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

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

Note that the lens has a negative focal length, in this case $f = -15$ cm.

$$1 / (20 \text{ cm}) + 1 / i = 1 / (-15 \text{ cm})$$

$$0.05 \text{ cm}^{-1} + 1 / i = -0.067 \text{ cm}^{-1}$$

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

$$1 / i = (-0.067 - 0.05) \text{ cm}^{-1}$$

$$1 / i = -0.017 \text{ cm}^{-1}$$

We multiply both sides of the equation by i to obtain

$$1 = (i)(-0.017 \text{ cm}^{-1})$$

We divide both sides of the equation by -0.017 cm^{-1} to obtain

$$i = 1 / (-0.017 \text{ cm}^{-1})$$

$$i = -58.8 \text{ cm}$$

This tells us that the image is located 58.8 cm behind the lens, which means that the image is on the same side of the lens as the object. This is shown in Figure 16.19 on page 326 in the text.

b) The image is virtual, because it is located behind the lens, and no real light rays intersect at the point where the image is formed.

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

$$m = -(-58.8 \text{ cm}) / (30 \text{ cm})$$

$$m = 1.96$$

The images is 1.96 times larger than the object. It is erect, because the magnification is positive.