

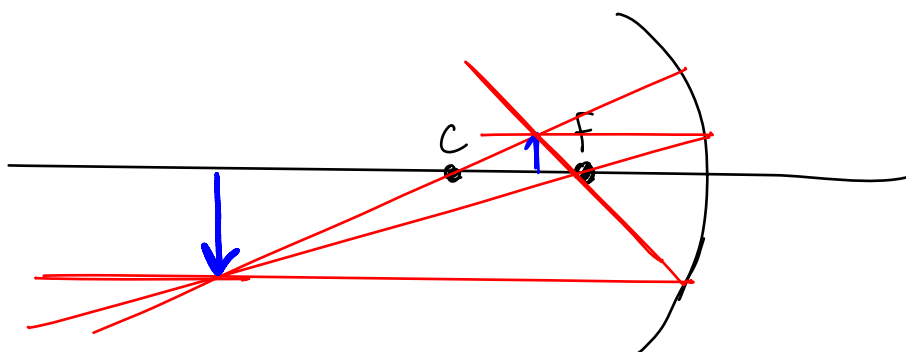
Name: KEY

Date: _____

Section C D F

Reflections IV: Mirror Calculations

1. A 4 foot tall boy is standing 10 feet away from a concave mirror in the House of Mirrors. If the mirror has a radius of curvature of 13 feet, will his image be:
- ~~Inverted~~ or upright? (circle one) (1 pt)
 - ~~Maximized~~ or minimized? (circle one) (1 pt)
 - At a closer distance to the mirror than the object? Yes ~~No~~ (circle one) (1 pt)
 - Draw a ray diagram. Assume that the boy's feet are on the principal axis, similar to all of the diagrams we have drawn in the past. (3 pts)



- e. Find q , the image distance (2 pts)

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

$$\frac{1}{10} + \frac{1}{q} = \frac{1}{6.5}$$

$$f = \frac{1}{2}R = \frac{1}{2}(13) = 6.5 \text{ cm}$$

$$q = 18.57 \text{ cm}$$

- f. Find h' , the image height (2 pts)

$$\frac{h'}{h} = -\frac{q}{p}$$

$$\frac{h'}{4} = -\frac{18.57}{10}$$

$$h' = -7.43 \text{ ft}$$

- g. Find M , the magnification (2 pts)

$$M = \frac{h'}{h} = \frac{-7.43}{4} = -1.857$$

Inverted (b/c neg)
Magnified (b/c > 1)

2. The child finds another concave mirror, and walks closer and closer to the mirror.

- a. If the child is initially very far away (beyond C), what happens to the size of his *image* as he approaches? (2 pts)
- Gets smaller
 - Gets larger
 - Stays the same
 - Not enough information

b. If the child finds that when he stands 3 feet away, his image is upright and twice as large as he is,

- i. Find q , the image distance (2 pts)

$$M = -\frac{q}{p}$$

$$+2 = -\frac{q}{3}$$

$$q = -6 \text{ ft.}$$

$$M = +2.0$$

- ii. Find R , the radius of curvature (2 pts)

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

$$f = \frac{1}{2} R$$

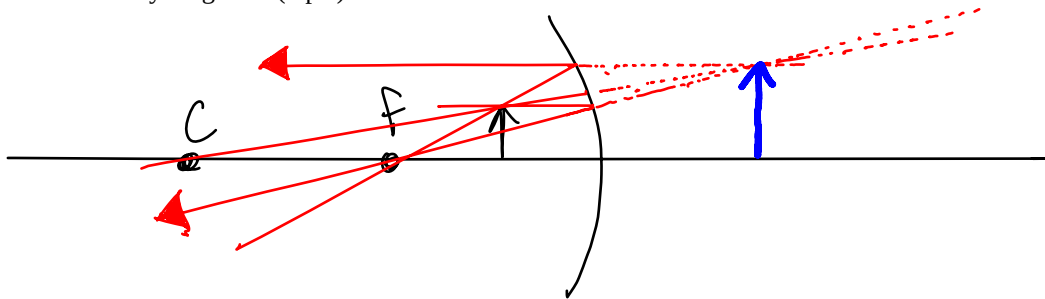
$$\frac{1}{3} + \frac{1}{-6} = \frac{1}{f}$$

$$\frac{1}{6} = \frac{1}{f}$$

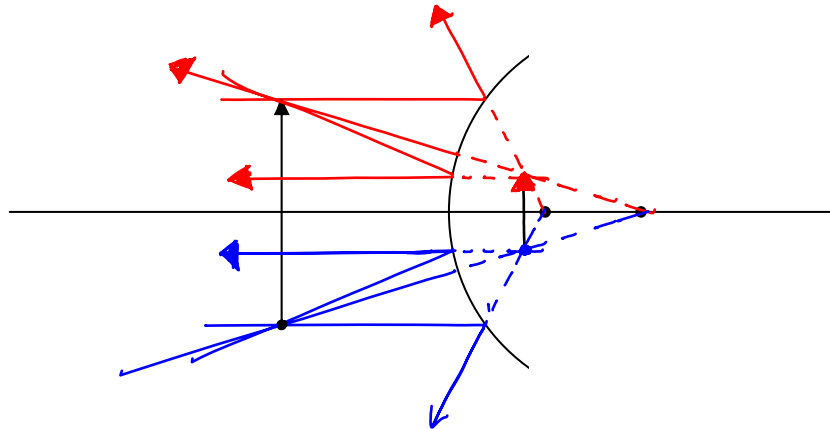
$$f = 6$$

$$R = 12 \text{ ft.}$$

- iii. Draw a ray diagram. (3 pts)



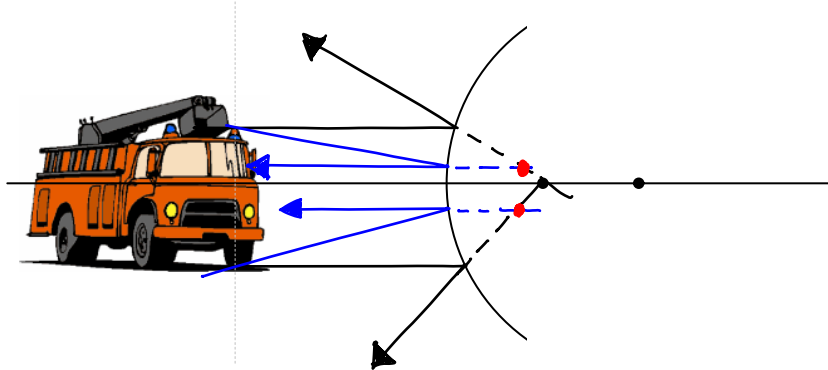
3. Find the image of the arrow in the convex mirror. Be sure to notice that the base of the arrow is *below* the principal axis; however all of our rules still apply. Find the image points of the tip of the arrow and the base of the arrow. (3 pts)



- a. What do you notice about the vertical alignment of the image points of the tip and base? Do the tip and the base still align vertically in the image? Yes / No (circle one) (1 pt)

4. Now let's take two object points that are vertically aligned in the diagram of the truck below. Find the image points of the person's head (similar to the tip of the arrow) and the bottom of the front left wheel (similar to the base of the arrow). Draw a ray diagram. (3 pts)

a.



- b. Does the phrase “OBJECTS IN MIRROR ARE CLOSER THAN THEY APPEAR” sound familiar? You got it. It's printed on the side-view mirror of your car, but only on the passenger side mirror. On the driver's side of the car, car manufacturers are required to provide a flat plane mirror, however the mirror on the passenger side is required by law to have this message printed on it. Why would the federal government require this message to be printed on the passenger side mirror and not the driver's side mirror? Please write in full sentences. (2 pts)

The passenger's side mirror is convex; hence the objects in the mirror are not a proportional distance away, like flat mirrors. Convex mirrors create images that are smaller than the object, while flat mirrors reflect full size images. If the viewer believed that the mirror was a flat mirror, the viewer would think that the object is farther away. Hence the warning that objects are “closer than they appear.”

5. What is the advantage of the convex mirror in the image below? Please write in full sentences. (2 pts)



Convex mirrors give a wider range of viewing angle, thus it is advantageous when attempting to look around corners.