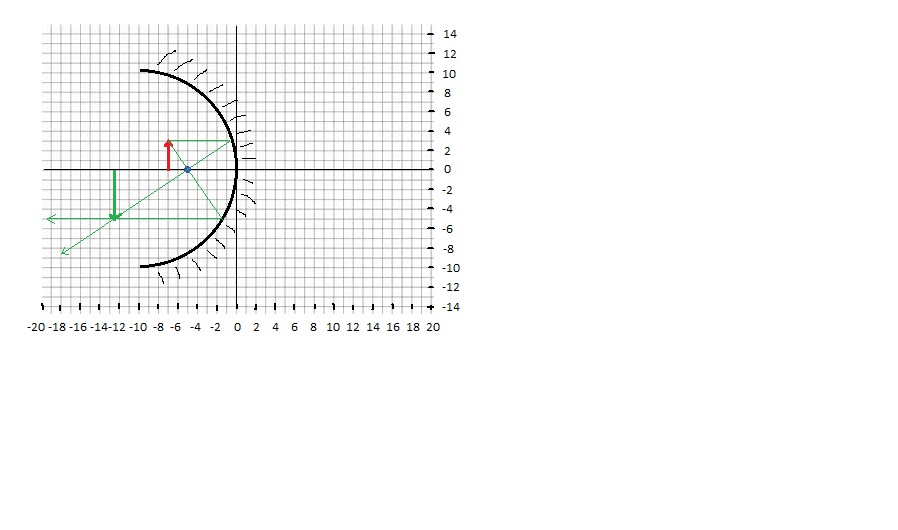
**Homework 8 Solutions never**

**Problem 1.** Consider the object below, in front of the concave mirror. (a) Using ray tracing alone, determine the location and size of the image. Fill your results into the table, with proper signs and all. Also state whether the image is real or virtual.

So first we have to calculate the focal length: f = R/2 = 10/2 = 5. Then we draw the two rays: the bottom one goes through f and emerges parallel to the principle axis, and the top onestarts parallel to the principal axis and goes through f. Where they meet, is where the image is.

****

So,

|  |  |
| --- | --- |
| **xi** | 13 |
| **hi** | -5 |

Note xi is positive, because the image shows up in the region where light *did* go after reflection. hi is negative because the image is upside-down. Image is real, because light rays do actually intersect to form the image.

(b) Now determine the position/height using the mirror equations. Are the results close?

According to these we’d have:



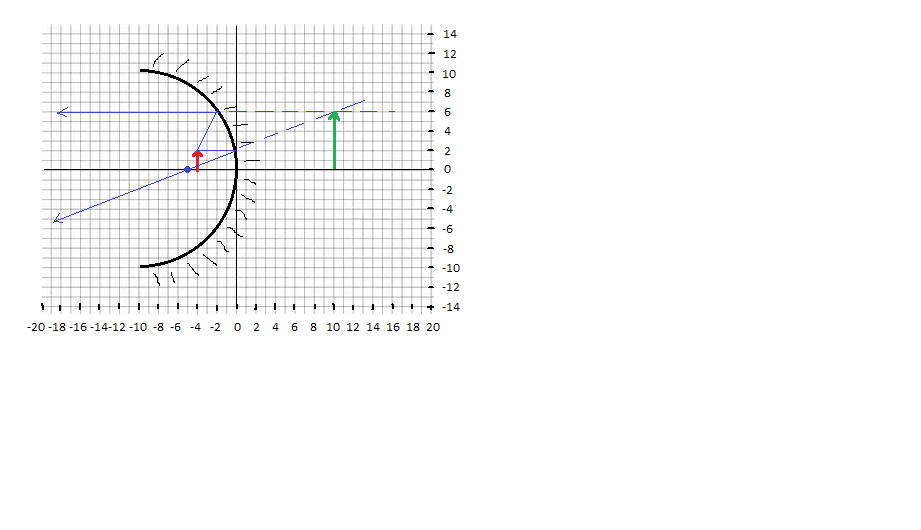
And,



So agreement is not the greatest. Turns out the mathematical analysis is the more accurate one.

**Problem 2.** Consider the object below, in front of the concave mirror. (a) Using ray tracing alone, determine the location and size of the image. Fill your results into the table, with proper signs and all. Also state whether the image is real or virtual.

Then we draw the two rays: the top one goes ‘through’ (really away from) f and emerges parallel to the principle axis, and the other starts parallel to the principal axis and goes through f. Where they ‘meet’, is where the image is. Of coure the light rays don’t actually meet anywhere, and so we have to trace them back wards to get to the point where they ‘meet’.

****

So we have approximately,

|  |  |
| --- | --- |
| **xi** | -10 |
| **hi** | 6 |

Note xi is negative because it showed up in the *negative* image distance region, i.e. the region where light does *not* go upon reflection. hi is positive because the image is upright. And image is virtual, because the light rays do not *actually* intersect to form that image.

(b) Now determine the position, height using the mirror equations. Are the results close?

So we have:



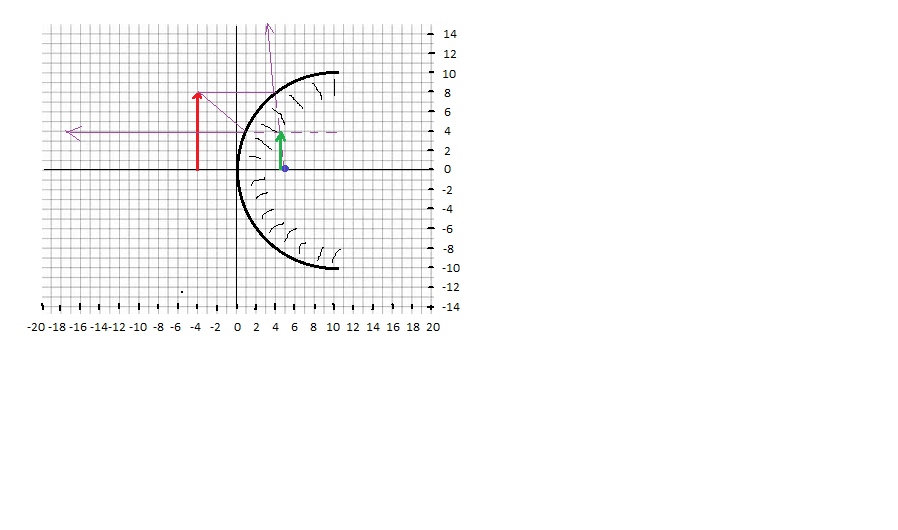
And,



Agreement could be better, again. The math gives the better results.

**Problem 3.** Consider the object below, in front of the concave mirror. (a) Using ray tracing alone, determine the location and size of the image. Fill your results into the table, with proper signs and all. And then state whether the image is real or virtual.

Then we draw the two rays: the bottom one goes ‘through’ (really just towards) f and emerges parallel to the principle axis, and the other starts parallel to the principal axis and goes ‘through’ (really directly away from) f. Where they ‘meet’, is where the image is. Of coure the light rays don’t actually meet anywhere, and so we have to trace them back wards to get to the point where they ‘meet’.

****

And we have:

|  |  |
| --- | --- |
| **xi** | -4.5 |
| **hi** | 4 |

The image distance is negative, since it showed up in the region where light did not actually go, and the image height is positive because it is upright. The image is virtual because the light rays don’t *actually* converge to form the image there, even though we would see the image.

(b) Now determine the position, height using the mirror equations. Are the results close?

So here we go. Note that the focal length is considered negative for this type of mirror.



And,



Agreement lackluster, again. And again, the math is the more accurate. But at least the drawings give an idea.