Optics Notes – MIRRORS cont.

Images Formed by Concave Mirrors

To draw a scale ray diagram, we will do the following:

1) Draw the mirror, showing the principle axis, centre of curvature (*C*), and the focal point (*f*).
2) Draw an arrow on principle axis to illustrate the position and size of the object
3) Draw two rays from the tip of the object arrow to the mirror.

   Ray 1 is parallel to the principle axis and is reflected through the focal point.

   Ray 2 is drawn to pass through the focal point on its way to the mirror. It then reflects parallel to the principle axis.

   The point where these two rays meet gives the location and size of the image.

Case 1: Object is beyond the centre of curvature

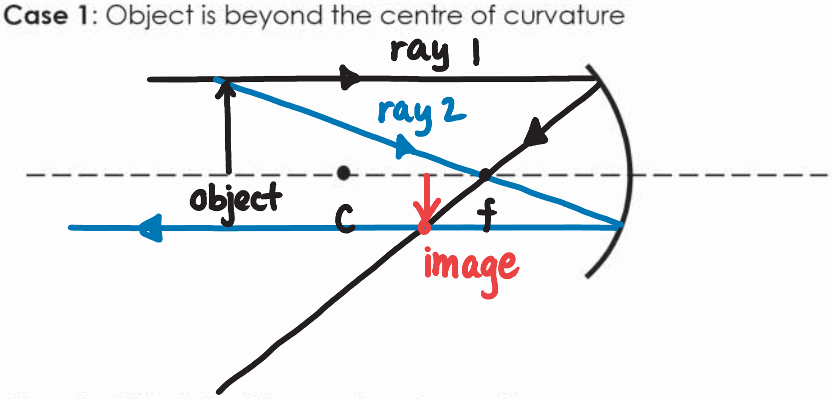


image is :
- inverted
- smaller
- real

Case 2: Object is at the centre of curvature

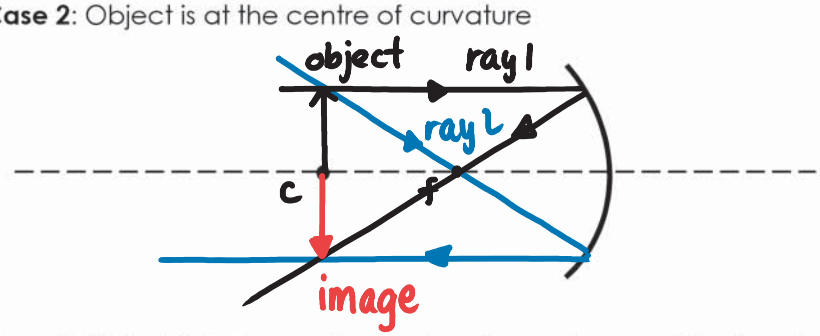


image is :
- inverted
- same size
- real

Case 3: Object is between the centre of curvature and the focal point

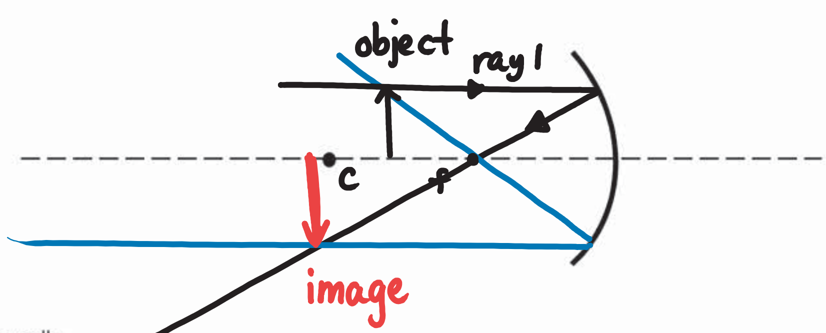
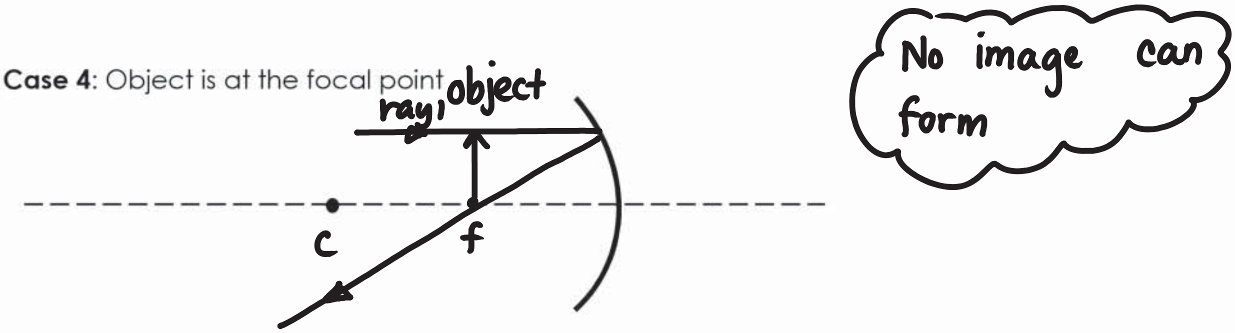
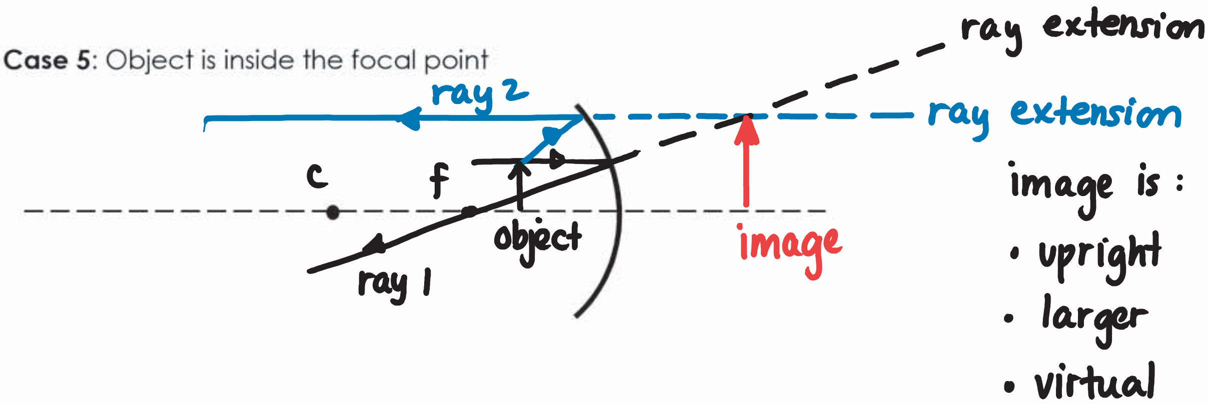


image is :
- inverted
- bigger
- real

Case 4: Object is at the focal point

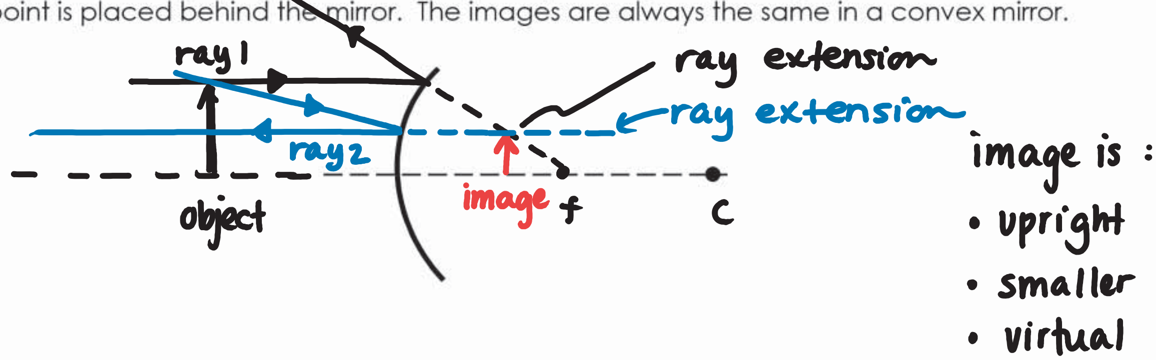


Case 5: Object is inside the focal point



Images Formed by Convex Mirrors

Since the reflected rays from a convex mirror always diverge, real images are never formed. The focal point is placed behind the mirror. The images are always the same in a convex mirror.



Sign Convention for Mirrors

As we have seen: Focal points can be real or virtual.
Images can be real or virtual
Images can be upright or inverted

So, we use the following sign conventions: Real focal points or images are **positive**
Virtual focal points or images are **negative**
Upright images are **positive**
Inverted images are **negative**

$\frac{h_i}{h_o} = \frac{-d_i}{d_o}$

Magnification

The ratio of the size of the image, h_i, to the size of the object, h_o, is called the **magnification** (m):

magnification → $$m = \frac{h_i}{h_o} \text{ or } m = \frac{-d_i}{d_o}$$

← the negative sign is necessary because of the sign convention.

If d_i and d_o are both positive (both are on the same side of the mirror), then both m and h_i are **negative**. This means the image is **inverted**.

Mirror Equation

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

f = focal length

d_o = distance of object

d_i = distance of image

Example: An object 3.00 cm tall is placed 10.0 cm in front of a concave mirror that has a focal length of 3.0 cm. Find the characteristics (location, size, orientation, type) of the image produced by:

a) drawing a ray diagram
b) using the mirror equation