

PEER INSTRUCTION: DISCUSSION AND “BRAINS-ON” DEMONSTRATION

Eric Mazur

Harvard University
5 May 1999

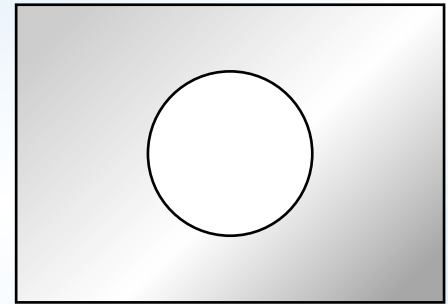


Outline

- ▶ **ConceptTests**
- ▶ **Feedback**
- ▶ **Problem with Problems**
- ▶ **Discussion**

Question 1

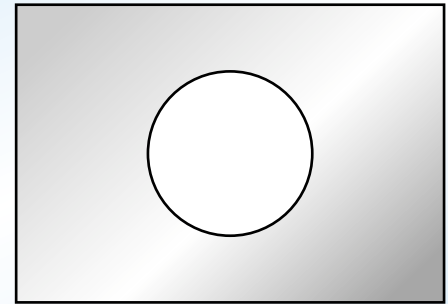
Consider a rectangular metal plate with a circular hole in it.



Question 1

Consider a rectangular metal plate with a circular hole in it.

When the plate is uniformly heated, the diameter of the hole



1. increases
2. stays the same
3. decreases

Message 1

It's easy to fire up the audience!

Question 2

A boat carrying a large boulder is floating on a lake. The boulder is thrown overboard and sinks to the bottom of the lake.

Question 2

A boat carrying a large boulder is floating on a lake. The boulder is thrown overboard and sinks to the bottom of the lake.

Does the level of the water in the lake (with respect to the shore)

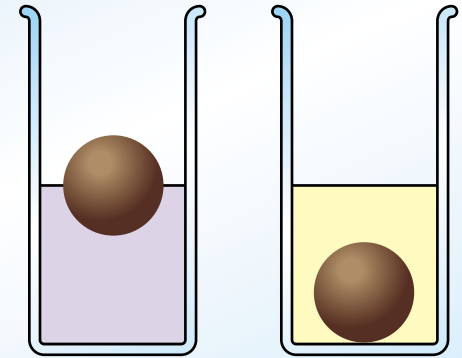
1. go up,
2. go down, or
3. stay the same?

Message 2

We all make mistakes!

Question 3

Consider an object that floats in water but sinks in oil. When the object floats in water, half of it is submerged.

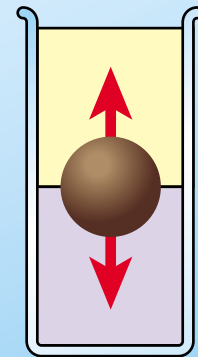
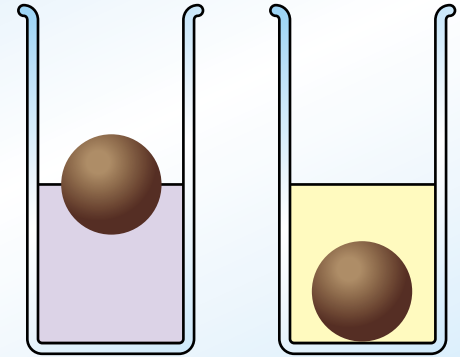


Question 3

Consider an object that floats in water but sinks in oil. When the object floats in water, half of it is submerged.

If we slowly pour oil on top of the water so it completely covers the object, the object

1. moves up.
2. stays in the same place.
3. moves down.



Message 3

It's easy to make simple demonstrations fascinating!

Question 4

When we hold a page of printed text in front of a mirror, the text on the image in the mirror runs from right to left:

The New York Times

Question 4

When we hold a page of printed text in front of a mirror, the text on the image in the mirror runs from right to left:

The New York Times

Why is it that right and left are interchanged and not top and bottom? Because

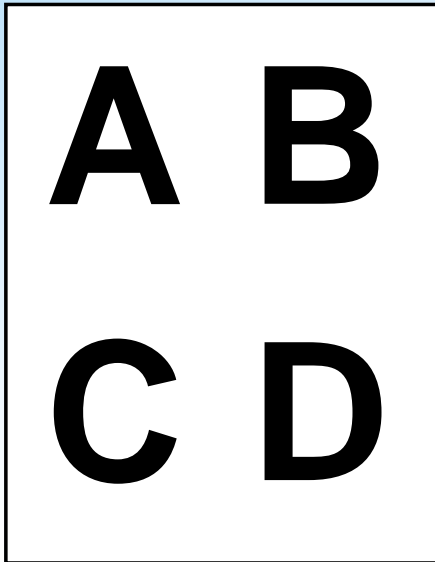
1. the mirror is oriented vertically,
2. we have two eyes in the horizontal plane,
3. the Earth's gravitation is directed downward,
4. a habit we have when looking at images in a mirror,
5. It only *appears* to run from left to right.

Message 4

It's "simple" only if you know the answer

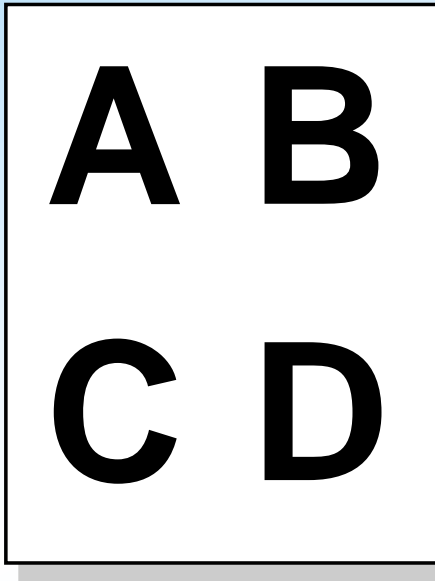
Feedback

Flashcards: simple and effective!



Feedback

Flashcards: simple and effective!



Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

Requires assumptions

Requires developing a model

Requires applying that model

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces. **On average people shop for about 2 hours.**

How long do you have to wait before someone frees up a space?

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces. **On average people shop for about 2 hours.**

How long do you have to wait before someone frees up a space?

Requires developing a model

Requires applying that model

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces. On average people shop for about 2 hours.

Assuming people leave at regularly-spaced intervals, how long do you have to wait before someone frees up a space?

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces. On average people shop for about 2 hours.

Assuming people leave at regularly-spaced intervals, how long do you have to wait before someone frees up a space?

Requires applying a (new) model

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area where people are known to shop, on average, for two hours. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area where people are known to shop, on average, for two hours. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

$$t_{wait} = \frac{T_{shop}}{N_{spaces}}$$

Problem with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area where people are known to shop, on average, for two hours. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

Requires using a calculator

$$t_{wait} = \frac{T_{shop}}{N_{spaces}}$$

Resources

Peer Instruction: A User's Manual (Prentice Hall, 1997)

<http://galileo.harvard.edu>

Funding

National Science Foundation

**For a copy of this talk and
additional information:**

<http://mazur-www.harvard.edu>