Pearson

ICTCM21 | Reimagined

MARCH 12 · JUNE 11 · OCTOBER 8

Pearson

Optics at Home

(and Grassroots Histories)

Asynchronous Version

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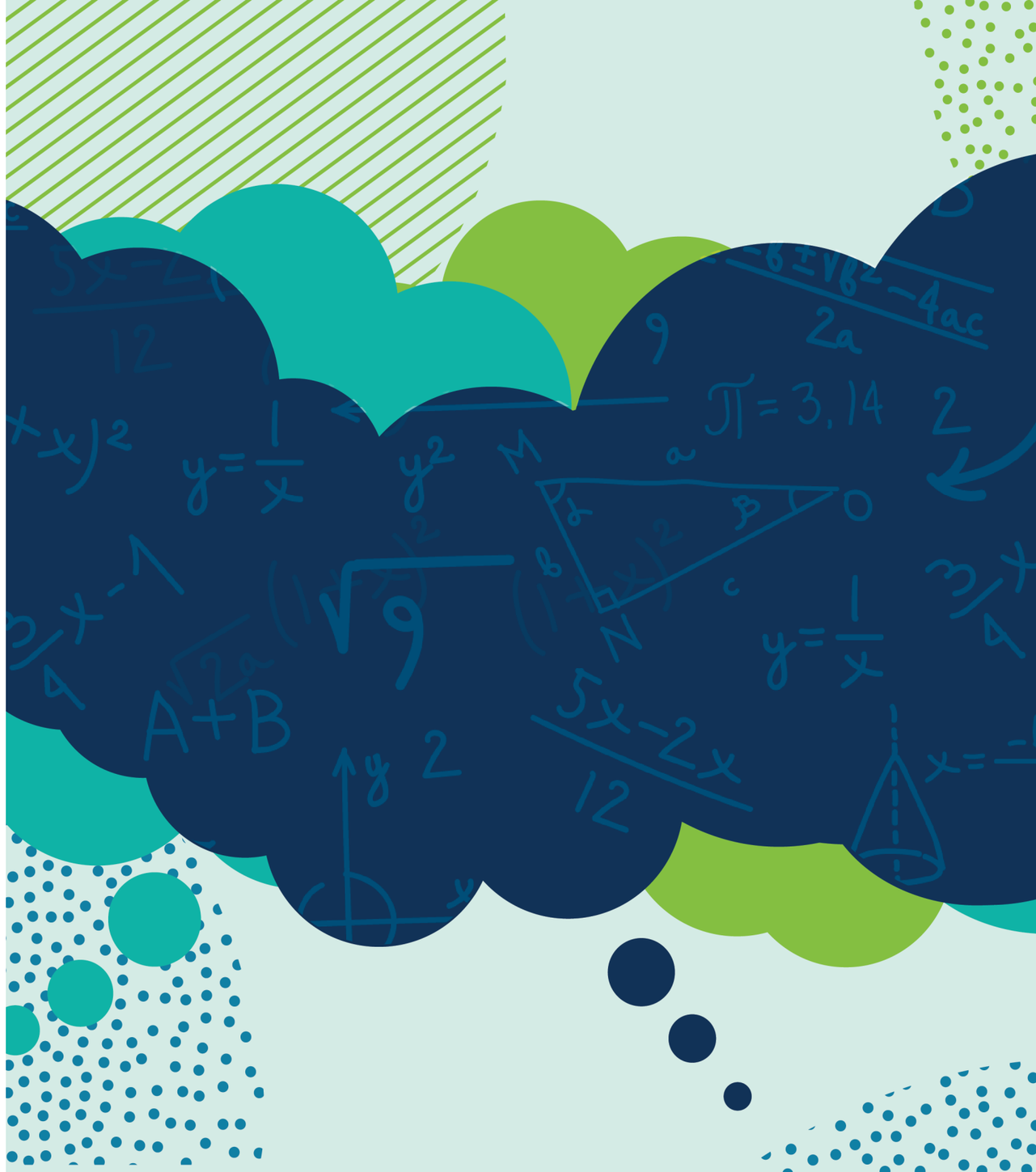
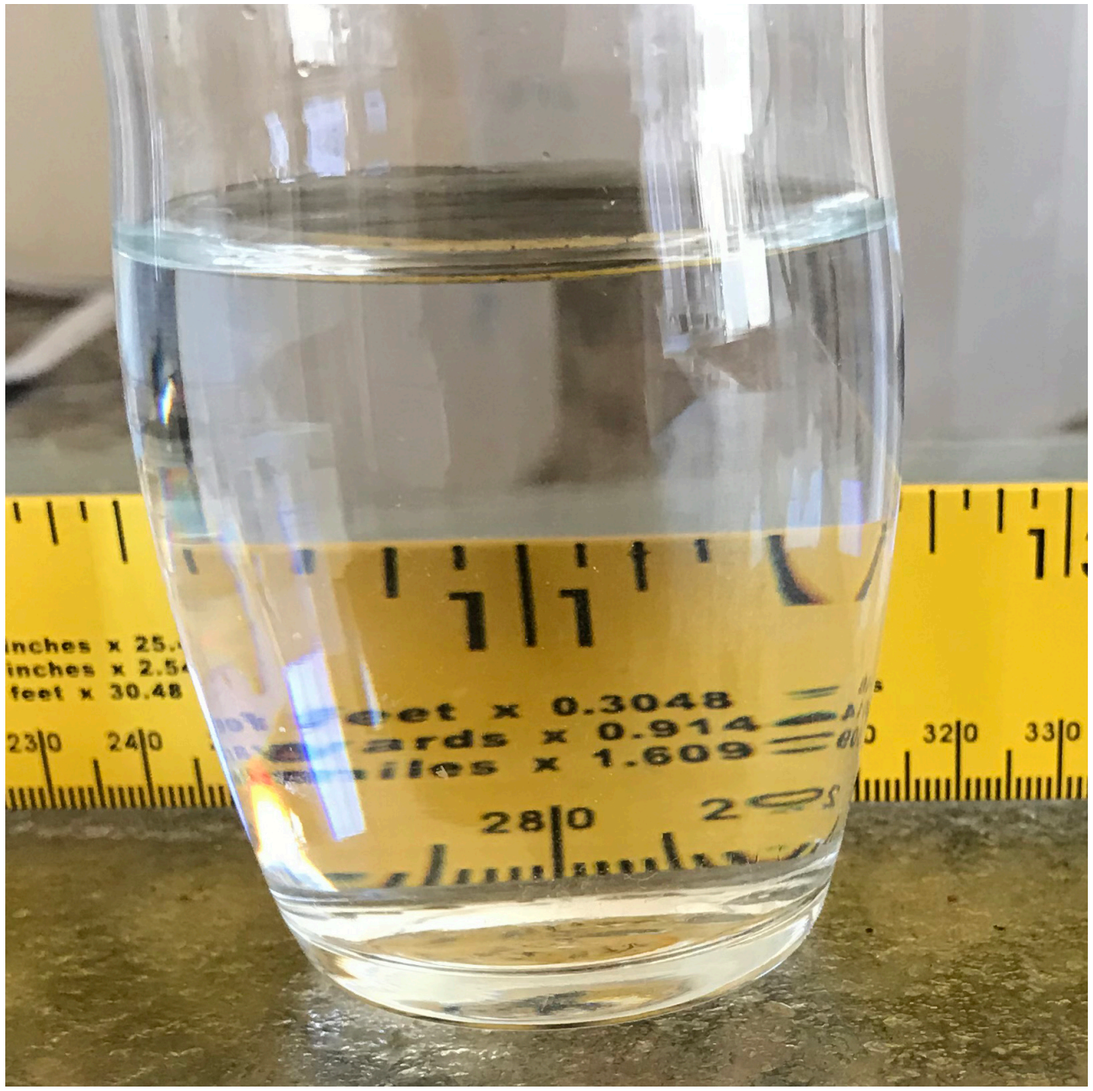
https://justaddmath.org/ictcmmarch2021/



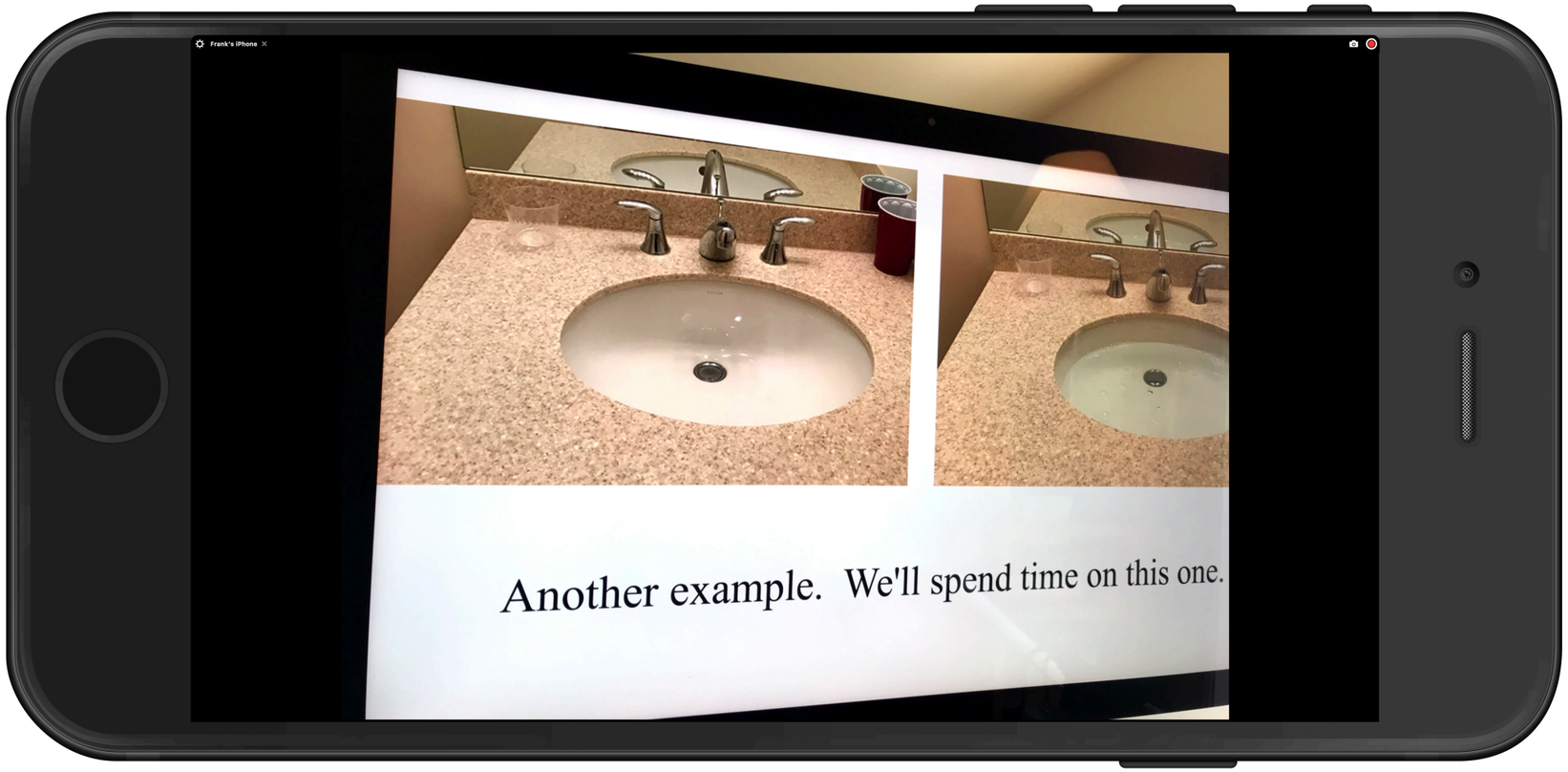
This is an interactive, participatory workshop. As you go through these slides you will hit slides like this one that ask you to walk away or turn away from your screen and do something.

Your house and your students' houses are filled with interesting optical phenomena that involve mathematics. Stop here and look around your house for examples.

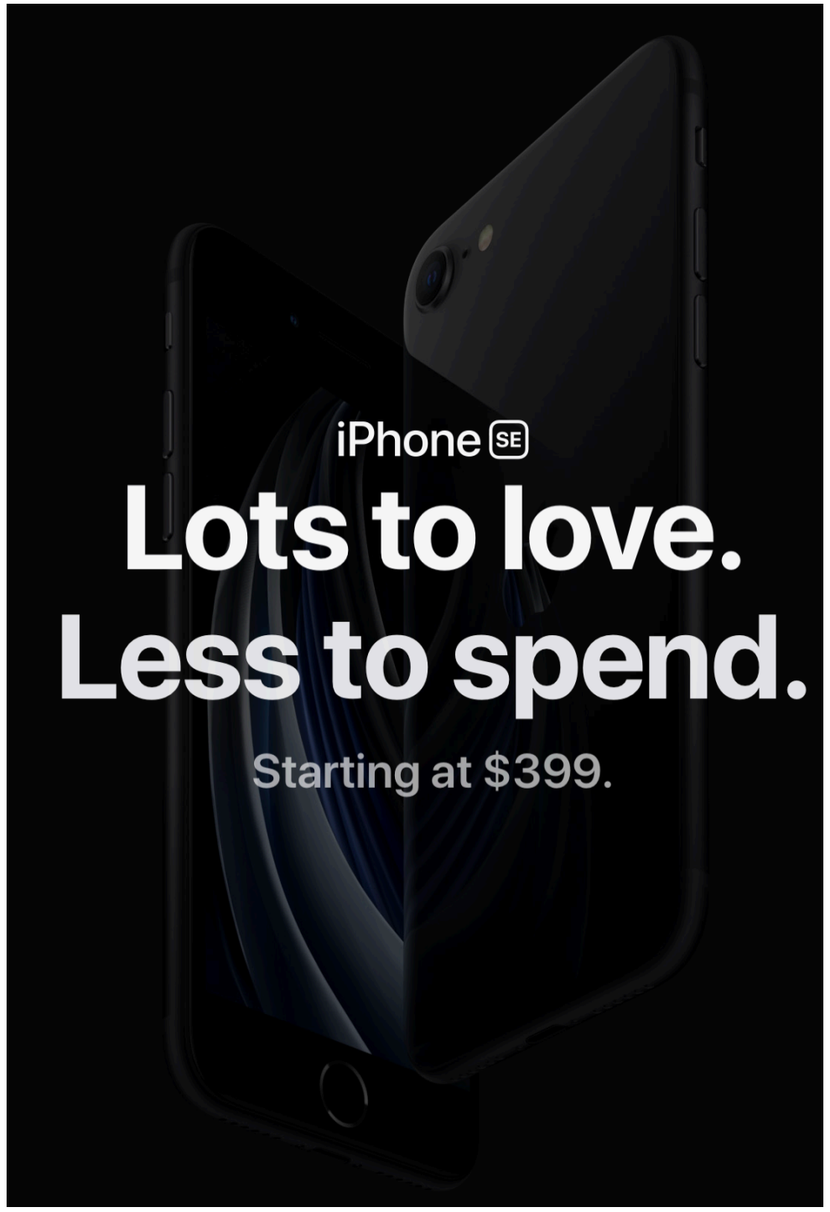


Two examples from my house

Another example. We'll spend time on this one.



One of the richest sources of optical phenomena and also of tools for their study is your cell phone. Look at it now and list some ways you might use it.



Camera	
	12MP Wide camera
	ƒ/1.8 aperture
	Digital zoom up to 5x
	Portrait mode with advanced bokeh and Depth Control
	Portrait Lighting with six effects (Natural, Studio, Contour, Stage, Stage Mono, High-Key Mono)
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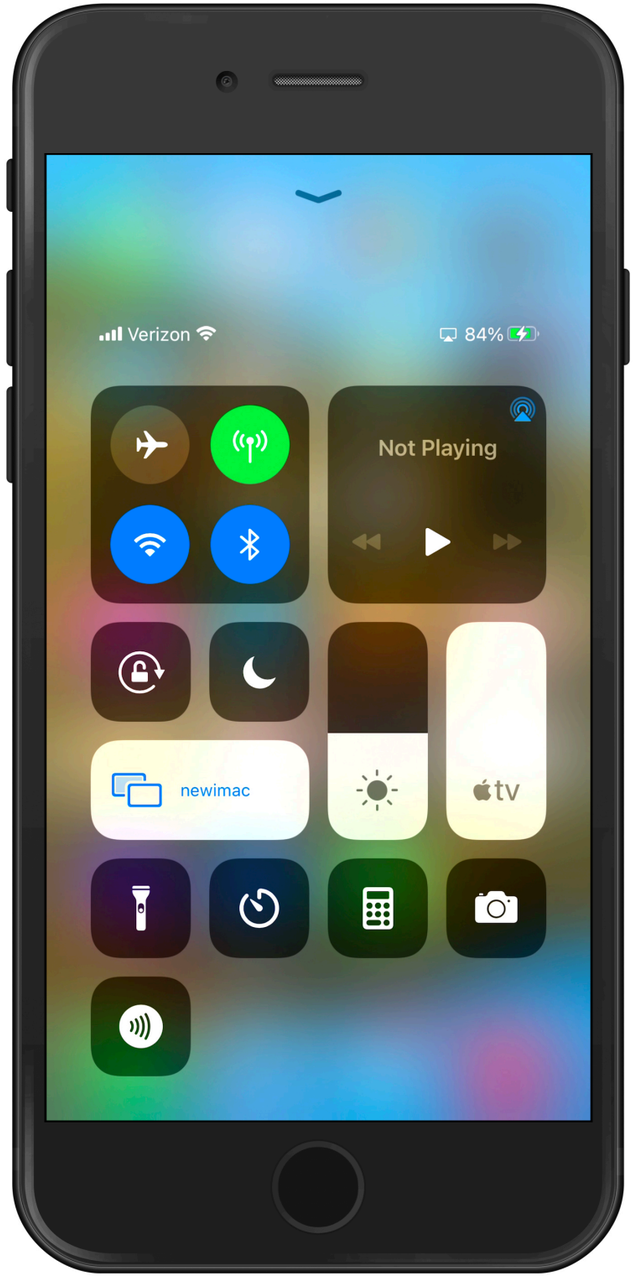
	Panorama (up to 63MP)
	Sapphire crystal lens cover
	Autofocus with Focus Pixels
	Wide color capture for photos and Live Photos
	Next-generation Smart HDR for photos
	Advanced red-eye correction
	Auto image stabilization
	Burst mode
	Photo geotagging
	Image formats captured: HEIF and JPEG

The camera - What do all those numbers mean for your pictures?

Your photo album -- Reflections everywhere



Your flashlight app

Hold your hand between your cellphone flashlight and a wall. Look at the shadow. Without moving your hand move the flashlight toward and away from your hand. Watch the shadow.

We'll compare this later with the "shadows" cast by lasers.

Optical Stories - An Example - Refraction - the Plot

- Setting the Stage - first experiments
- Preparing for Quests - standard course topics
- Tasks & Checks - begin with "routine" but then
- A Surprise
- Experimental Verification

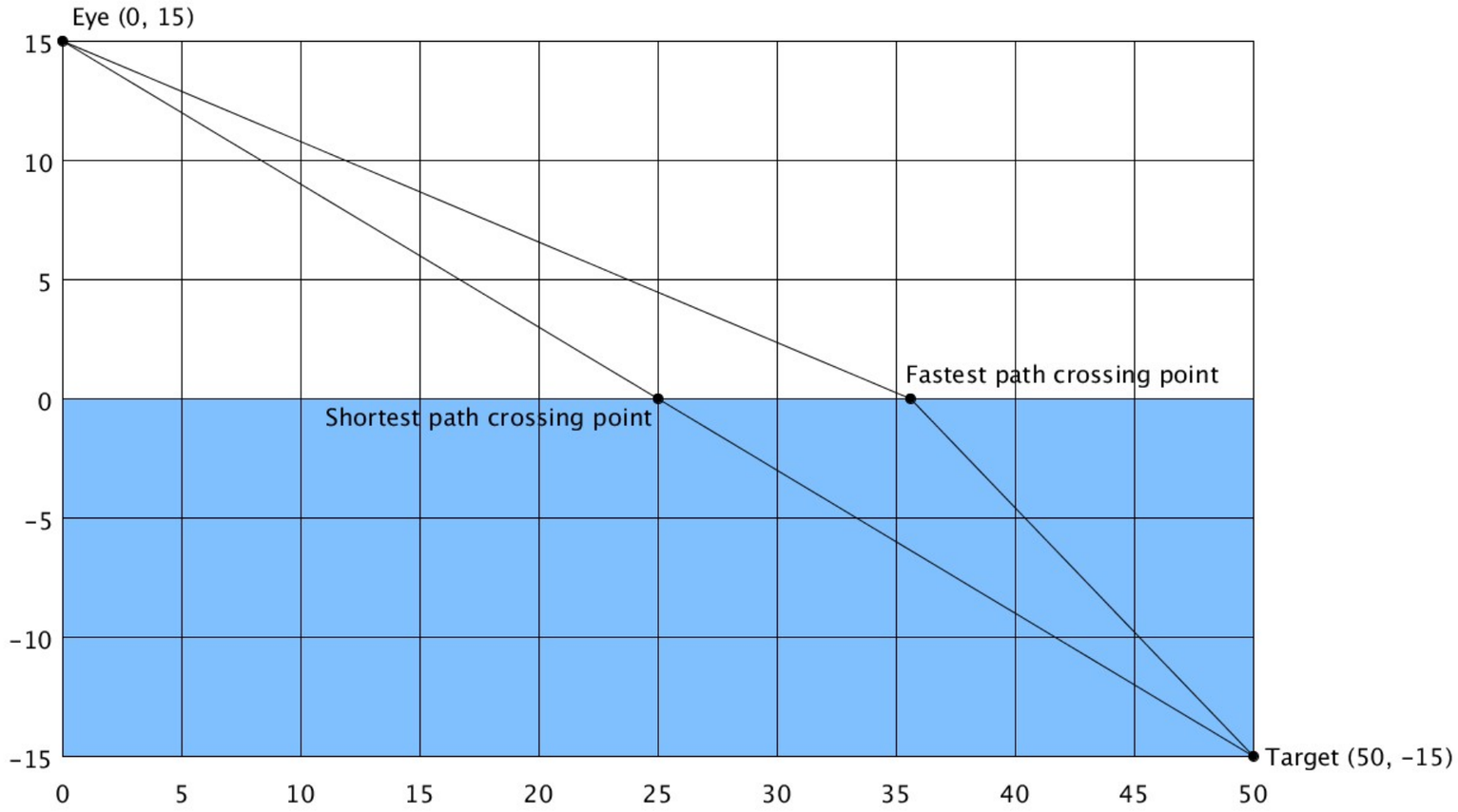
Themes - teamwork, students need to explain their work

Preparing for Quest

- Graphing
- Linear Functions
- Minimizing a Function

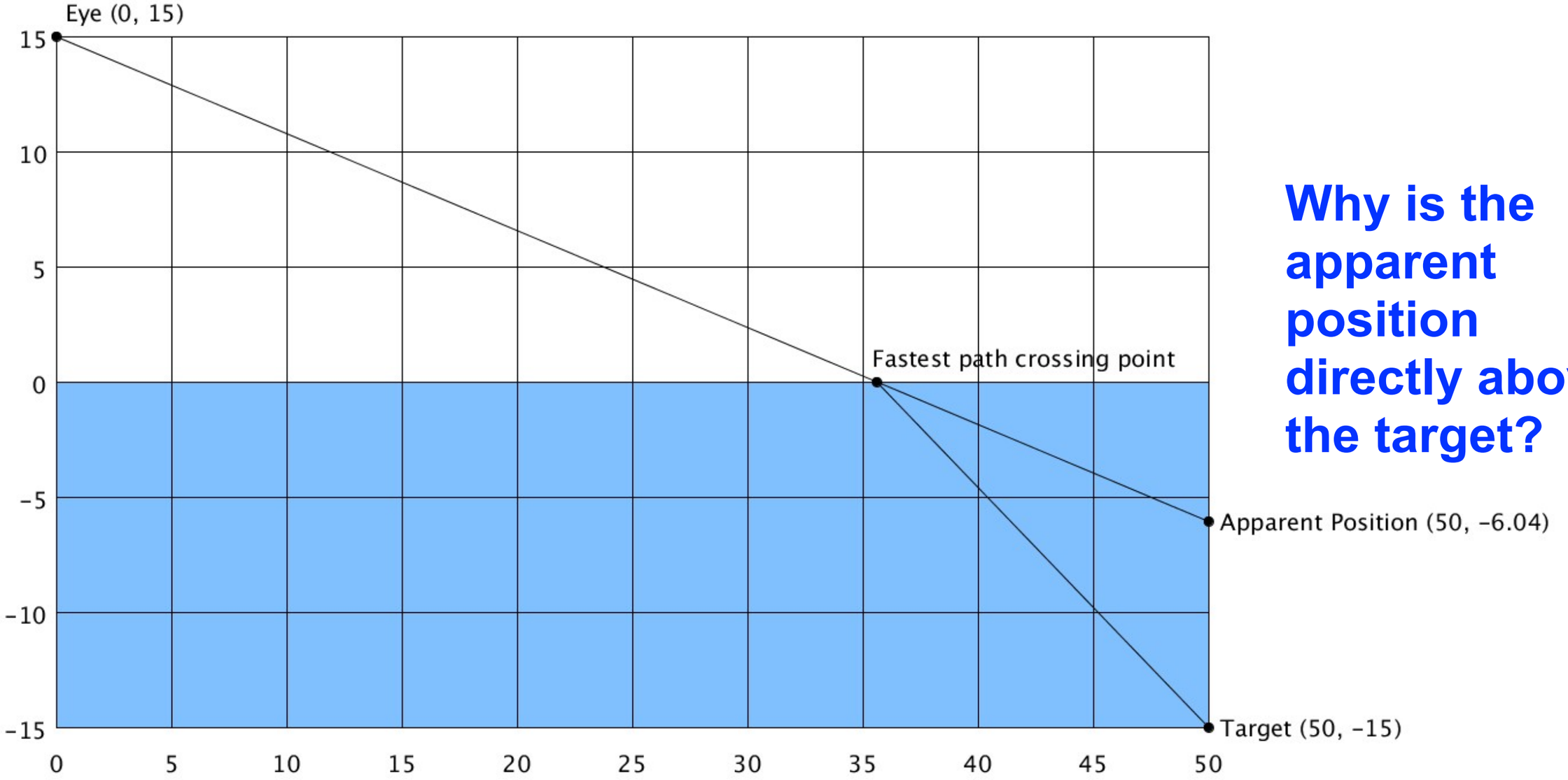
  - Graphing Calculator
  - Software (e.g. Desmos)
  - Programming (Optional)
  - Calculus (Optional) - Great Optimization Problems

Preparing for Quest - Fermat's Principle - Light takes the fastest path



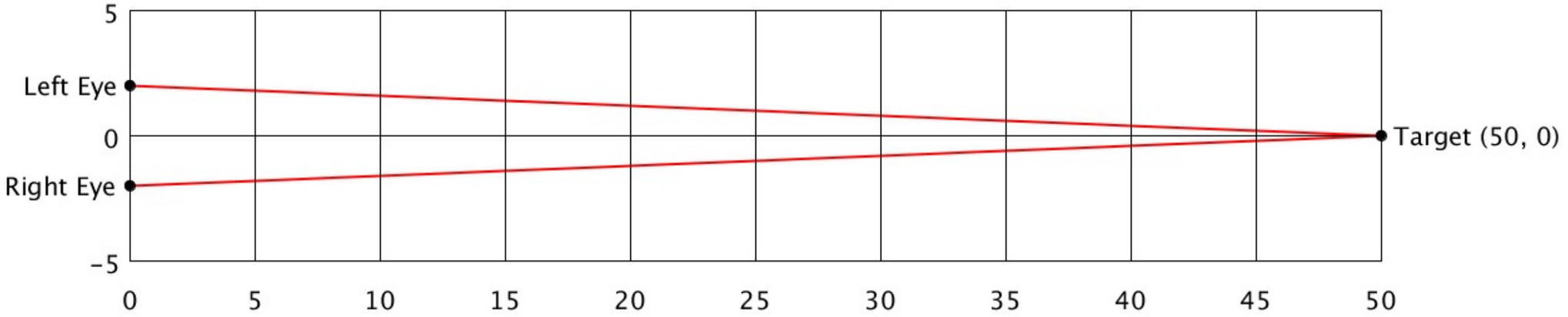
The speed of light in air is 30 cm/ns. In water it is 22.5 cm/ns

Lines and Linear Functions



Why is the apparent position directly above the target?

If you have red/blue 3D glasses use them to view the image above



Your brain combines two one-dimensional images to get a 3D model

Bow fishermen know all about this. They must aim low.

Now students do a series of problems building to harder and more open-ended ones. This is one of the more difficult ones.

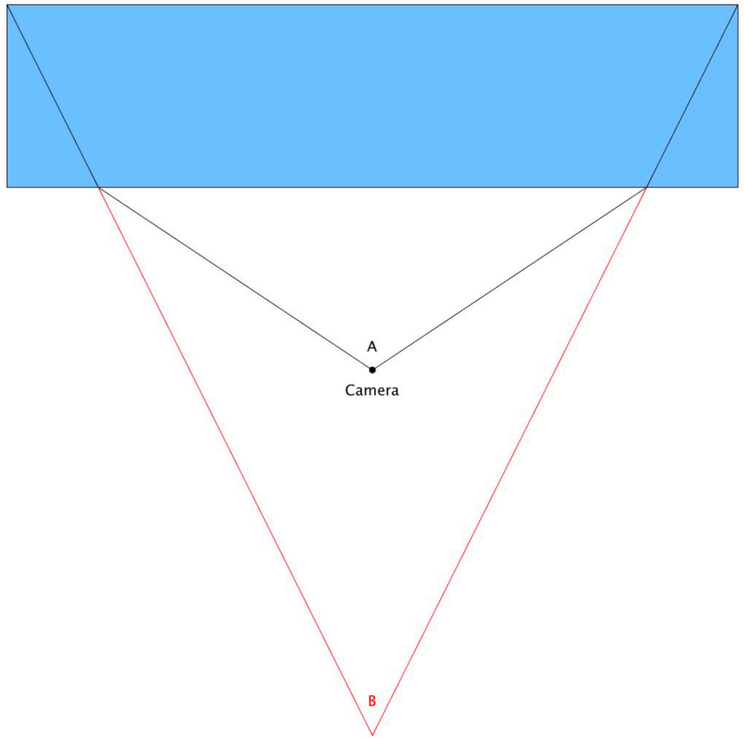
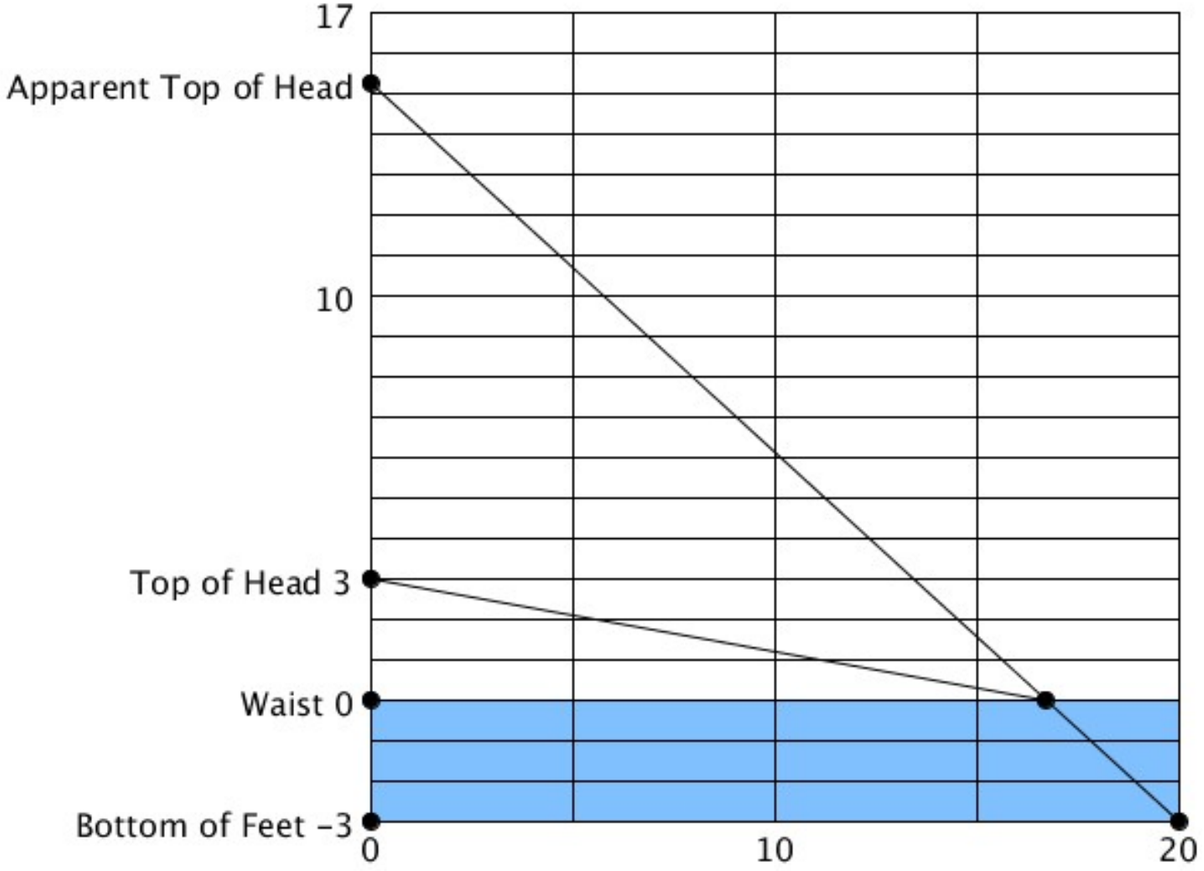


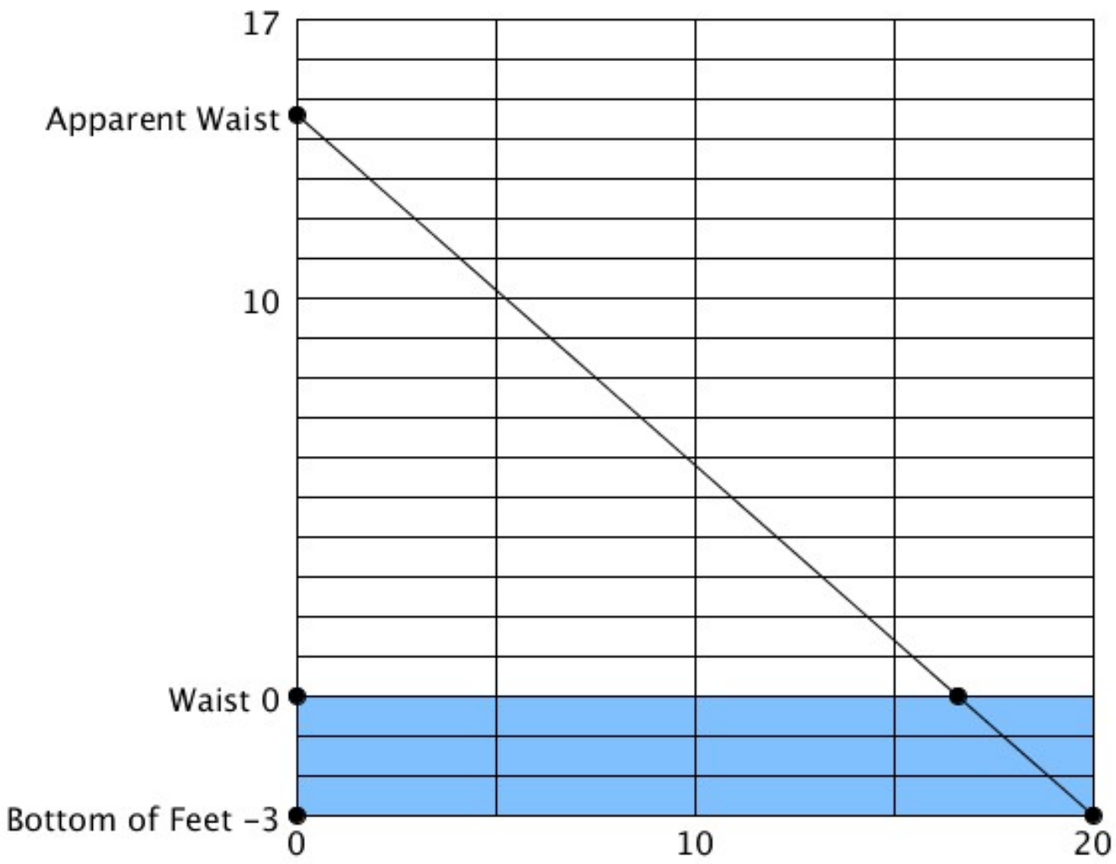
Figure 1.11: Designing an Underwater Camera

Question 4: You designing an underwater housing for a camera. The camera is an ordinary camera that is usually used in air. A glass plate at the front of an underwater housing separates the camera from the water, protecting it from water damage. Because the glass plate is relatively thin, we can assume that light rays traveling from objects underwater to the camera inside the housing travel through water and then through air as shown in Figure 1.11. As usual these light rays obey Fermat's Principle. Angle B is the effective field-of-view for photographs captured by the camera. Angle A is the field-of-view of the camera's lens when it is used in air. Investigate and discuss the relationship between the angles A and B. How does the distance between the camera and the front plate affect this relationship?

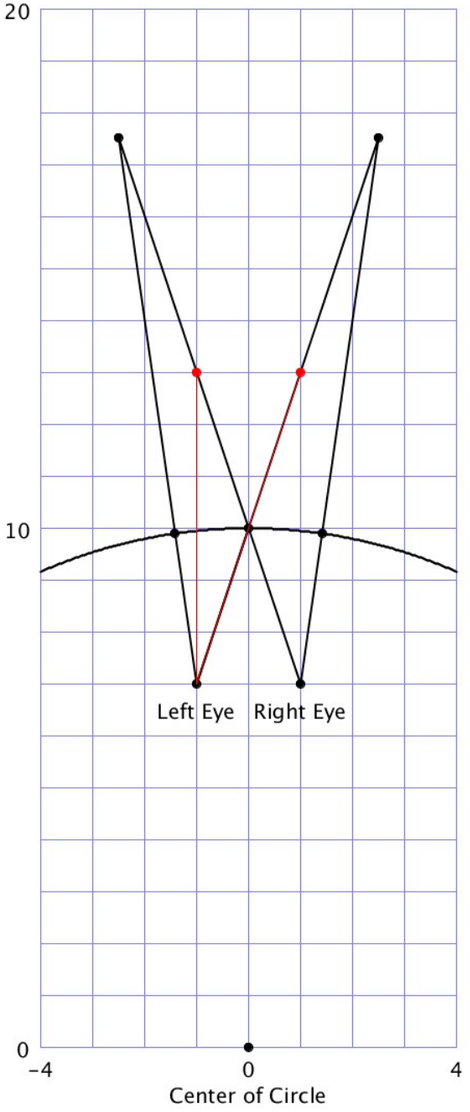
Question 5 Suppose a six foot tall fisherman is standing waist deep in a pool that is three feet deep and suppose that a fish at the bottom of the pool 20 feet away is looking at the fisherman. What does the fish see?

This one seems routine but it isn't.
Try it before going on.



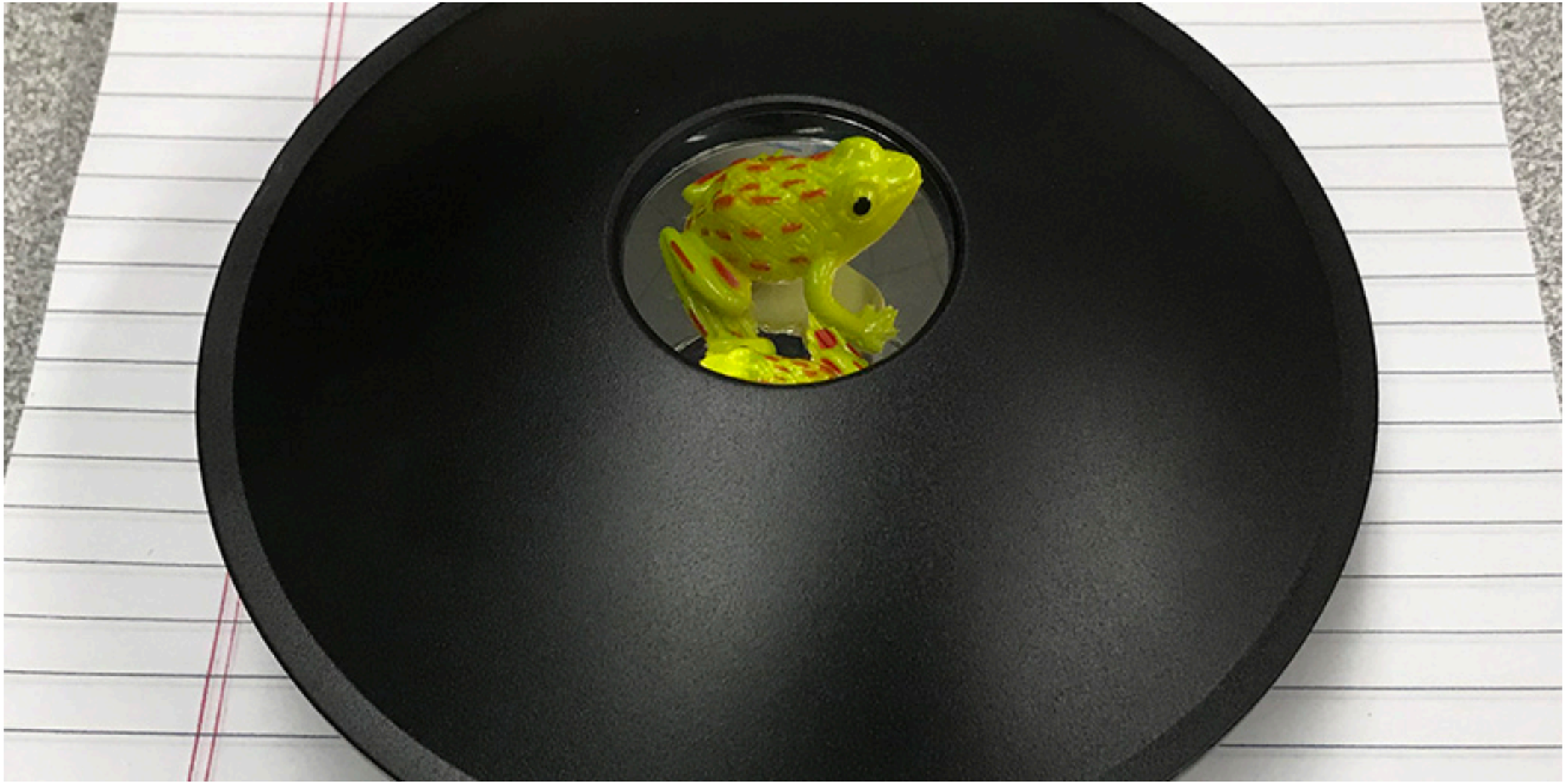


Surprise!! The fisherman is cut in half.
This cries out for experimental validation.

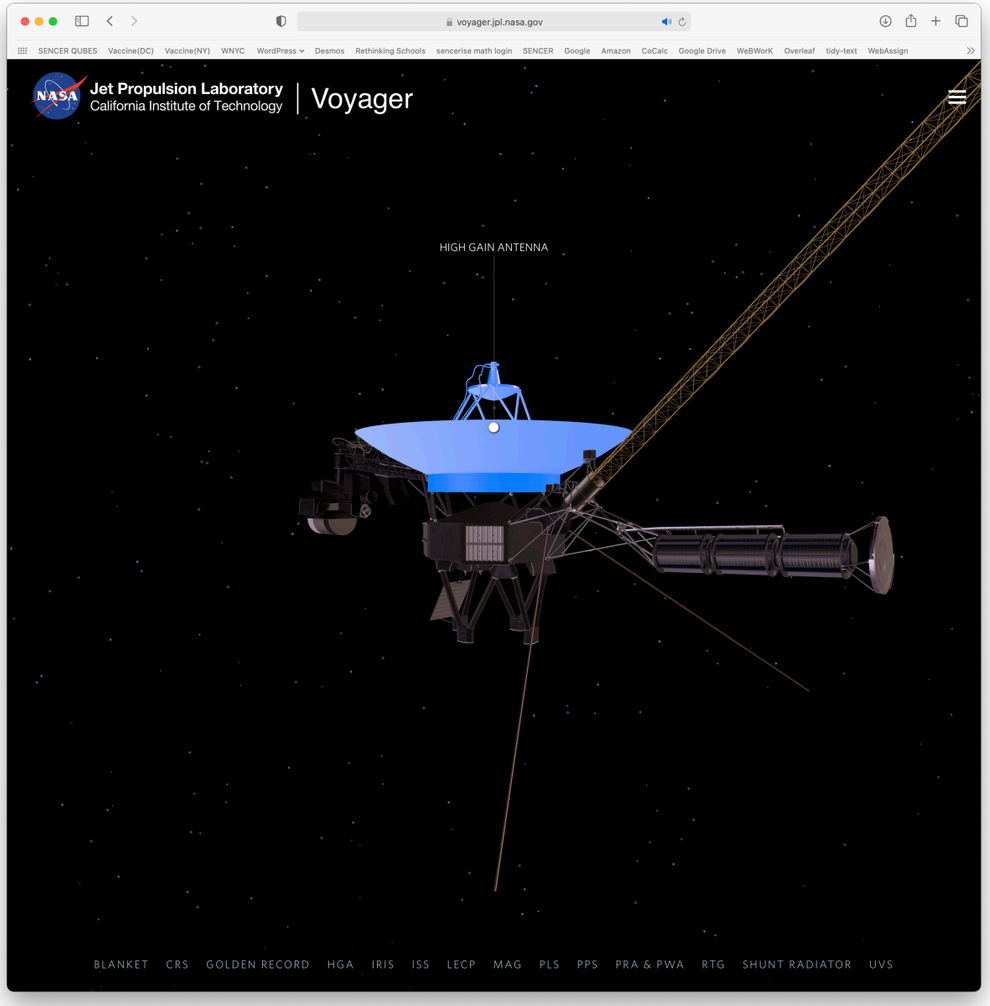


Up Close in a Make-up Mirror

Mirrors everywhere - this one is in Chicago



Parabolic mirrors - the mirascope "mirage"



Beating 1/R^2 - NASA's Deep Space Network and Voyager

Cheap diffraction grating glasses and ...

Roll over image to zoom in




3Pcs Cat Toy for Kitten & Dogs, Toys for Indoor Cats

Brand: UHKZ

4.4 out of 5 stars 306 ratings

Was: $21.99

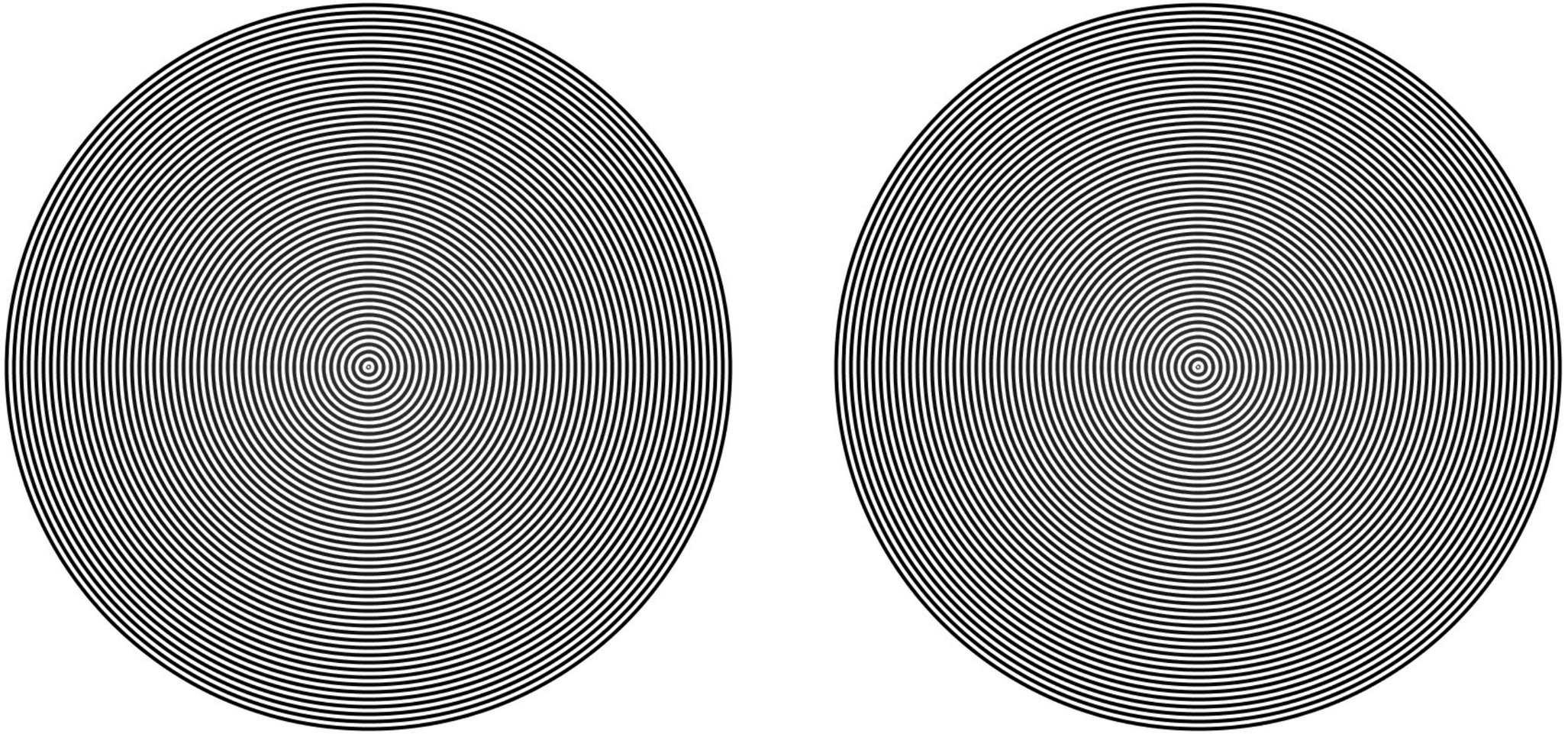
Price: $18.99 prime FREE One-Day & FREE Returns

You Save: $3.00 (14%)

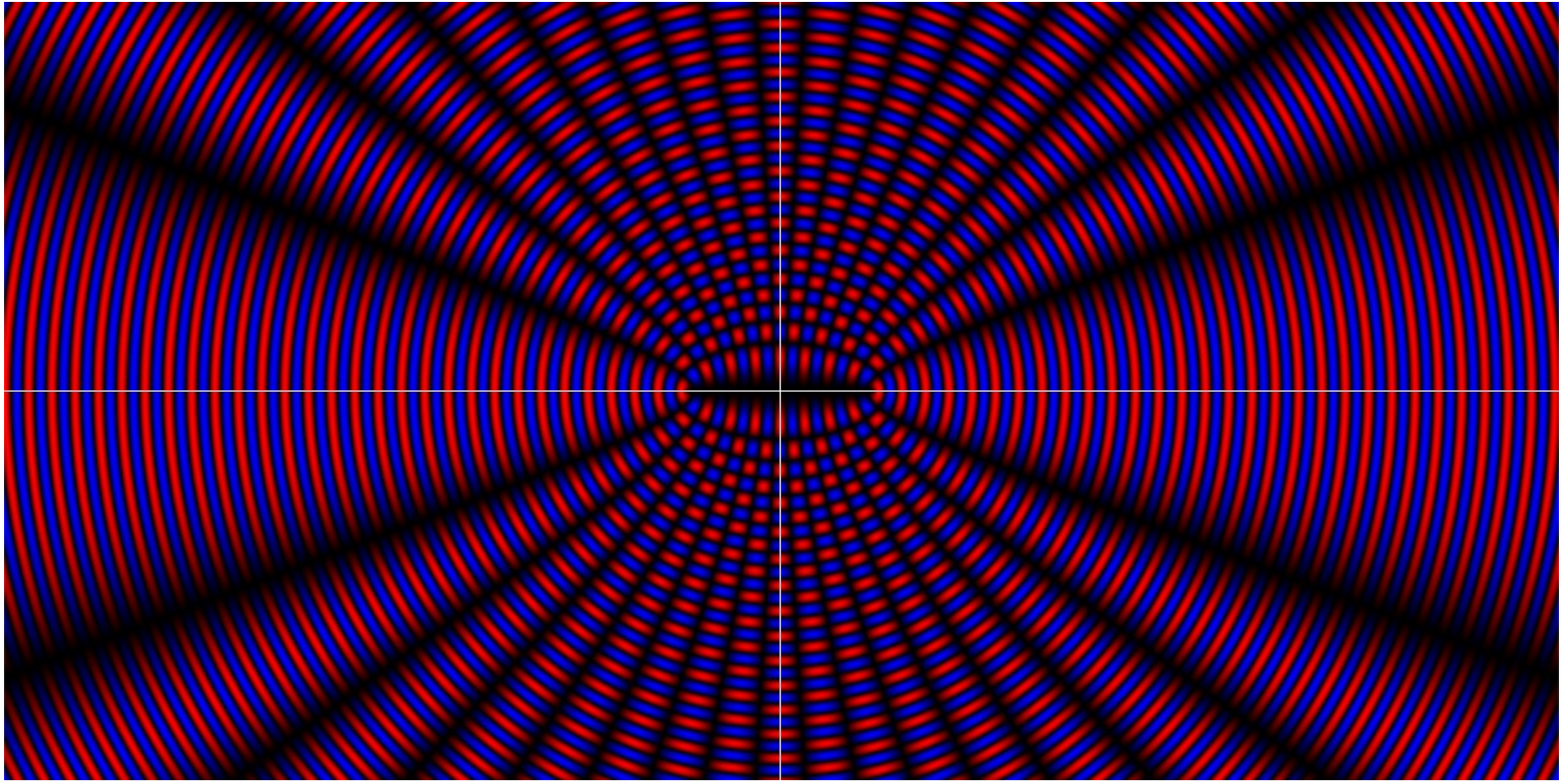
Your cost could be $8.99. Eligible customers get a $10 bonus when reloading $100.

- Warm Reminder:The cat toys powered by 2 x AAA batteries(not included in the package),you could easily find this batteries from local store.
- Multi Color:3 color(Green,Red,Blue),could be used as interactive toy for pet cat dog training,exercise and entertainment,it's can be enhance pet exercise.
- High Quality Material:High quality aluminum alloy shell with anti-off tape and clip , providing a comfortable touching and more durable for use.
- Protable Design:Mini size and easy to carry,easily put this interactive toys in your pocket or bag,use it anytime and anywhere for added convenience.
- Perfect Cat Interactive Toys:This is a great interactive toy for your lovely cats & dogs,to make pet more exciting when training and to stimulate their interests in greater.It will provide endless fun and exercise for your pet.

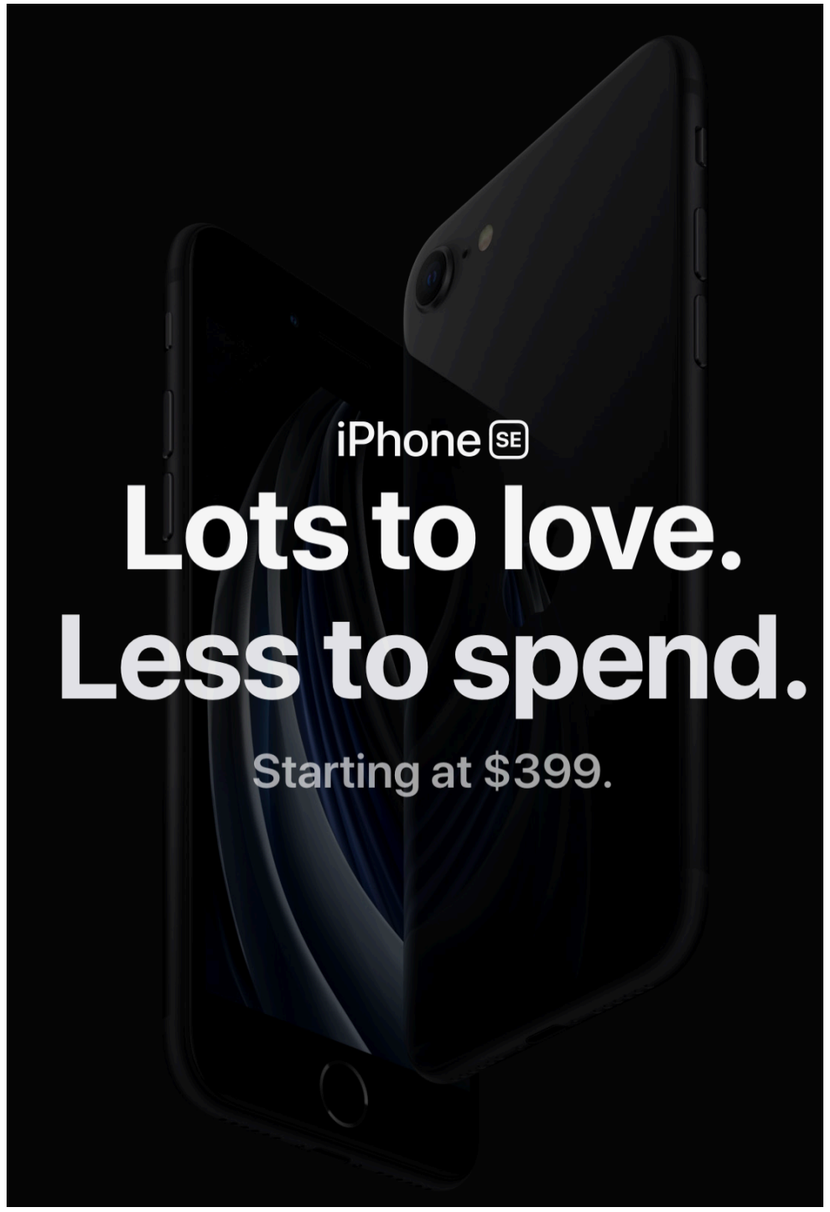
Cheap lasers and the shortcomings of geometric optics



A simple interference manipulative



Grassroots Histories - Visual Diaries and Narrative



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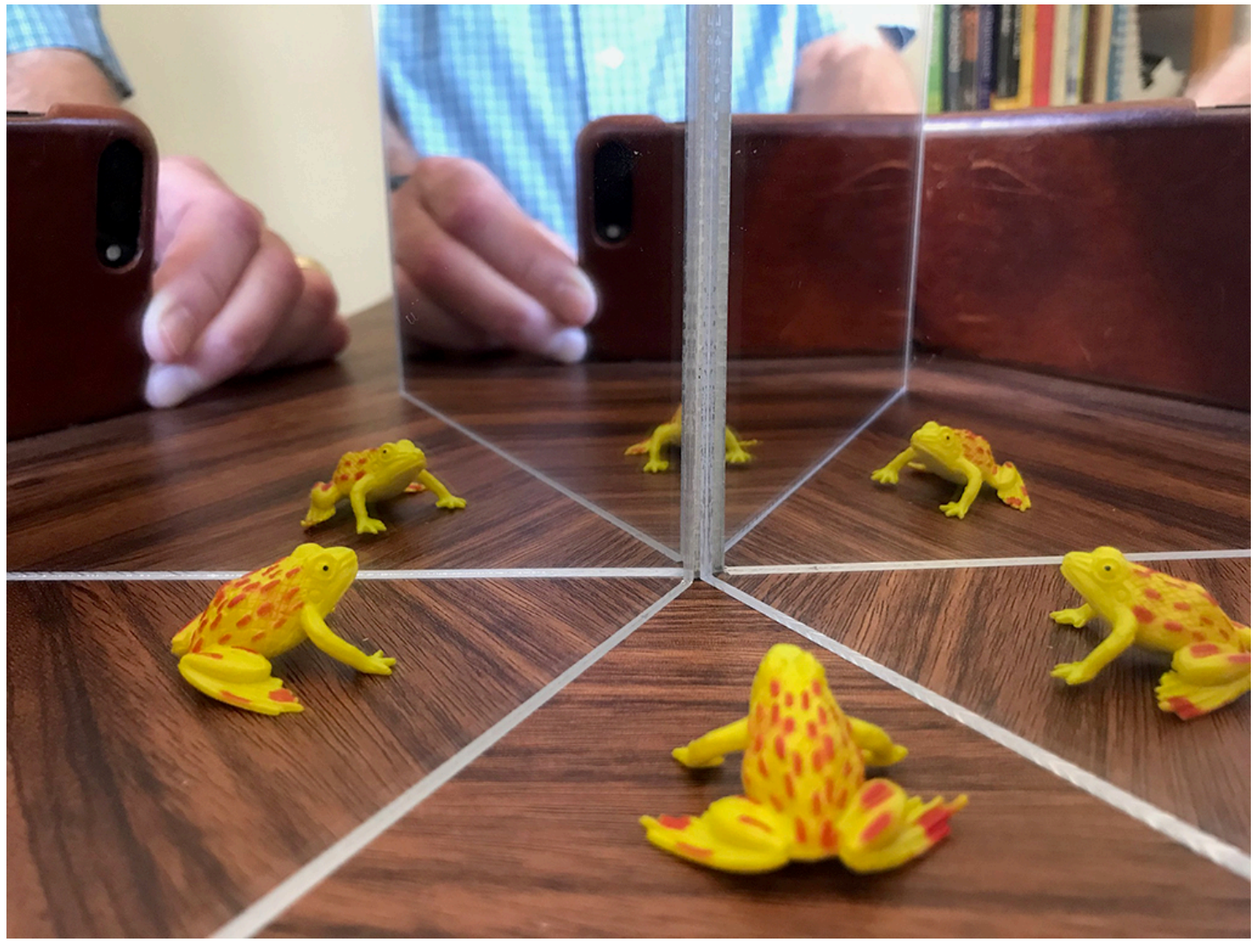
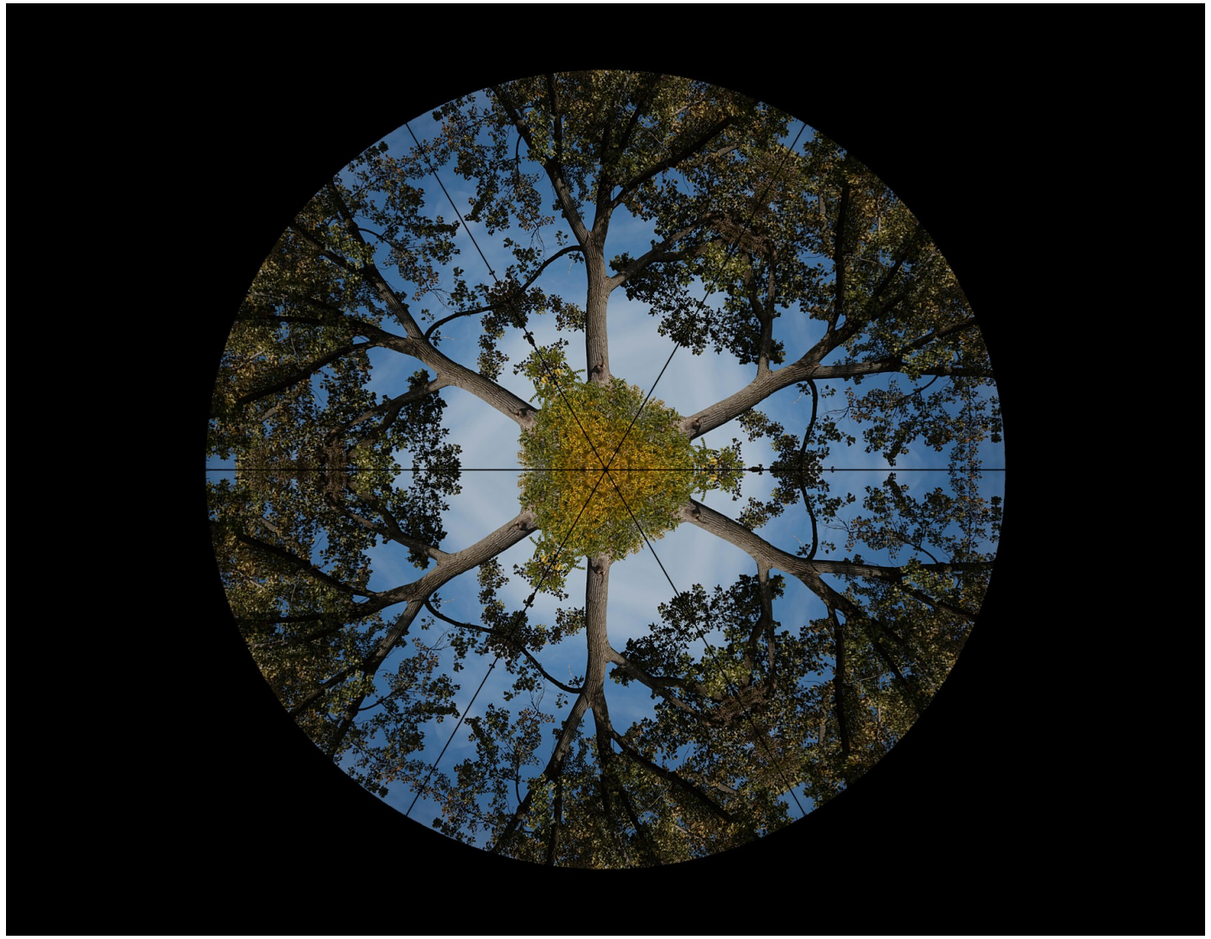
What does all that mean for your pictures?

Geometry and field-of-view


Code as Creative Medium
A Handbook for Computational Art and Design
Golan Levin and Tega Brain

and Math

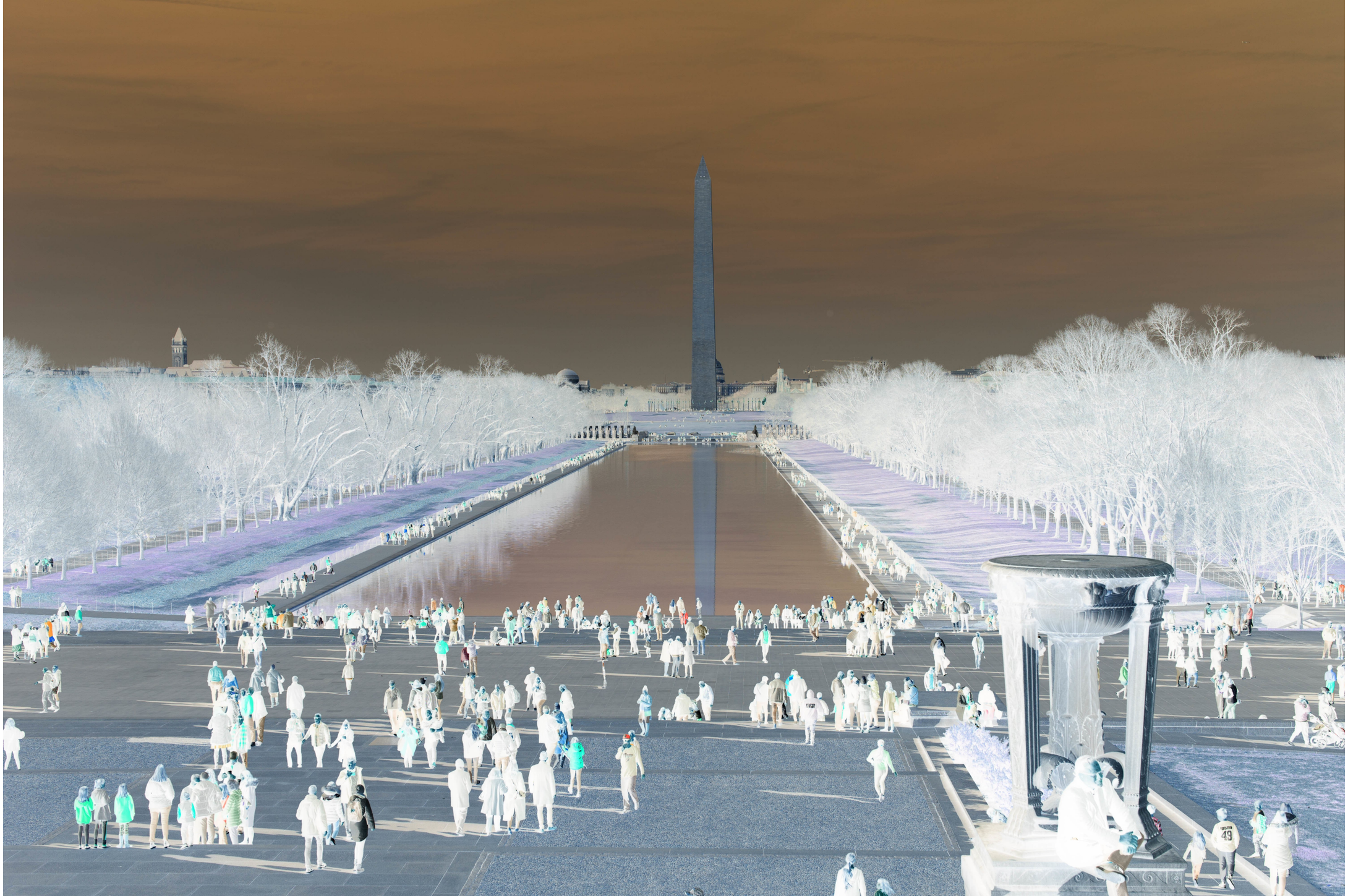




Linear Algebra and Kaleidoscopes

A bit of math and code replaces expensive, bulky lights

Creativity unleashed by math and code



Guided Tours - Download and play


6
8
7
4
5
2
3
1

Solving jigsaw puzzles focuses attention on parts

Download puzzle and play

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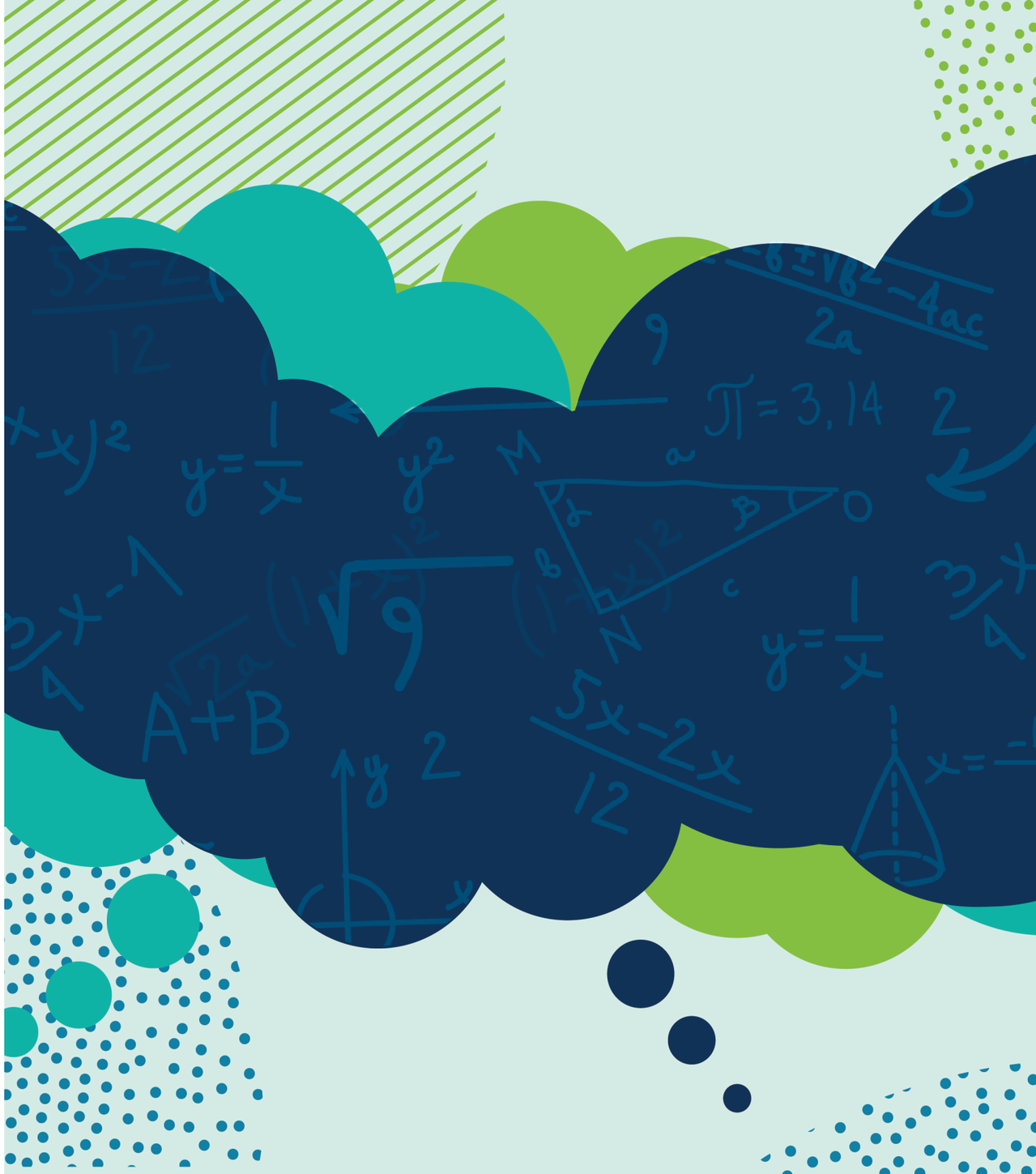

Questions?

Thank you!

ALWAYS LEARNING