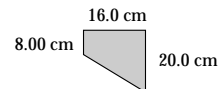


## Chapter 36 Even Answers

2. 4.58 m
4. 5 images. See solution.
6. (a) 13.3 cm,  $-0.333$ , real and inverted (b) 20.0 cm,  $-1.00$ , real and inverted  
(c) no image is formed
8. Behind the worshiper, 3.33 m from the deepest point in the niche.
10. (a) 48.0 cm (b) See solution
12. 30.0 cm
14. (a) See solution (b)  $3.56 \text{ cm}^2$
16.  $M = +1/11.0$ ,  $q = -15.0/11.0 \text{ cm}$  (behind the mirror)
18. 4.82 cm
20. The image is real, inverted, and diminished.
22. 2.00
24. 1.50 cm/s
26. 20.0 cm
28. (a)  $q = 40.0 \text{ cm}$ ,  $M = -1.00$ ; real and inverted (b)  $q \rightarrow \infty$ , no image is formed  
(c)  $q = -20.0 \text{ cm}$ ,  $M = +2.00$ ; virtual and upright
30. (a) 6.40 cm (b)  $-0.250$  (c) converging
32. 7.50 cm
34. (a) 3.40, upright (b) See solution
36. (a)  $f = 39.0 \text{ mm}$  (b)  $p = 39.5 \text{ mm}$
38. (a)  $f = 13.3 \text{ cm}$  (b) Image is a trapezoid, shown in figure.  
(c)  $224 \text{ cm}^2$
40. (a)  $p = \frac{d}{2} \pm \sqrt{\frac{d^2}{4} - fd}$



- (b) Both images are real and inverted, but one is diminished while the other is enlarged.
42. (a)  $-34.7$  cm; virtual, upright and diminished  
 (b)  $-36.1$  cm; virtual, upright and diminished
44. 23.2 cm
46.  $-3.70$  diopters
48. (a) 4.17 cm (b) 6.00
50. 2.14 cm
52. (b)  $h' = -hf/p$  (c)  $-1.07$  mm
54. 3.38 min
56.  $f = \frac{-Md}{(1-M)^2}$  if  $M < 1$ ,  $f = \frac{Md}{(M-1)^2}$  if  $M > 1$
58. (a) 23.1 cm (b) 0.147 cm
60.  $q = 5.71$  cm, real image
62. (a)  $1.40$  kW/m<sup>2</sup> (b)  $6.91$  mW/m<sup>2</sup>  
 (c) 0.164 m (d)  $58.1$  W/m<sup>2</sup>
64. (a) 0.334 m or larger (b)  $R_a$  must be at least  $0.0255 R$
66. (a) 1.99 (b) 10.0 cm to the left of the lens,  $-2.50$   
 (c) inverted
68.  $p = f$ , the object must be at the focal point of the lens
70. (a) 13.3 cm (b)  $-5.90$  (c) inverted
72. It is real, inverted, and actual size.