Billiards Handout

Note: These are not problems to solve before we begin, but rather a guide to help follow along. All necessary definitions will be given. Difficult problems are marked with a star (*).

Illumination

1. Is every convex room illuminable?

2. Find a room that is not illuminable from some point.

3. Find a room that is not illuminable from any point.*

4. Find a polygon room that is not illuminable from a point.*

5. Find a polygon room that is not illuminable from any point.*

Periodic Orbits

1. Is there a periodic orbit on a square table from any position?

2. Is every shot on a square table periodic?

3. Can the DVD logo on a sleeping TV screen hit all four corners at some time? How many can it hit?

4. Is there a periodic orbit on any right triangle table?

5. Is there a periodic orbit on any right triangle table from any point?

6. Is there a periodic orbit on any acute triangle table?

7. Is there a periodic orbit on any triangle table?*

8. Is there a periodic orbit on any polygon table?*

9. Is there a periodic orbit on a circular table? From any point? What if the circle doesn't have a center?

10. Is every shot on a circular table periodic?

11. What do caustics on an ellipse look like?*

Physics

1. How do you model elastic collisions with billiards?

Invisible Objects

1. Can you think of an invisible object where rays bounce no more than 3 times?

2. Can you think of a 3-dimentional invisible object?

3. Does there exist an object that's invisible from more than one direction?*