

# Outline

Models of Light: Rays

Office Hours: Thursday 3-5pm

# Quiz 9

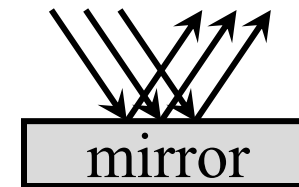
Average 7.1				
Correct	C	A	B	B
<b>Frequent Incorrect</b>	B	E	A	

# Foothold Ideas 3:

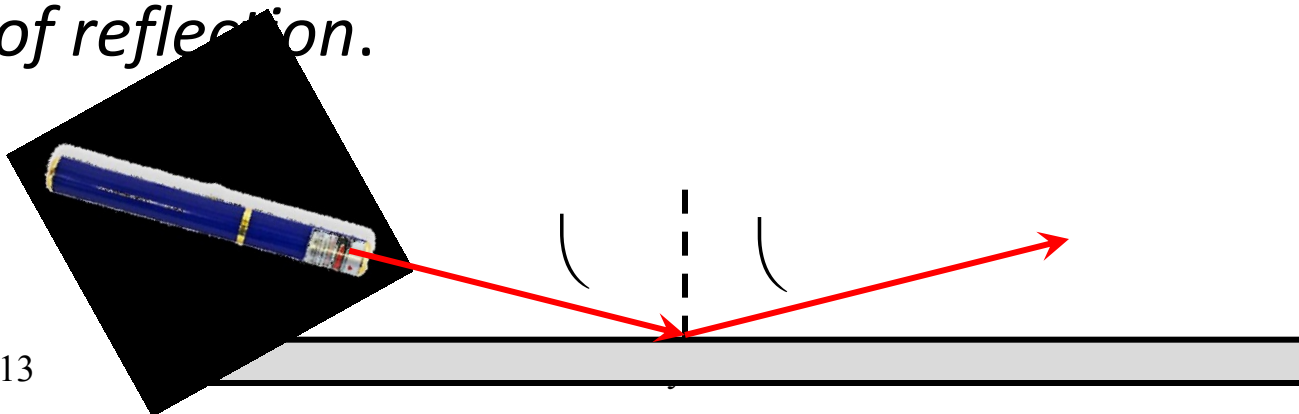
## Mirrors



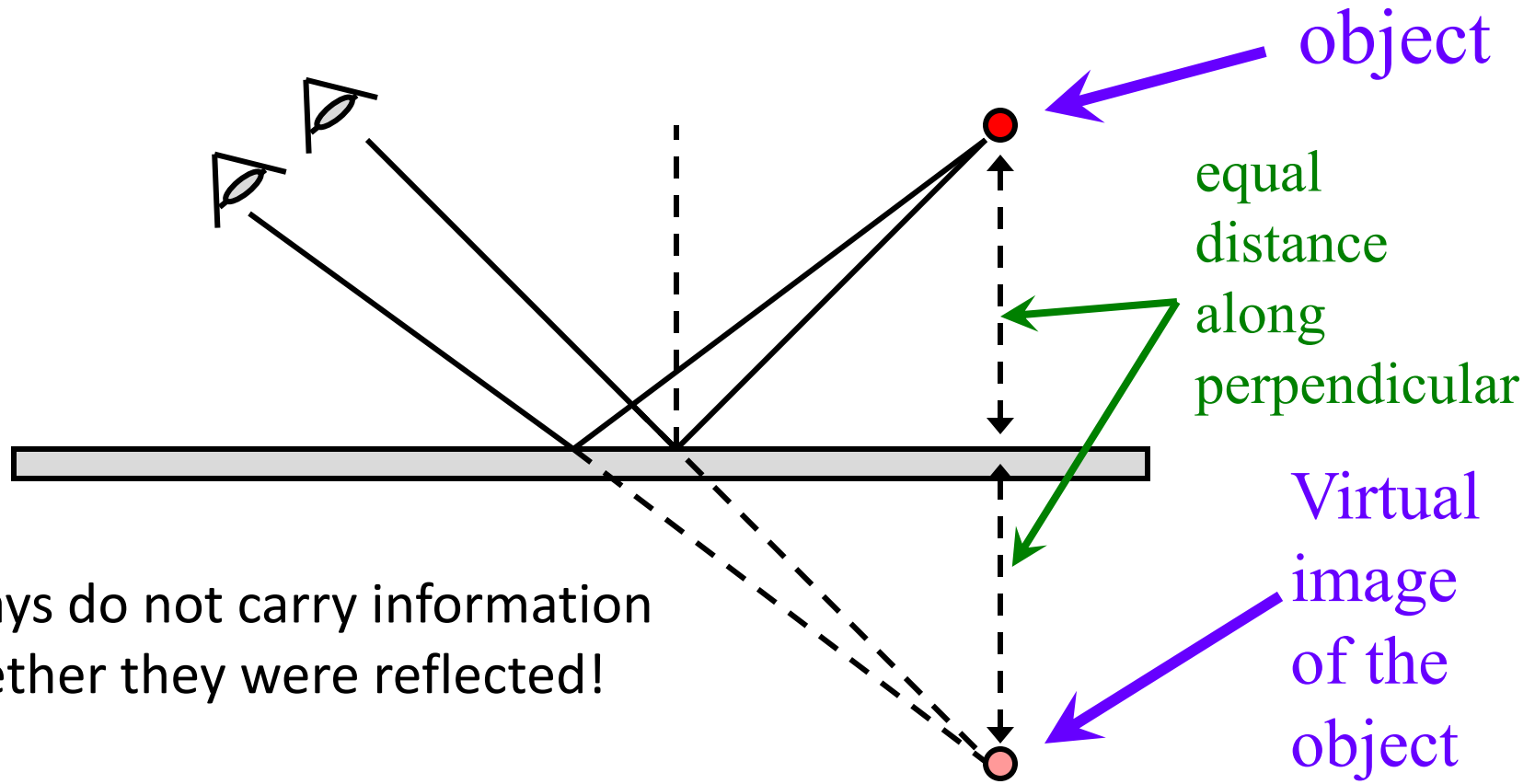
- For most objects, light scatters in all directions. For some objects (mirrors) light scatters from them in controlled directions.



- A polished surface reflects rays back again according to the rule: *The angle of incidence equals the angle of reflection.*



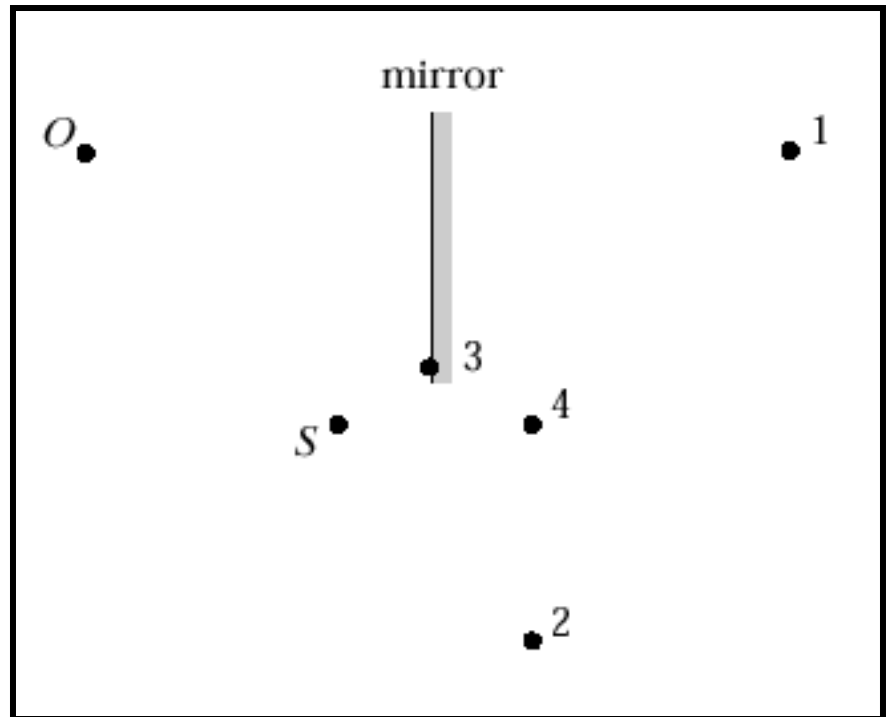
# Where does an object seen in a mirror appear to be?



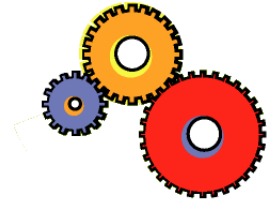
Light rays do not carry information on whether they were reflected!

An observer  $O$ , facing a mirror, observes a light source  $S$ . Where does  $O$  perceive the mirror image of  $S$  to be located?

- 1.
- 2.
- 3.
- 4.
5. Some other location
6.  $O$  cannot see  $S$  in the mirror when they are as shown.

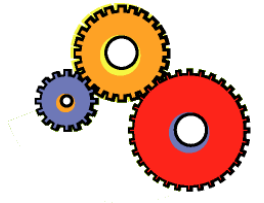


# Kinds of Images: Virtual



- In the case of the previous slide, the rays seen by the eye do not actually meet at a point – but the brain, only knowing the direction of the ray, assumes it came directly from an object.
- When the rays seen by the eye do not meet, but the brain assumes they do, the image is called *virtual*.
- If a screen is put at the position of the virtual image, there are no rays there so nothing will be seen on the screen.

I have a small mirror – about 8 inches high – hanging on my wall. When I'm standing right in front of it, I can only see my head. Can I see all of myself at once by moving far back enough?



1. Yes
2. No
3. I can if I ...

You want to put a “full length mirror” on the wall of your room; that is, a mirror that is large enough so that you can see your whole self in it all at the same time. How big should the mirror be?

1. You can see yourself in any size mirror if you go back far enough.
2. It depends on the size of your room and whether you can step back far enough from the mirror.
3. The mirror needs to be about half your size.
4. The mirror needs to be as big as you are.
5. Some other answer.



# What does a mirror do to the image?

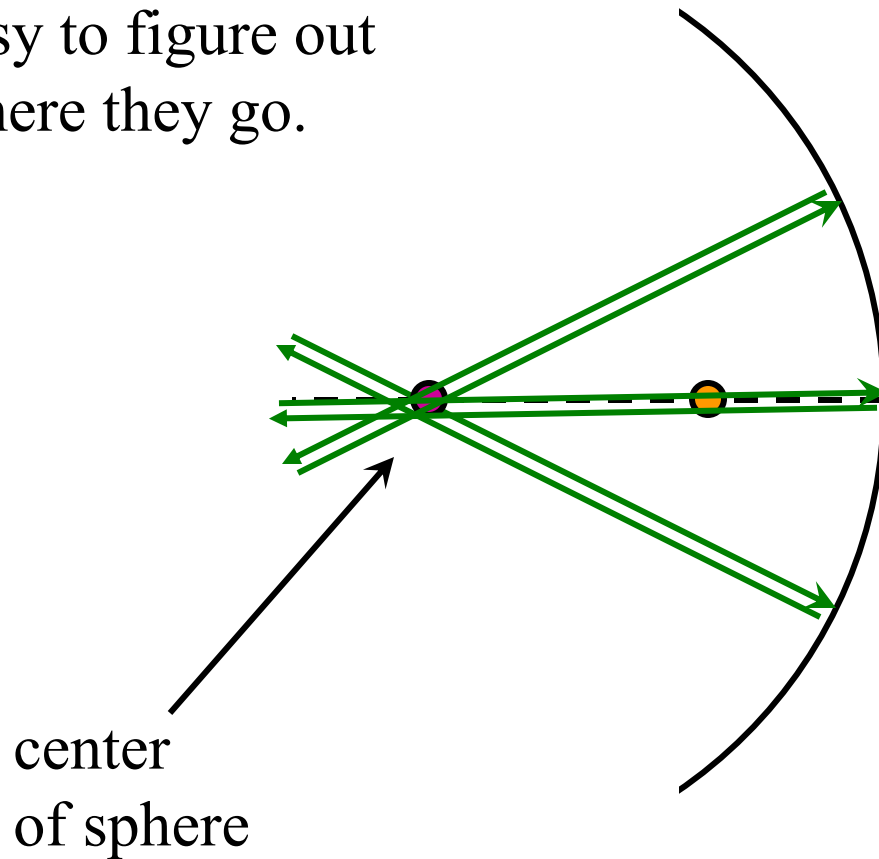
1. Flips it left to right.
2. Flips it upside down.
3. Does both.
4. Does something else.

# What will a real image look like if there is no screen?

1. Nothing. You won't be able to see the image without the screen.
2. You will still see the image, but it will appear to be floating in front of the mirror.
3. You will still see the image, but it will appear to be on the mirror.
4. You will still see the image, but it will appear to be behind the mirror like it is with a flat mirror.

# A Spherical Mirror: Central Rays

A few rays are easy to figure out where they go.

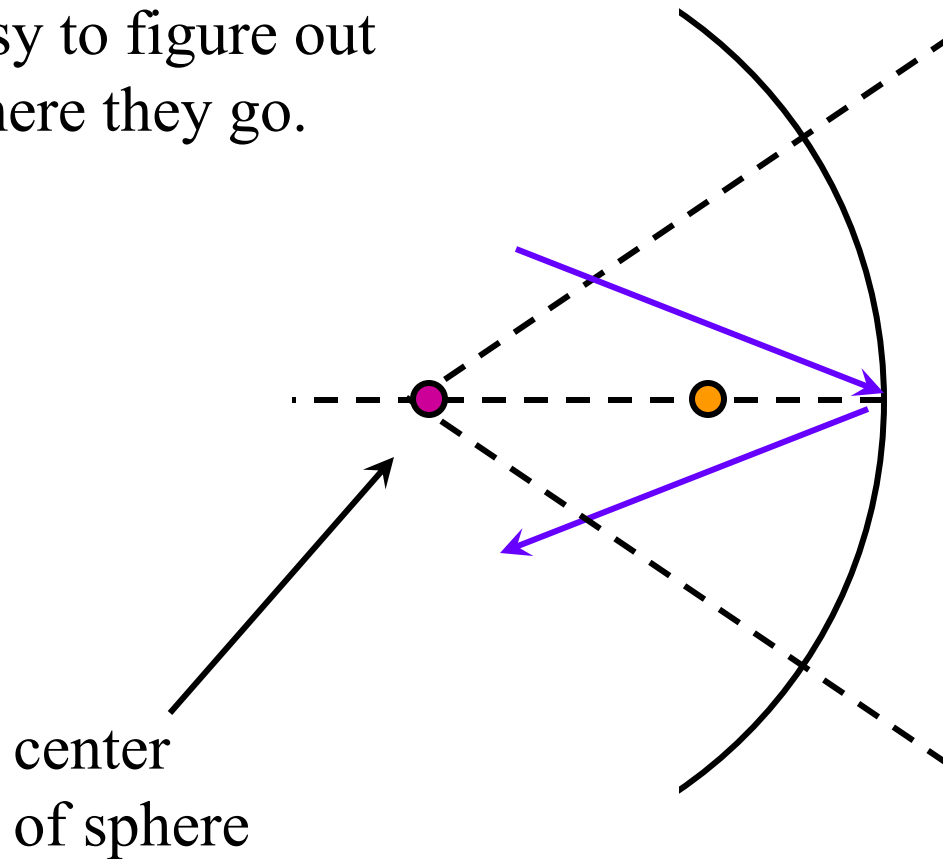


All rays satisfy the “angle of incidence = angle of reflection” measured to the normal to the surface

All rays through the center strike the mirror perpendicular to the surface and bounce back along their incoming path.

# A Spherical Mirror: Central Ray

A few rays are easy to figure out where they go.



All rays satisfy the “angle of incidence = angle of reflection” measured to the normal to the surface

The ray hitting the central line of the diagram is particularly simple.

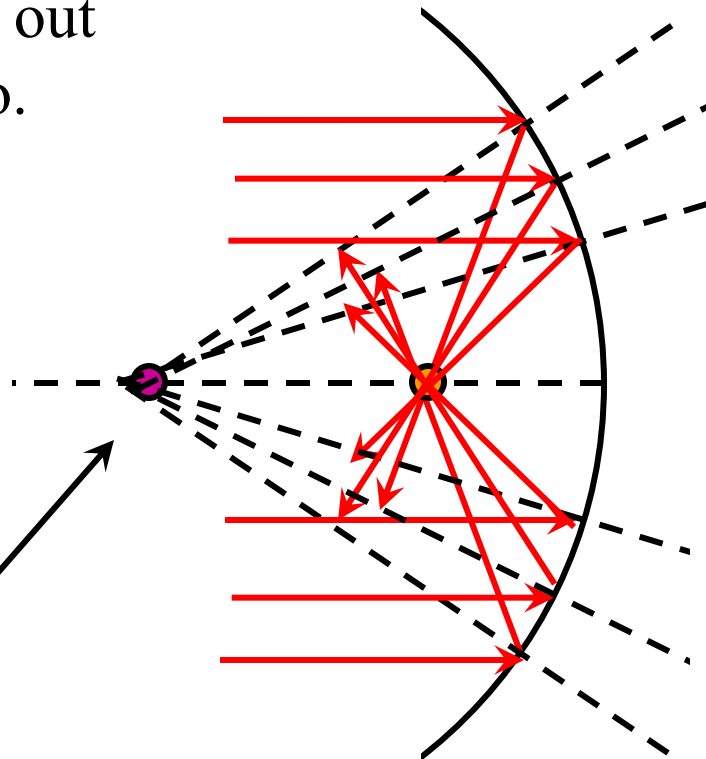
# A Spherical Mirror: Parallel Rays

A few rays are easy to figure out where they go.

All rays satisfy the “angle of incidence = angle of reflection” measured to the normal to the surface

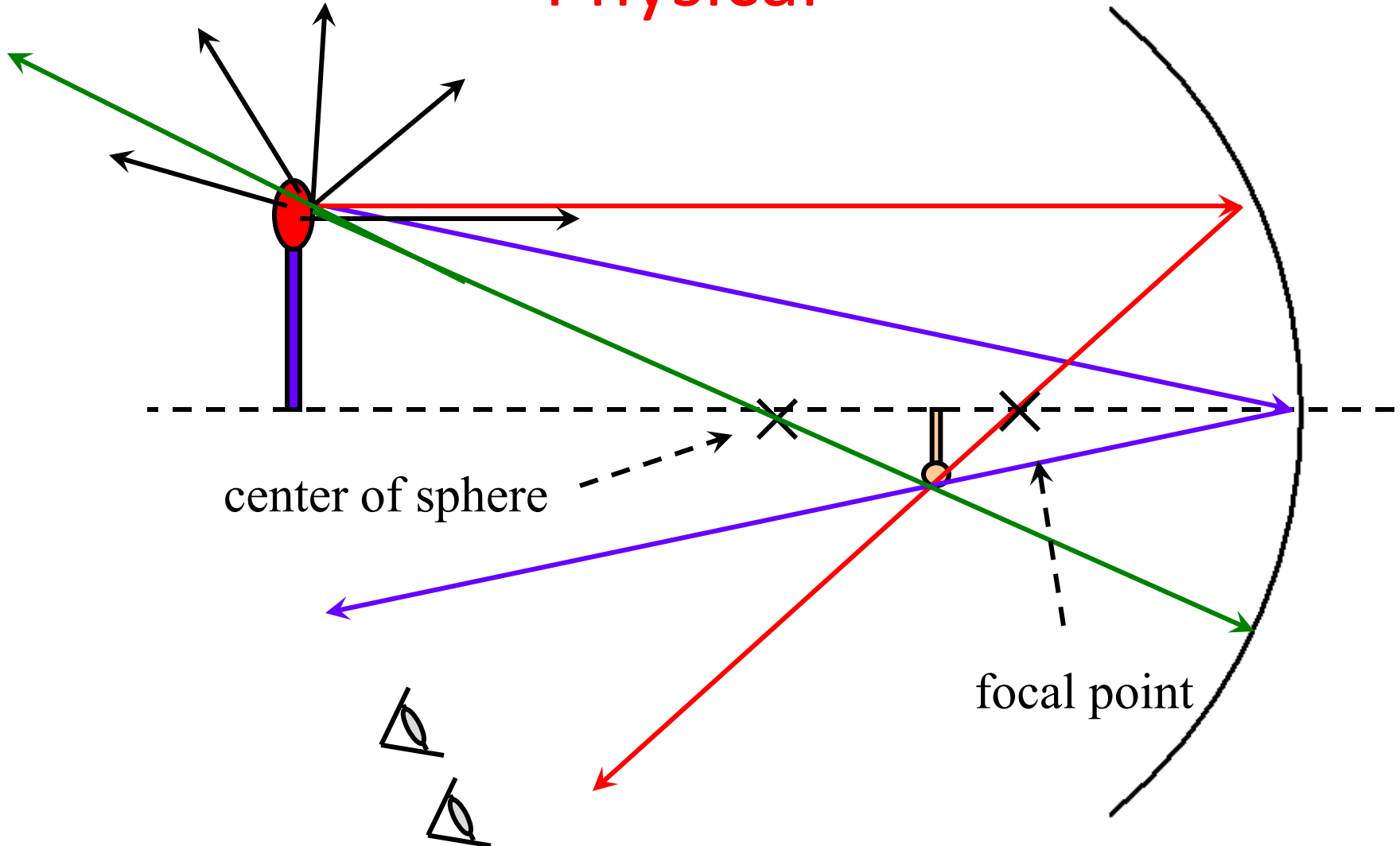
All rays parallel to and near an axis of the sphere reflect through a single point on the axis (the focal point)

center of sphere

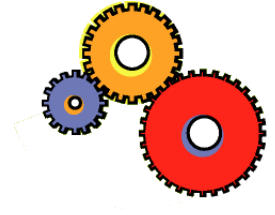


# Images in a Spherical Mirror: 1

## Physical



# Kinds of Images: Real



- In the case of the previous slide, the rays seen by the eye do in fact converge at a point.
- When the rays seen by the eye do meet, the image is called *real*.
- If a screen is put at the real image, the rays will scatter in all directions and an image can be seen on the screen, just as if it were a real object.