10. a) The equation expressing the relationship of the image distance, the object distance and the focal length is given as

$$1 / o + 1 / i = 1 / f$$

A converging lens has a positive focal length.

$$1 / (20 \text{ cm}) + 1 / i = 1 / (10 \text{ cm})$$

$$0.\ 0.05 \text{ cm}^{-1} + 1 / i = 0.10 \text{ cm}^{-1}$$

We subtract 0.05 cm-1 from each side of the equation to obtain

$$1 / i = (0.10 - 0.05) \text{ cm}^{-1}$$

$$1 / i = 0.05 \text{ cm}^{-1}$$

We multiply both sides of the equation by i to obtain

$$1 = (i) (0.05 \text{ cm}^{-1})$$

We divide both sides of the equation by 0.06 cm^{-1} to obtain

$$i = 1 / (0.05 \text{ cm}^{-1})$$

$$i = 20.0 \text{ cm}$$

This tells us that the image is located 20 cm from the lens on the opposite side as the object, as is shown in Figure 16.16 on page 324 in the text.

b) The image is real, because it is located behind the lens, and real light rays actually intersect at the location where the image is formed.

c) The magnification is calculated as $m = - i / o$

$$m = - (20.0 \text{ cm}) / (20 \text{ cm})$$

$$m = - 1.0$$

The image is 1.0 times as large as the object, i.e. it is the same size as the object. It is inverted, because the magnification is negative.