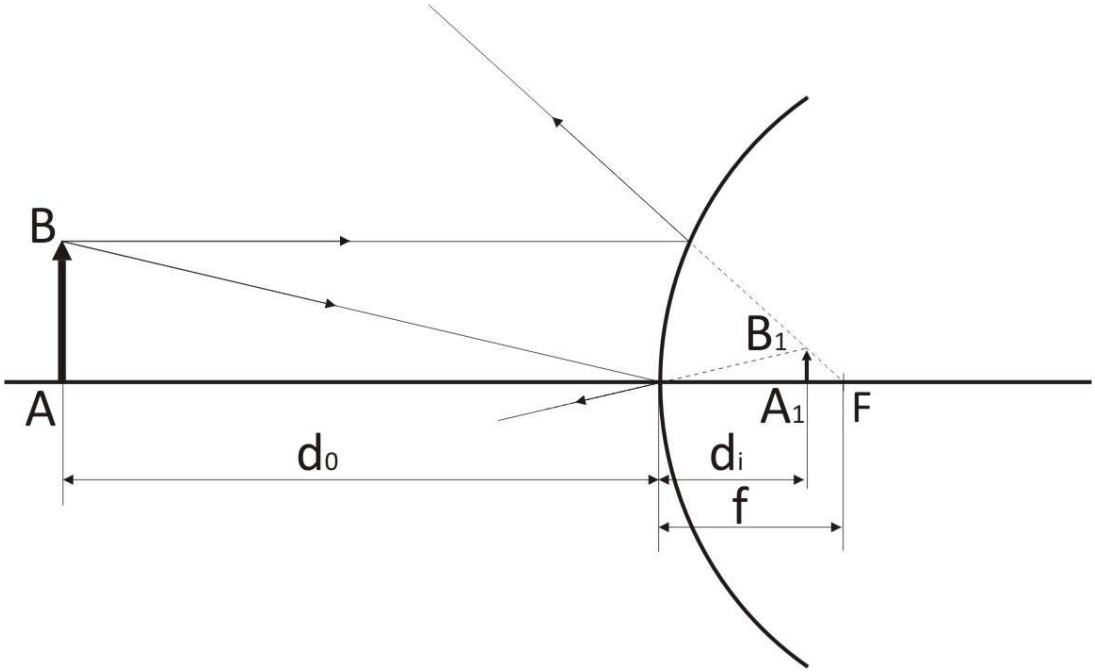
A reflecting, spherical Christmas tree ornament has a diameter of 9.0 cm. A child looks at the ornament from a distance of 24 cm. Describe the image she sees. Where is the image located?

Solution.

$$d = 9.0cm = 0.09m, d_o = 24cm = 0.24m;$$
$$d_i - ?$$



Spherical Christmas tree ornament is the convex mirror.

The symbols in the diagram:

d_o – a distance from the object to the mirror;

d_i – a distance from the image to the mirror;

f – a focal length of the mirror;

AB – object;

A_1B_1 – image.

The mirror equation:

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}.$$

f is negative, because the mirror is convex.

d_i is negative, because the image is formed behind the mirror.

$$\frac{1}{d_o} - \frac{1}{d_i} = -\frac{1}{f}.$$

A focal length of the mirror:

$$f = \frac{r}{2};$$

r - the radius of the spherical mirror.

$$r = \frac{d}{2};$$

$$f = \frac{d}{4}.$$

$$\frac{1}{d_o} - \frac{1}{d_i} = -\frac{4}{d}.$$

$$\frac{1}{d_i} = \frac{1}{d_o} + \frac{4}{d};$$

$$\frac{1}{d_i} = \frac{d + 4d_o}{d \cdot d_o};$$

$$d_i = \frac{d \cdot d_o}{d + 4d_o}.$$

$$d_i = \frac{0.09 \cdot 0.24}{0.09 + 4 \cdot 0.24} = 0.02(m) = 2(cm).$$

Answer: A child sees the virtual upright diminished image of himself. The image is located behind the mirror. The distance from the image to the mirror is: d_i=2cm.