1.7 Curved Mirrors

Convex and concave mirrors are spherical mirrors. When light shines on a convex mirror, the reflected rays diverge. When light shines on a concave mirror, the reflected rays converge. Ray diagrams can be used to determine the orientation, size and type of image produced by a curved mirror. Now for some terminology...

C = centre of curvature (from c to the mirror = radius of the sphere)

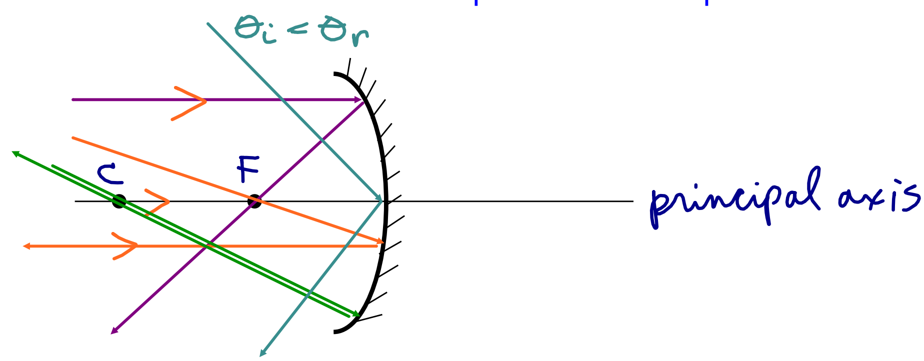
F = focal point

f = focal length (is always halfway between the mirror and C... 2f = radius)

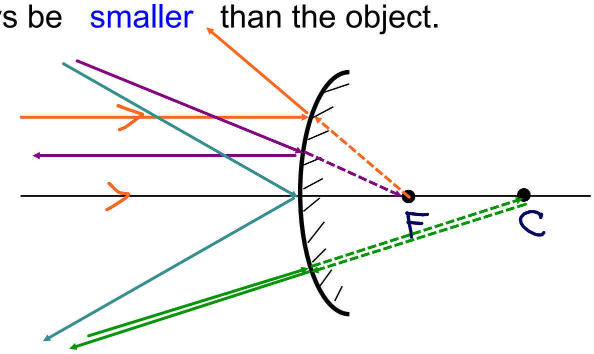
Principal axis is the centre line of the diagram and passes through F and C

Rules of Reflection (concave)

Incident Ray		Reflected Ray
1. parallel to principal axis	→	through focal point
2. through focal point	→	parallel to principal axis
3. through centre of curvature	→	back through C
4. strikes the mirror at the axis	→	point acts like a plane mirror



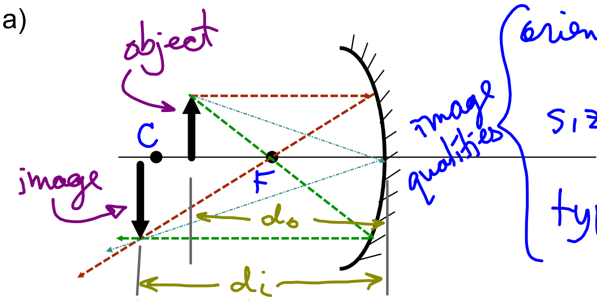
For convex mirrors, the same principals apply only the rays diverge. This means they always form virtual images. This means the image can not be projected onto a screen since it is on the other side of the mirror. The images will also always be smaller than the object.



A minimum of 2 rays is needed to locate an image. Depending on the location of the object, not all options are possible.

ex. locate the following images and determine their size, orientation and type

a)



orientation : upside down (inverted)

size : bigger than object

type : real since it is on the same side as the object

The magnification of an image can be determined by the equation:

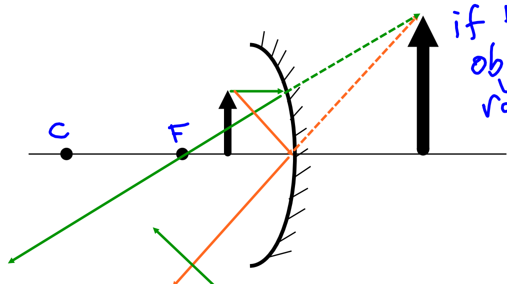
$$m = \frac{h_i}{h_o} = \frac{-d_i}{d_o}$$

where *h = height* *i = image* *o = object*

d = distance (reflective side is positive)

If *m* yields a negative number, that means the image is inverted. If m > 1, the image is larger than the object; if m < 1, the image is smaller

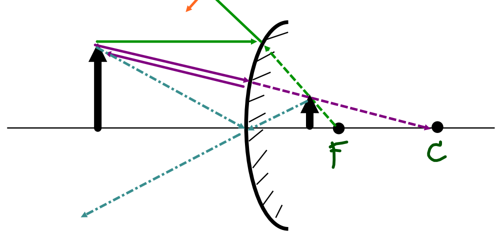
b)



if the rays diverge on the object side, extend the rays so they converge on the other side... this forms a VIRTUAL image

bigger, upright

c)



- upright
- virtual
- smaller

<u>The Mirror Equation:</u> relates focal length, image distance and object distance

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

ex. if in example c) above, the object is 20 cm from the mirror and f = 12 cm, find the images position.

$$\frac{1}{12} = \frac{1}{d_i} + \frac{1}{20}$$

$$\frac{1}{12} - \frac{1}{20} = \frac{1}{d_i}$$

$$0.08\overline{3} - 0.05 = \frac{1}{d_i}$$

$$0.0\overline{3} = \frac{1}{d_i}$$

$$d_i = \frac{1}{0.0\overline{3}} = \boxed{30\text{ cm}}$$

Homefun: pg. 469 #12, 13, 15
pg. 472 #17, 19, 21