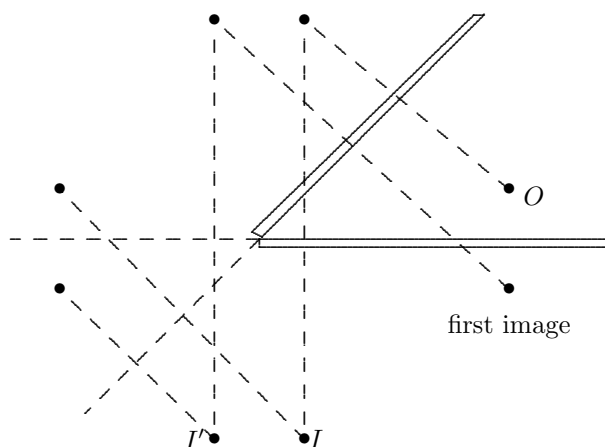


4. In each case there is an object and its “first” image in the mirror closest to it (this image is the same distance behind the mirror as the object is in front of it and might be referred to as the object’s “twin”). The rest of the “figuring” consists of drawing perpendiculars from these (or imagining doing so) to the mirror-planes and constructing further images.

- (a) For $\theta = 45^\circ$, we have two images in the second mirror caused by the object and its “first” image, and from these one can construct two new images I and I' behind the first mirror plane. Extending the second mirror plane, we can find two further images of I and I' which are on equal sides of the extension of the first mirror plane. This circumstance implies there are no further images, since these final images are each other’s “twins.” We show this construction in the figure below. Summarizing, we find $1 + 2 + 2 + 2 = 7$ images in this case.



- (b) For $\theta = 60^\circ$, we have two images in the second mirror caused by the object and its “first” image, and from these one can construct two new images I and I' behind the first mirror plane. The images I and I' are each other’s “twins” in the sense that they are each other’s reflections about the extension of the second mirror plane; there are no further images. Summarizing, we find $1 + 2 + 2 = 5$ images in this case.
- (c) For $\theta = 120^\circ$, we have two images I'_1 and I_2 behind the extension of the second mirror plane, caused by the object and its “first” image (which we refer to here as I_1). No further images can be constructed from I'_1 and I_2 , since the method indicated above would place any further possibilities in front of the mirrors. This construction has the disadvantage of deemphasizing the actual ray-tracing, and thus any dependence on where the observer of these images is actually placing his or her eyes. It turns out in this case that the number of images that can be seen ranges from 1 to 3, depending on the locations of both the object and the observer. As an example, if the observer’s eye is collinear with I_1 and I'_1 , then the observer can only see one image (I_1 and not the one behind it). Another observer, close to the second mirror would probably be able to see only I_1 and I_2 . However, if that observer moves further back from the vertex of the two mirrors he or she should also be able to see the third image, I'_1 , which is essentially the “twin” image formed from I_1 relative to the extension of the second mirror plane.