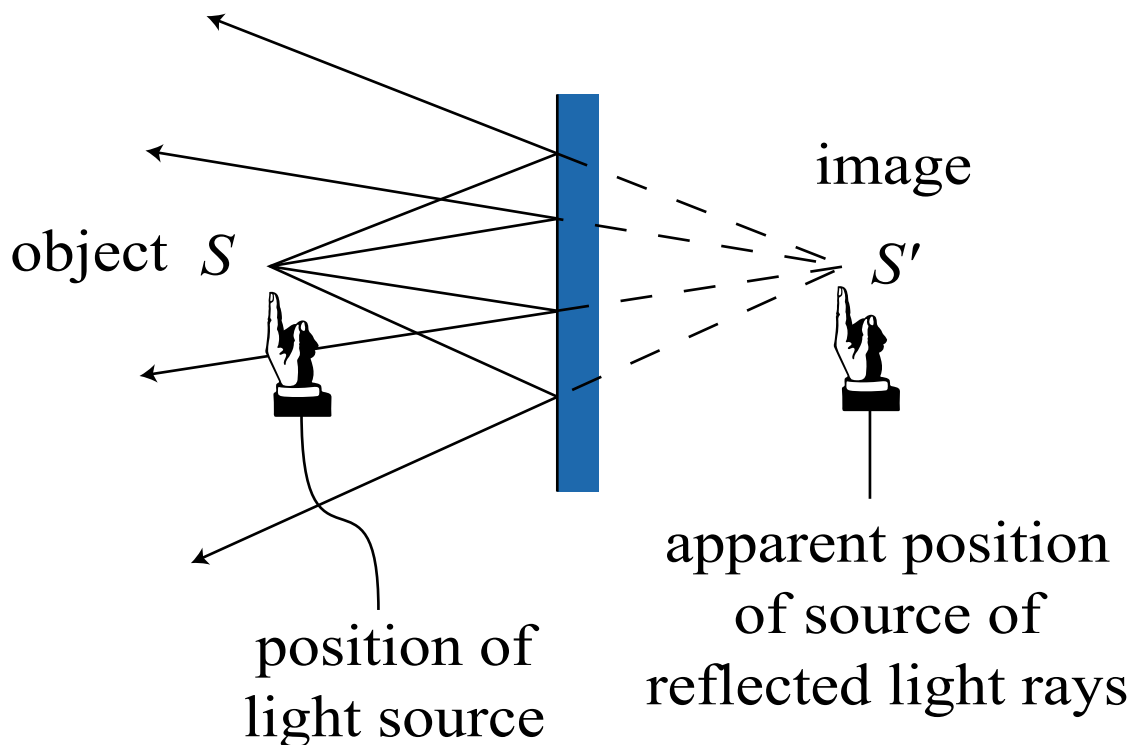


1.3 Images formed by spherical mirrors

Benson 35.6&7, p. 719ff

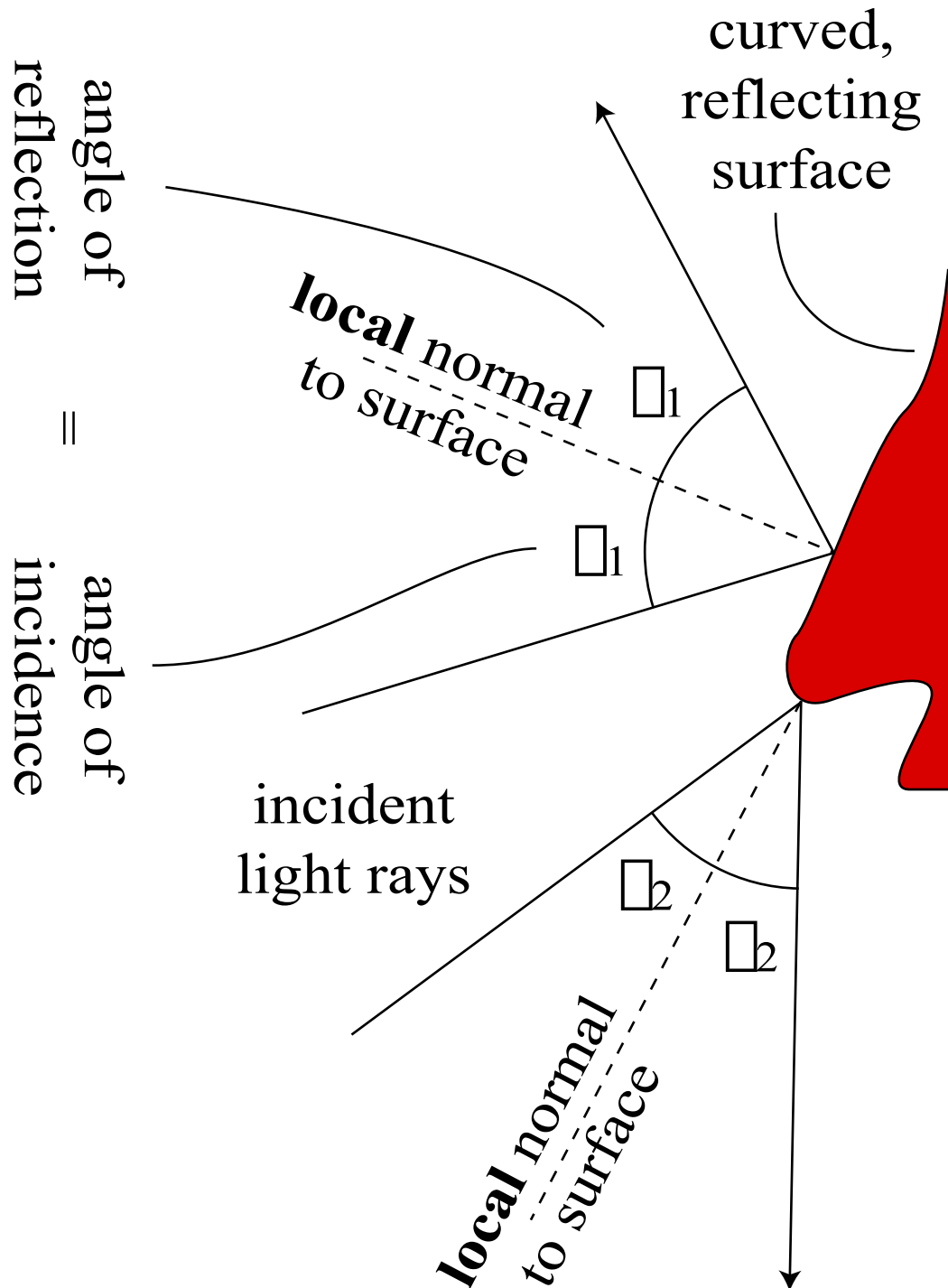
1.3.1 Reminder: Images formed by plane mirrors



the continuation of every reflected ray which originated at S intersects at S'
our eye-brain system *infers* that they originated at S'

Incidentally, why do mirrors interchange left and right? Answer in Benson (p. 720)

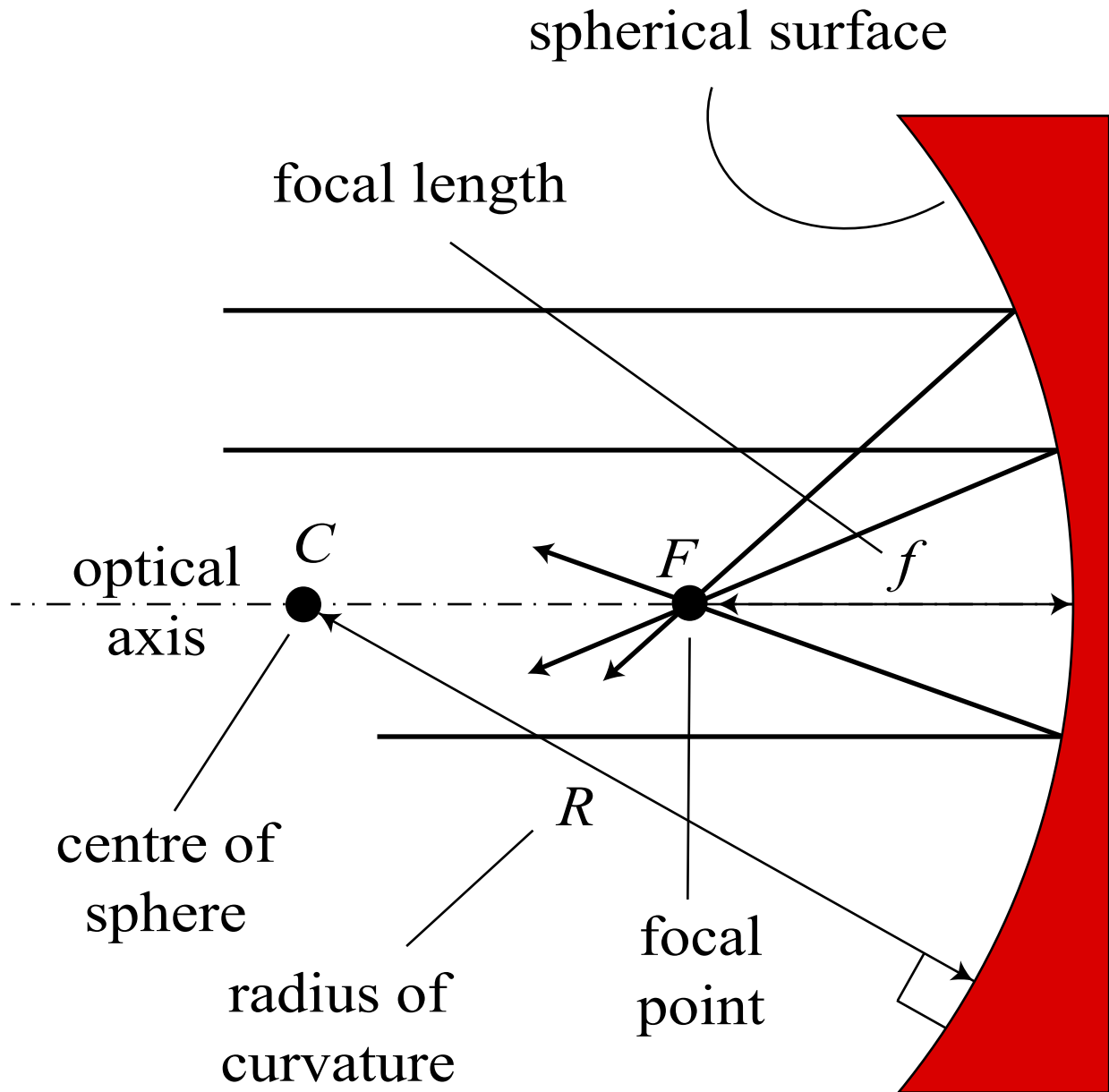
1.3.2 Reflection at curved surfaces



law of reflection still holds, provided all angles are measured w.r.t. the local normal to surface

1.3.3 Focal length and radius of curvature of spherical mirrors

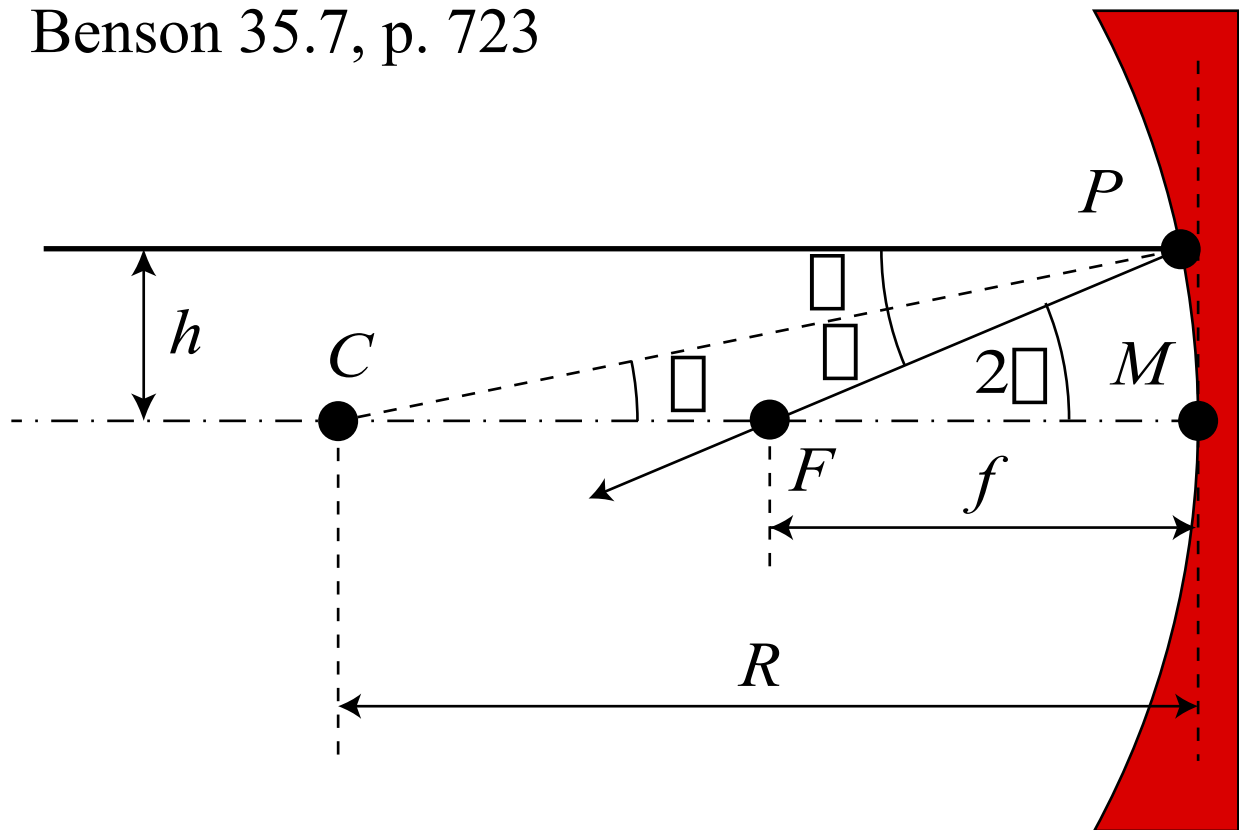
Benson 35.7



after reflection, every light ray that is initially parallel to the optical axis passes through the mirror's focal point, F , located a distance f from the mirror

calculate the focal length, f :

Benson 35.7, p. 723



triangle CPM : $\frac{h}{R} = \tan \theta$

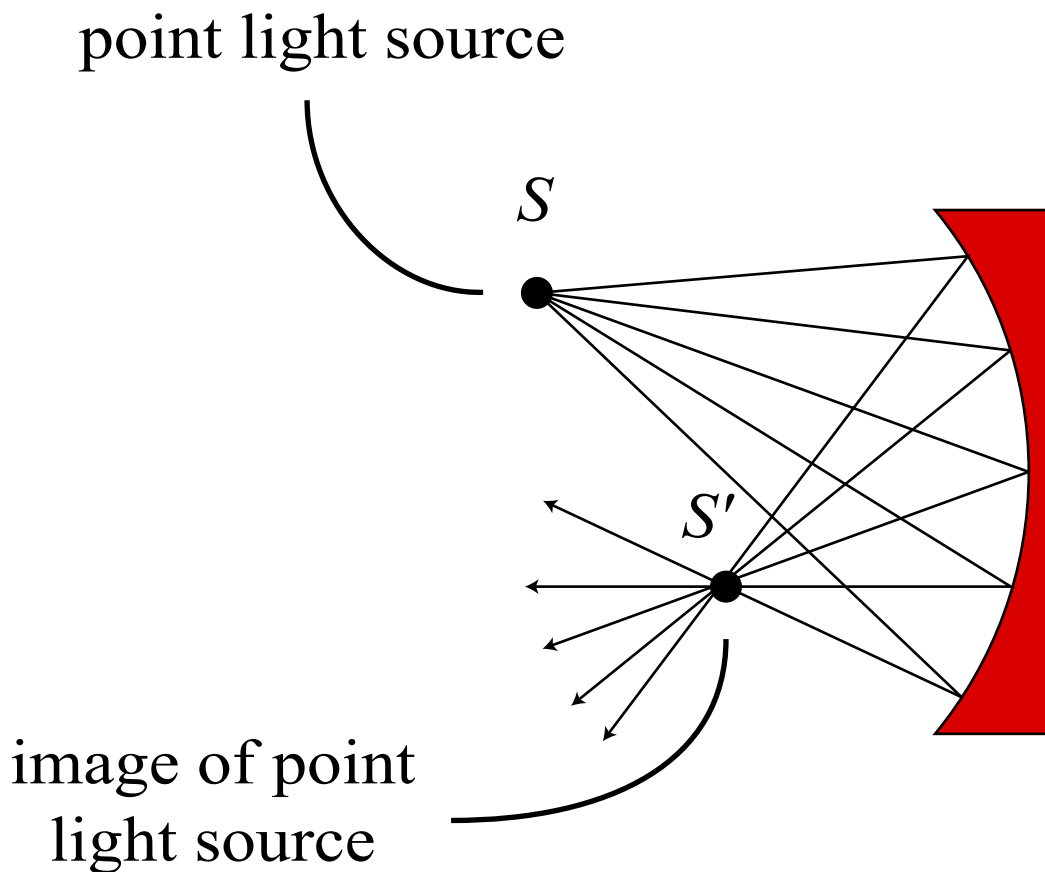
triangle FPM : $\frac{h}{f} = \tan 2\theta$

eliminate h and θ :

$$f = \frac{R}{2}$$

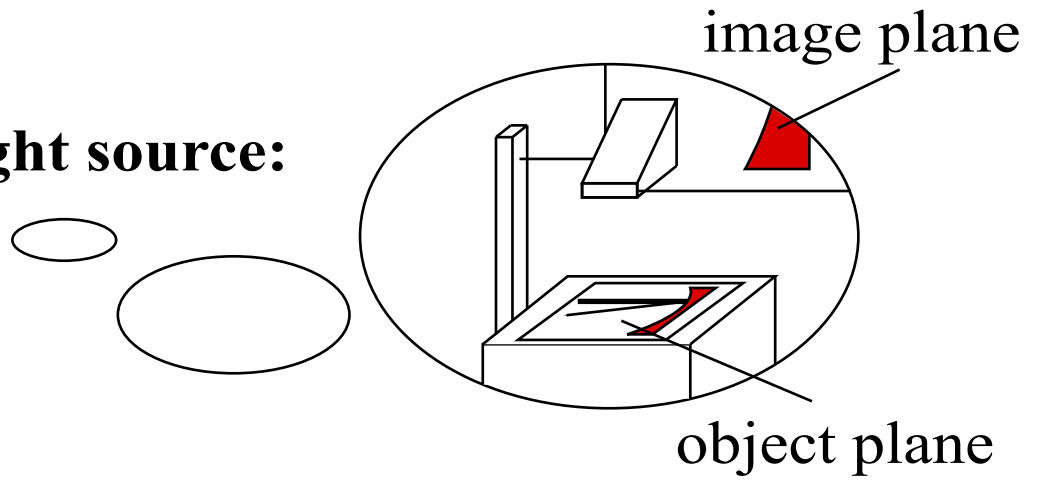
1.3.4 Image formation

Point light source:

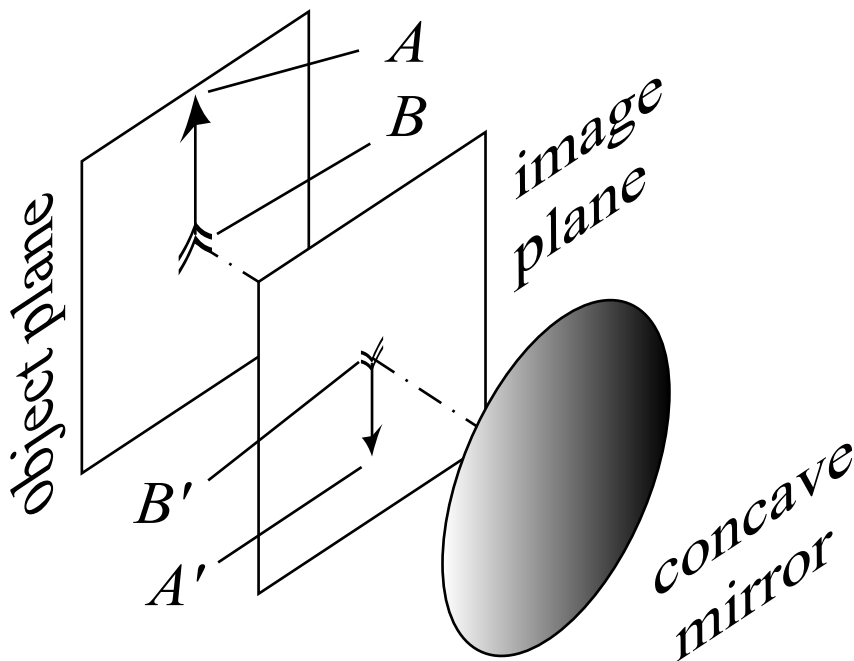


after reflection, all the light rays from a **point light source** intersect in one point, the image of the point light source

Extended light source:



light distribution in a plane normal to the optical axis, the **object plane**, as light source



every point (e.g. A , B) in the object plane acts like a point light source

the images of all those point light sources (A' , B') lie in another plane normal to the optical axis, the **image plane**

the light distribution in the image plane is a stretched copy of the light distribution in the object plane (see later: transverse magnification)

1.3.5 Principal rays & ray diagram

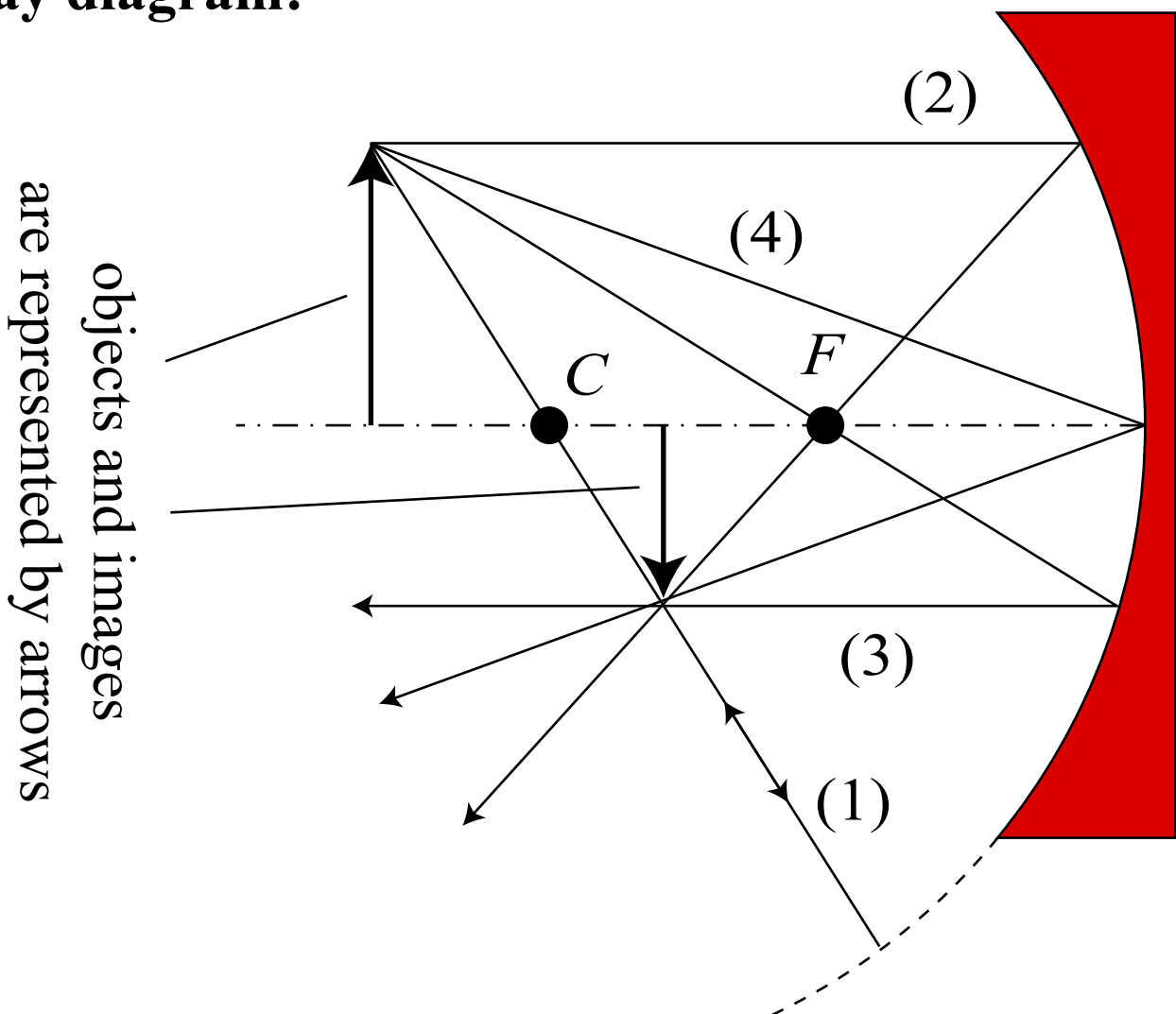
Benson 35.7, p. 723

the positions of the image of a point light source and the positions of the image plane corresponding to an object plane can be found graphically in a **ray diagram** by constructing the intersection of two or more **principal rays** passing through the light source

principal rays:

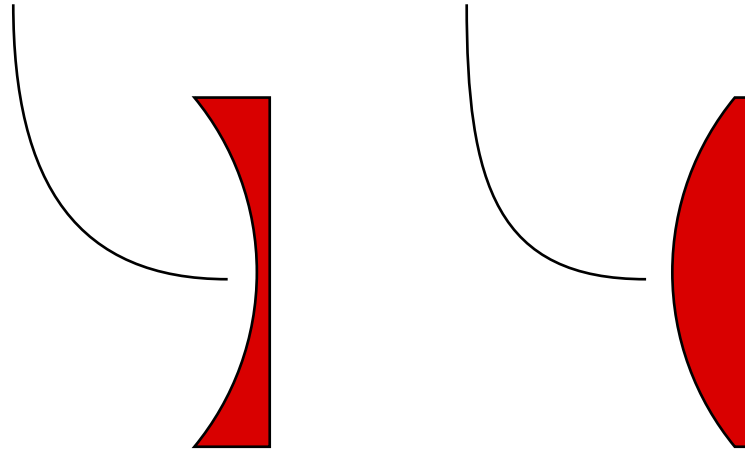
- (1) a ray along the radius (i.e. through the centre, C) reverses its path upon reflection
- (2) a ray parallel to the axis passes through the focal point after reflection
- (3) a ray through the focal point is reflected parallel to the axis
- (4) a ray incident at the centre of the mirror makes the same angle with the axis after reflection

ray diagram:



light rays *always* come from the left

1.3.6 Concave & convex mirrors



Benson 35.7,
p. 721

ray diagrams also work for *convex* mirrors:

