

Two Flat Mirrors (aka the Hinged-Mirrors)

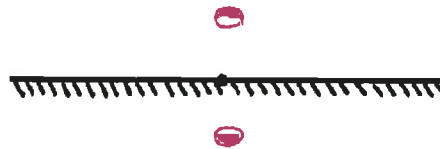
(Where 'more gets you less' and 'less gets you more'!)

You have a nice pair of 3" x 5" mirrors...

Assemble the hinged-mirrors as instructed (FRSs towards the inside)

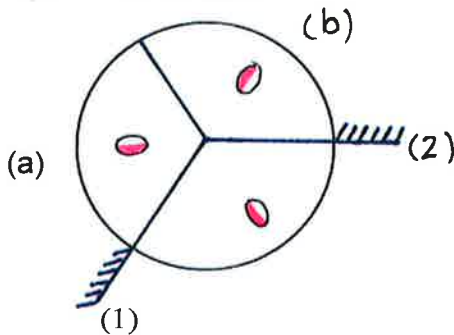
(360 degrees/ x-degrees) - 1

When you open the two mirrors like the diagram below you will see **one object** and **one reflection**. *The plane is divided into two parts.*



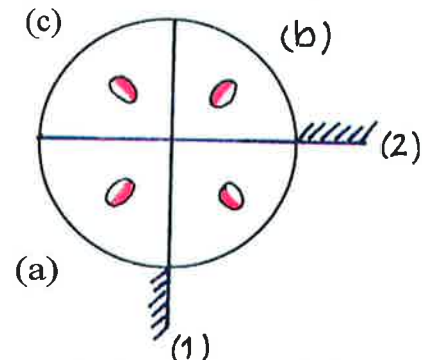
When you arrange the two mirrors like the diagram below you will see **one object and two reflections**. *The plane is divided into three parts.* Each of the two mirrors reflects the object. Reflection (a) is from the first mirror and reflection (b) is from the second mirror.

Nothing unusual so far...

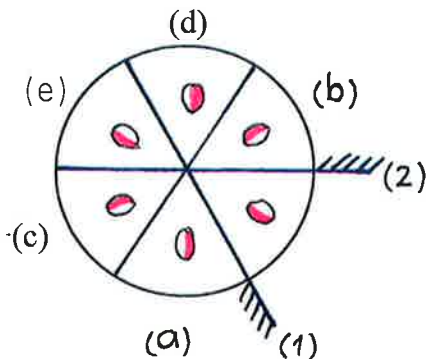


Arrange the two mirrors so you can see four things, **one object and three reflections**. Reflection (a) is from the first mirror and is _____*. Reflection (b) is from the second mirror and is _____*. What about reflection (c)?

The plane is now divided into four parts.



Arrange (close down) the two mirrors like the diagram below with *the plane divided into 6 parts* which gives you **one object and five reflections**.



Notice that all the images are NOT the same...

Some appear to have *changed**

(I use that term as I am not able to come up with a better one!)

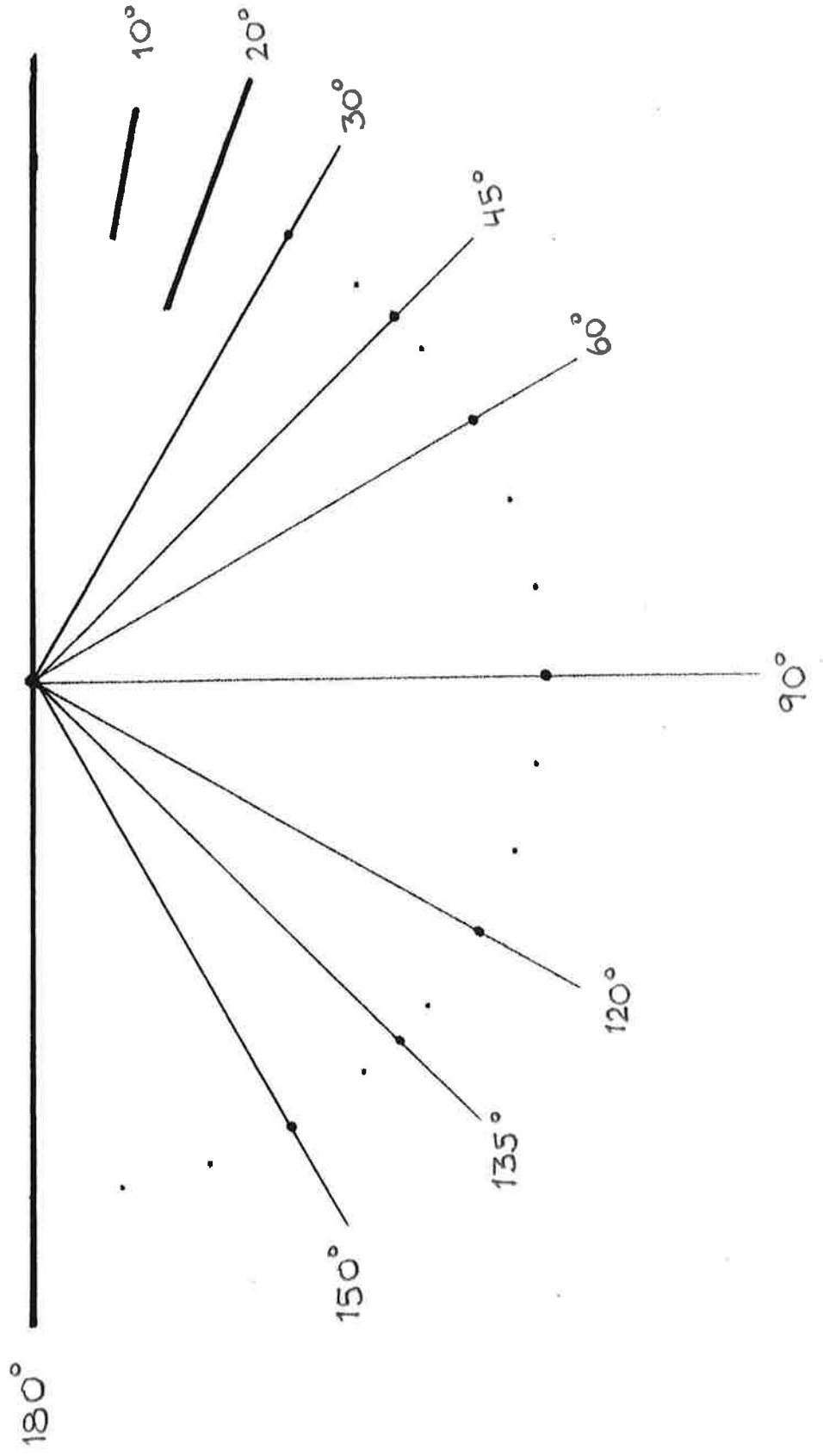
Look for patterns!!!

There is a pattern! The first reflection *appears* to change something, the second reflection doesn't (un-dos?), the third reflection changes it again and the fourth doesn't. The reflections appear to alternate and as you increase the number of times the light is reflected, the weaker/duller the reflections become.

Essentially, what we are doing is increasing the number of reflections by decreasing the angle between the two mirrors, thus having *more reflections of reflections!*

Data-table

Angle between mirrors	# of images plus the object itself	# of just images (or reflections)	Observations
180°			
120°			
90°			
60°			
45°			
30°			
20°			
10°			
	5		
	15		



Images/Reflections + Object

VS.

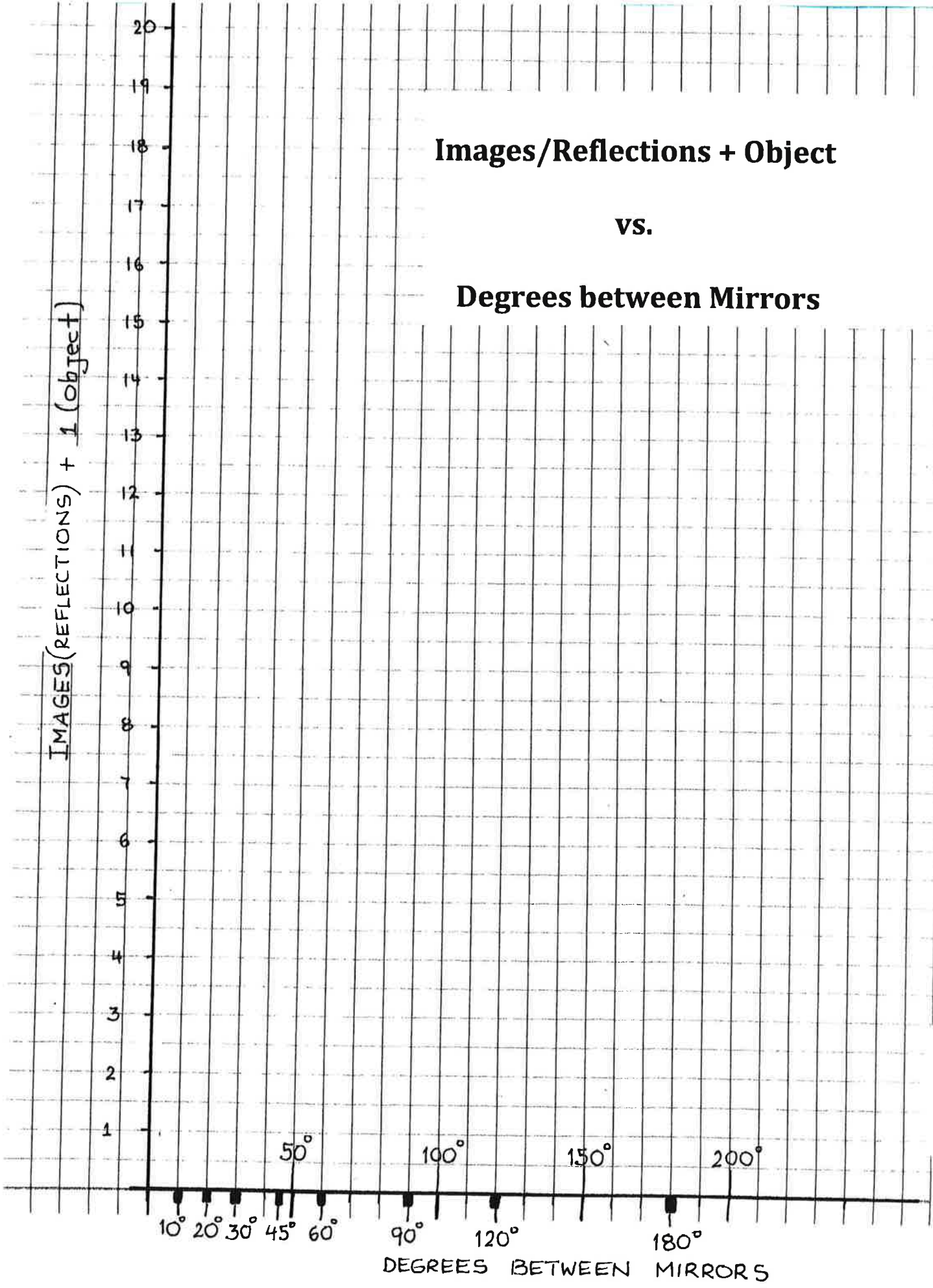
Degrees between Mirrors

IMAGES (REFLECTIONS) + 1 (object)

20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1

10° 20° 30° 45° 60° 90° 120° 150° 180° 200°

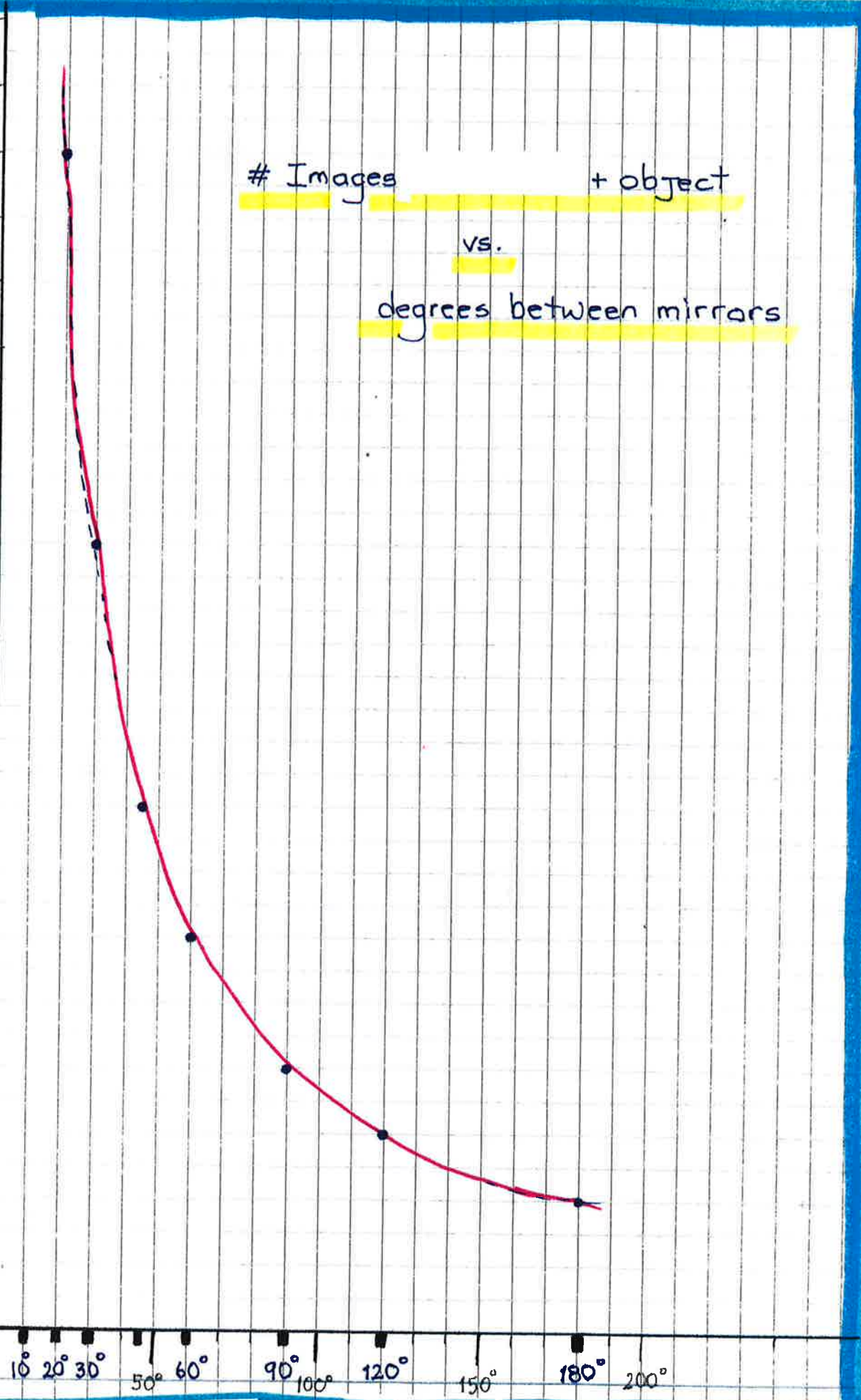
DEGREES BETWEEN MIRRORS



Reflections + 1 (object)



Images + object
vs.
degrees between mirrors



Degrees between mirrors

Hinged-mirror questions

Subject-Centered Questions

- What causes the object to be repeatedly reflected?
- What caused the patterns you noticed?
- What makes the object seem to magically disappear and reappear?
- Why does the image change when you move the mirrors?
- Why are different numbers of images produced as the mirrors are moved?
- What affects the number of images you can observe?
- Can an image act as a source?

Person-Centered Questions

- Why do you think you make more images when the angle of the mirror is smaller?
- Why do you think different numbers of images are produced when the mirrors are moved?
- How do you explain the image(s) of the object in the mirror?
- How would you explain your observation?
- How would you explain the occurrence of the phenomena you are observing?
- How can you explain what is happening in the mirror with both the object and the mirror?
- What do you think is happening with the mirror?

Process-Centered Questions

- What happens to the image of the object when you move the two mirrors closer to each other?
- What changes do you see happening when you move the mirror?
- Can you predict the position needed to view four images? Eight images?
- What is the relationship between the position of the mirrors and the number of images?
- What is the relationship between the angle of the mirror and the number of odd/even images?
- What did you notice when the mirrors were open wide vs. opened narrow and why?
- What would you change to get the 'most' reflections of the object in your mirrors?
- How would you arrange the mirrors to see just two objects?
- Have you seen any patterns?
- Tell me what you see.

Background information courtesy of Mr. Chris Holle (LAUSD Science Advisor) and the **Institute For Inquiry** (The Exploratorium)