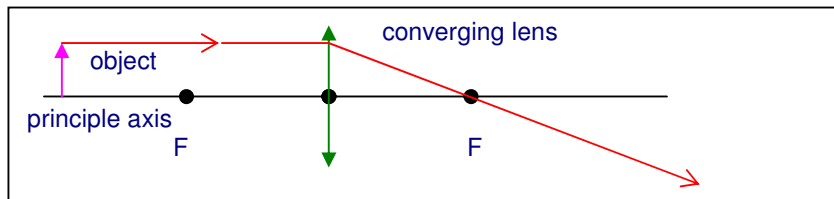


Task: a lens of focal length $+15.0\text{cm}$ has an object at a distance of 10cm . Find the image distance and characteristics.
 Ans: -30.0cm , virtual upright enlarged factor two.

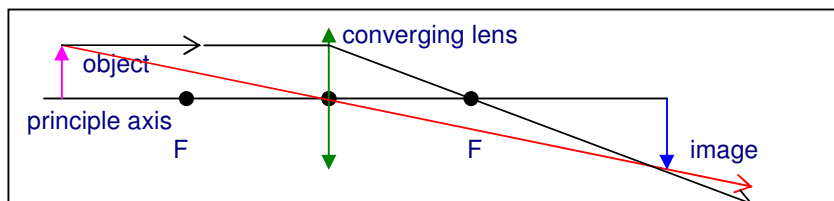
Diverging problem: a lens of focal length -20.0cm has an object 3.0cm high placed 30cm in front of it. Find the image characteristics including its height.
 Ans: virtual, upright, diminished, closer and 1.2cm high.

Image formation

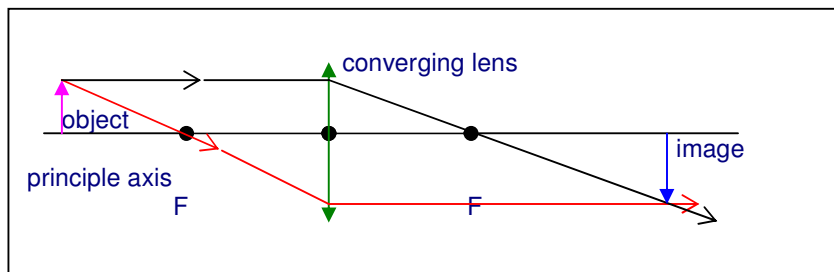
- in ray diagrams, lenses are represented as straight vertical lines.
- the ends arrowed inwards for converging and outwards for convex lenses.
- an object is usually drawn as an upright arrow, usually on the principle axis.
- the image is found by drawing two of three special rays.
- remember the sign rule 'real is positive', so all real object, image and focal lengths are positive and all virtual ones are negative.
- a ray of light parallel to the principle axis passes through the principle focus.



- a ray passing through the centre of the lens continues along the same path.

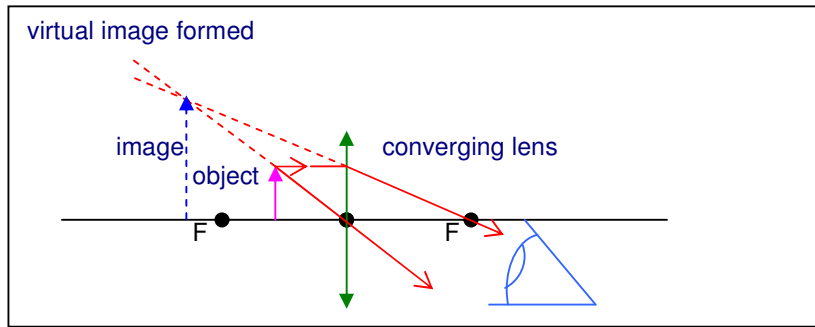


- a ray that passes through the first focus ends up parallel to the axis.



- the rays meet where the image is formed.
- in this case, the image is real (the rays meet and a screen could be placed there), further from the lens than the object, upside down (inverted) and larger.
- the image is not always real or inverted in a converging lens.
- in the diagram below, the rays do not meet, but appear to come from the same place if they are traced back.
- this image is unreal and upright, closer to the lens and enlarged.

-to see the image, the observer must look through the lens.



Task : by drawing suitable rays, complete the diagrams below and note the results, image size, type, position way up etc, then compare them with the predicted images listed on the next page.

