Physics 220: Unquiz 08

An object is placed 10 cm from a mirror. The image is real, inverted and the magnification is 2. Is this possible? What is the focal length of the mirror and what is the image position? Would this be possible if the image were virtual?

An object and an image are at the same position when imaged from a mirror. How is the object distance related to the focal length and characterize the image.

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$$M=\frac{-s_i}{s_0}=-2\Rightarrow s_i=2s_0=+20:\frac{1}{s_i}+\frac{1}{s_o}=\frac{1}{f}=\frac{1}{10}+\frac{1}{20}=\frac{3}{20}\Rightarrow f=\frac{+20}{3}=+6.67$$

If the image were virtual, then the only way that the magnification can be -2 is if the object were virtual which could not happen with a single element system.

An object and an image are at the same position. How is the object distance related to the focal length and characterize the image.

$$s_0=s_i\Rightarrow\frac{2}{s_0}=\frac{1}{f}\Rightarrow\frac{s_0}{2}=f$$

The image is inverted, unmagnified and real.

Two thin converging lenses are in direct contact. Each lens has a focal length of 10 cm. Characterize the image that forms when an object is placed at 2 cm.

$$\frac{1}{f_{eff}}=\frac{1}{f_1}+\frac{1}{f_2}=\frac{2}{10}\Rightarrow f_{eff}=\frac{10}{2}=5.\ \frac{1}{s_i}=\frac{1}{5}-\frac{1}{2}=\frac{2}{10}-\frac{5}{10}=\frac{-3}{10}\Rightarrow s_i=\frac{-10}{3}=-3.333$$

$$M=\frac{-s_i}{s_o}=\frac{3.333}{2}=1.67$$

The image is virtual, upright, magnified