P. 70 Dr. Bob

1. $d_o = 50\,m$

$d_i = 0.20\,m$

$h_i = -0.040\,m$

$h_i < 0$ because images are inverted in a camera obscura.

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

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

$= -\frac{50\,m}{0.20\,m}(-0.040\,m)$

$\boxed{h_o = 10.\,m}$

2. $h_o = 30\,m$

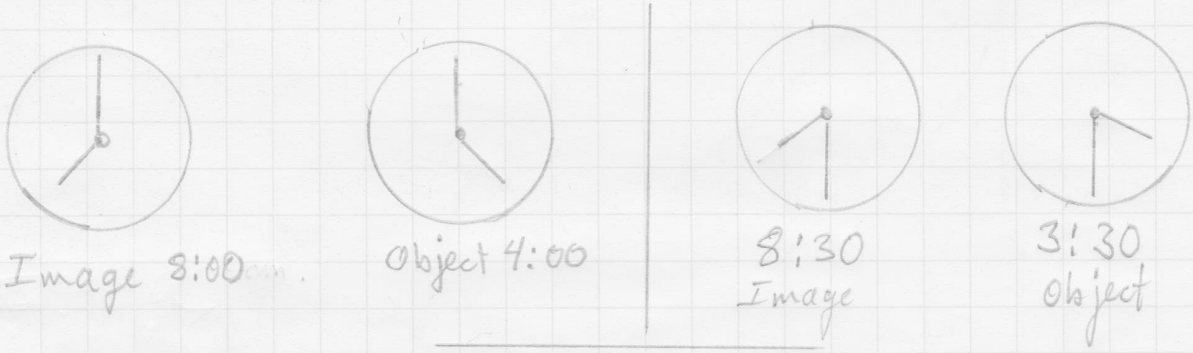
$h_i = -0.015\,m$

$M = \frac{h_i}{h_o} = \frac{-0.015\,m}{30\,m} = \frac{-1}{2000}$

$\boxed{M = -0.00050 = -5.0 \times 10^{-4}}$

3. The image is virtual, upright, and positioned behind the mirror. The height is the same as I am. Also, the right looks like it is the left hand in the image. I move my left hand, and it looks like image moves its right hand and vice versa. This is called lateral inversion.

4.



Dr. Bob

5. In a plane mirror the image is upright, but the left & right are exchanged. This produces what is known as a mirror image. On the front of ambulances the word is written as a mirror image so the word AMBULANCE would be correctly read in the rear view mirror of a car. This phenomenon is called lateral inversion.

6. $\theta = 60°$

$$N = \frac{360°}{\theta} - 1$$

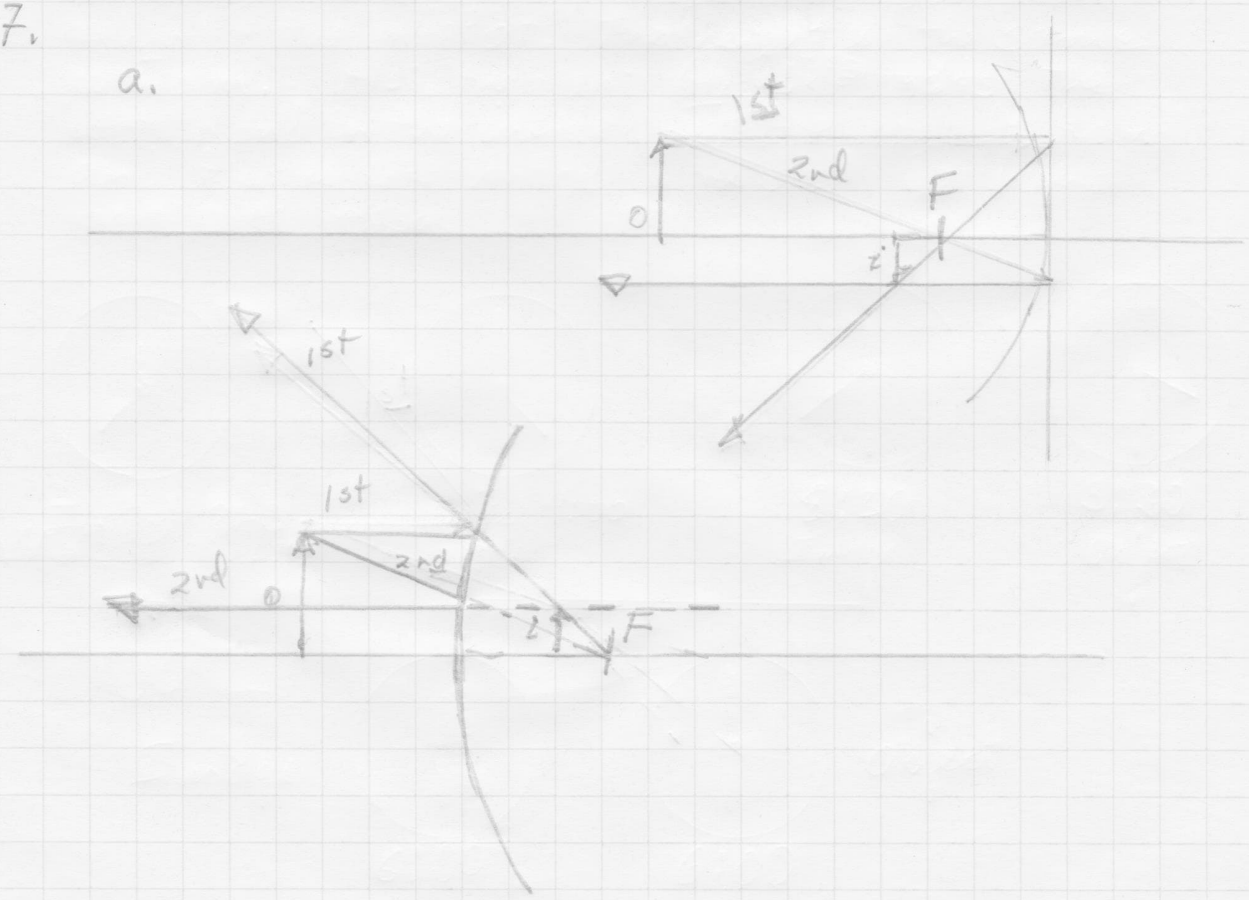
$$= \frac{360°}{60°} - 1$$

$$= 6 - 1$$

$$\boxed{N = 5}$$

7.

a.



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8. $f = -60\,cm = -0.60\,m$

$h_o = 1.5\,m$

$d_o = 6\,m$

$d_i = ?$

$h_i = ?$

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

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

$$d_i = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1} = \left(\frac{1}{-0.60\,m} - \frac{1}{6\,m}\right)^{-1}$$

$$= \left(\frac{-10 - 1}{6\,m}\right)^{-1} = \left(\frac{-11}{6\,m}\right)^{-1} = \frac{-6}{11}\,m$$

$$\boxed{d_i = -0.55\,m}$$

$$h_i = -\frac{d_i}{d_o}\,h_o = -\left(\frac{-0.55\,m}{6\,m}\right)1.5\,m$$

$$\boxed{h_i = 0.14\,m}$$

Image is upright, virtual, & smaller like on page 61

P. 70 Since it's a truck, I am going to assume a convex lens. Dr. Bob

9. $f = 50\,cm = 0.50\,m$ $\quad \frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$

$M = 0.10$ $\quad M = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$

$d_i = ?$ $\quad d_o = ?$

$\left(M = \frac{-d_i}{d_o}\right)\frac{-1}{d_i} \Rightarrow \frac{1}{d_o} = -\frac{M}{d_i}$

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

$$\frac{1}{f} = \frac{1-M}{d_i}$$

$$d_i = (1-M)f$$

$$= (1-0.10)(-0.5m)$$

$$\boxed{d_i = -0.45\,m}$$

$$d_o = -\frac{d_i}{M} = -\frac{-0.45m}{0.10}$$

$$\boxed{d_o = 4.5\,m}$$

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10.

$f = 20mm = 0.020m$

$d_o = 15mm = 0.015m$

$M = ?$

$d_i = ?$

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

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{0.020m} - \frac{1}{0.015m}$$

$$\frac{1}{d_i} = -\frac{16.67}{m}$$

$$d_i = \frac{-1}{16.67}\,m = -0.060m$$

$$d_i = -0.060m$$

$$M = -\frac{d_i}{d_o} = -\frac{-0.060m}{0.015m}$$

$$\boxed{M = 4}$$

11. $d_o = 2m$ $R = ?$ $f = ?$
$M = 3$

for the image the mirror will be concave, I'm going to assume that it is a virtual upright image; that is the person is between V & F!

$$\left(M = -\frac{d_i}{d_o}\right) -d_o \qquad -Md_o = d_i$$

$$\frac{1}{d_i} = \frac{-1}{Md_o}$$

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

$$= \frac{-1}{Md_o} + \frac{M}{Md_o} = \frac{M-1}{Md_o}$$

$$f = \frac{Md_o}{M-1} = \frac{3(2m)}{3-1} = 3m$$

$$f = 3m$$

$$R = 2f = 2(3m)$$

$$\boxed{R = 6m}$$

12. $R = \frac{-8\,cm}{2} = -4\,cm = -0.04\,m$

$f = \frac{R}{2}$ / $f = -0.02\,m$ $\quad M = \frac{1}{2}$ $\quad d_o = ?$

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ , $M = \frac{h_i}{h_o} = \frac{-d_i}{d_o}$ , $R = 2f$

$d_i = -M d_o \qquad \frac{1}{d_i} = \frac{-1}{M d_o}$

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

$\frac{M}{f} = \frac{M}{d_o} \frac{-1}{d_o} = \frac{M-1}{d_o}$

$d_o = \frac{(M-1)f}{M} = \frac{(\frac{1}{2}-1)(-0.02\,m)}{\frac{1}{2}}$

$\boxed{d_o = 0,02\,m}$