

Conventional wisdom

Empirical observation

Hypothesis - predications

Measurements

Verification

General rules

Theory

What if the system is too small or too large for observation?

Symmetries – Conservation laws

Homogeneity of time – energy

Homogeneity of space - momentum

Isotropy of space – angular momentum

Curiosities – observation

Analytical – logical reasoning

Math – most compact language

Open-minded – search for truth

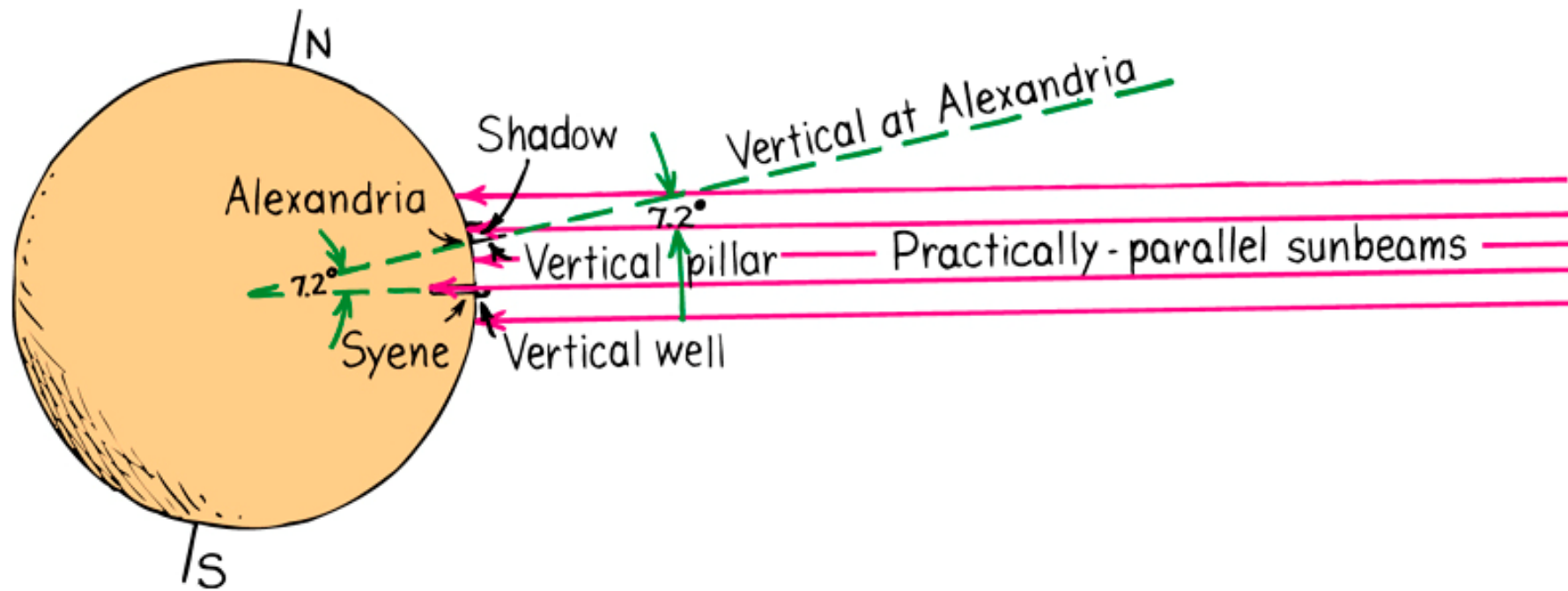
Math – beauty (e.g., geometry)

Fine music

Combinations of organized oscillations of smoothly varying sound waves.

Noise

Combinations of random oscillations of ugly looking sound waves

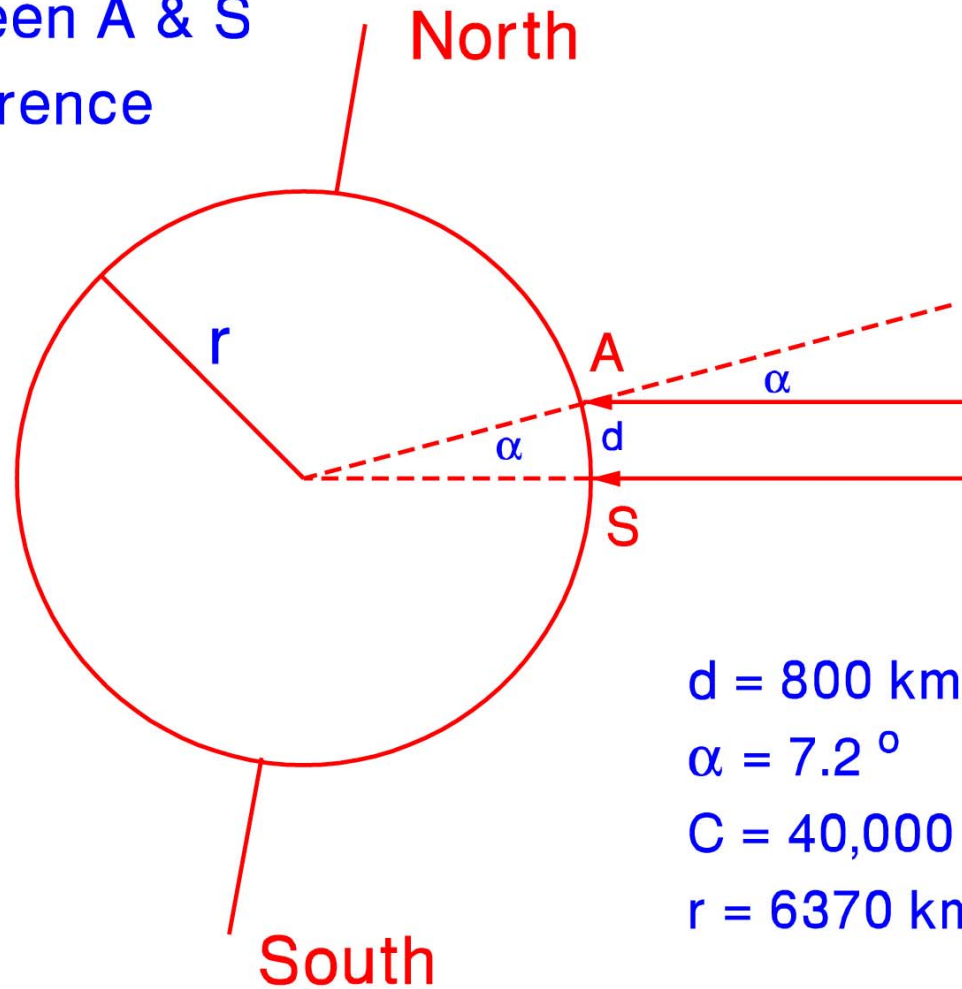


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r: earth radius

d: distance between A & S

C: earth circumference



$$C = 2 \pi r$$

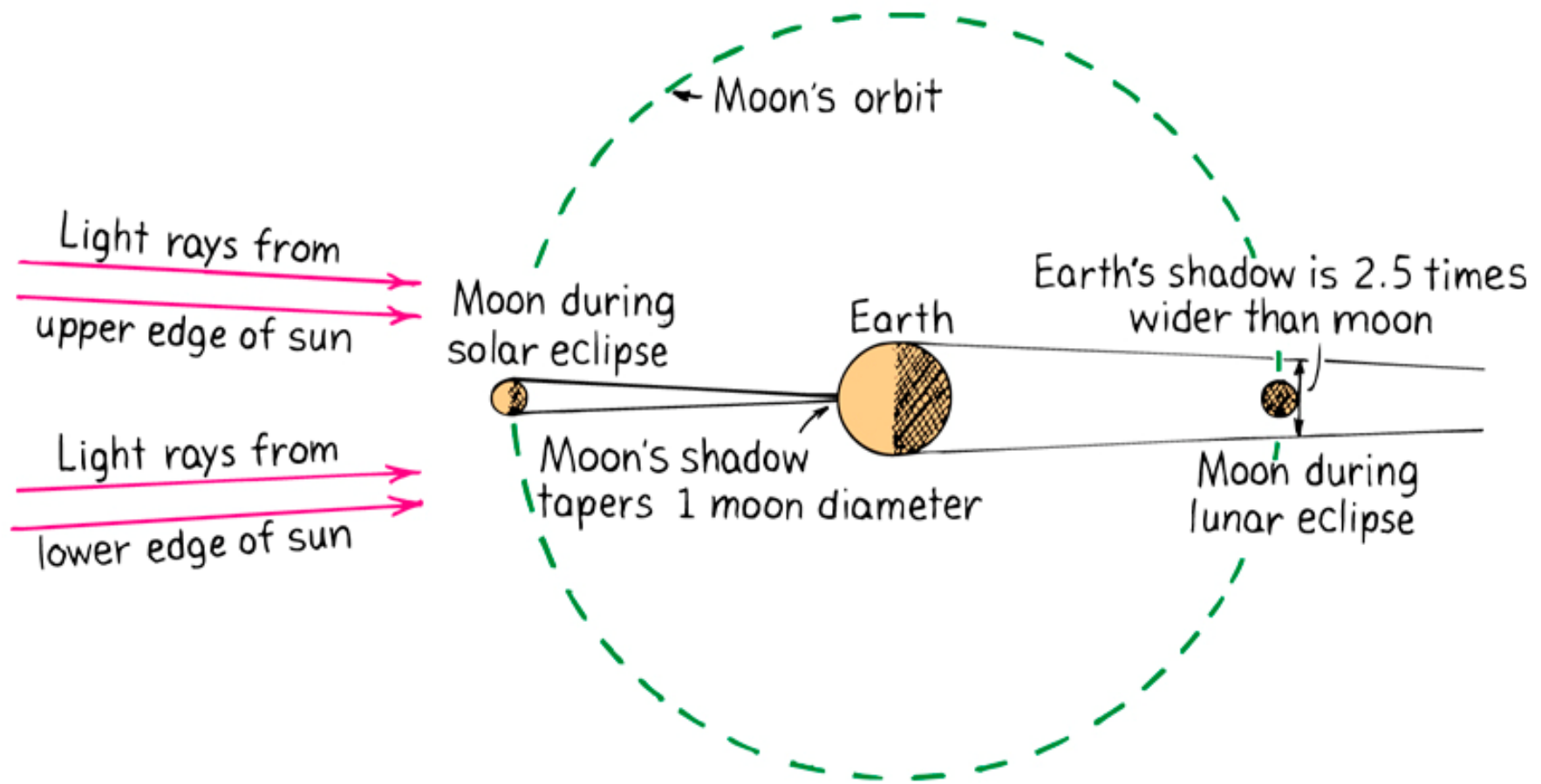
$$d/C = \alpha / 360^\circ$$

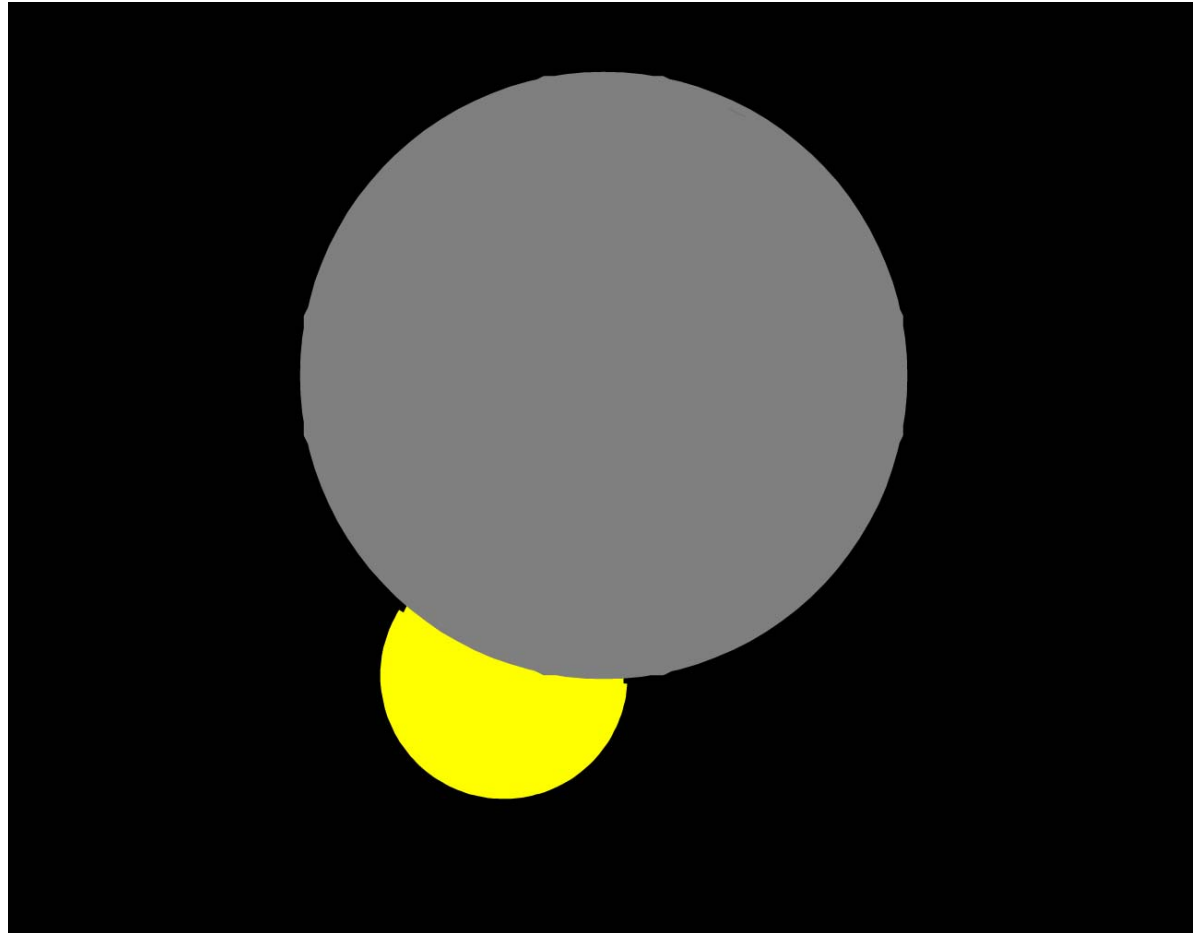
$$d = 800 \text{ km}$$

$$\alpha = 7.2^\circ$$

$$C = 40,000 \text{ km}$$

$$r = 6370 \text{ km}$$



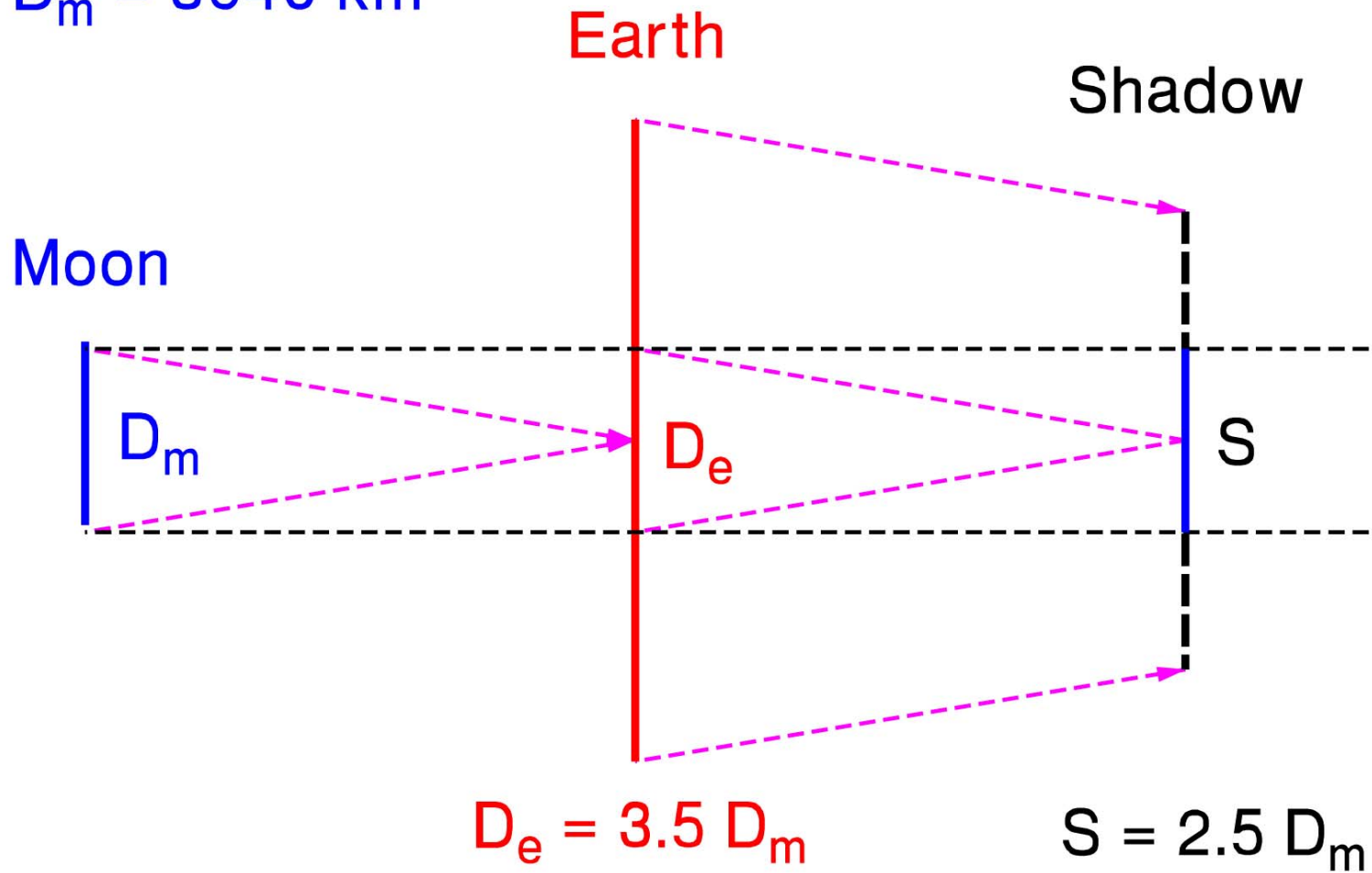


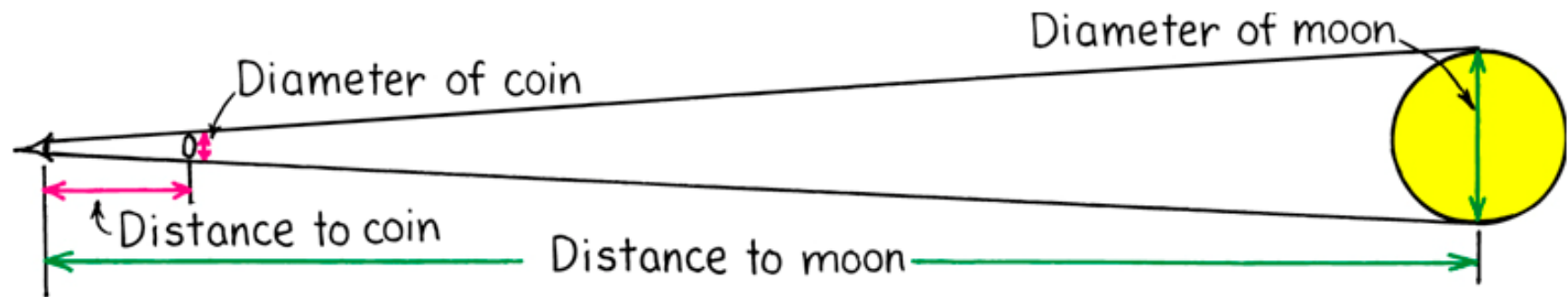
Lunar eclipse

$$\mathbf{R_{\text{earth's shadow}} = 2.5 R_{\text{moon}}}$$

$$D_e = 12740 \text{ km}$$

$$D_m = 3640 \text{ km}$$





$$\frac{\text{Coin diameter}}{\text{Coin distance}} = \frac{\text{Moon diameter}}{\text{Moon distance}} = \frac{1}{110}$$

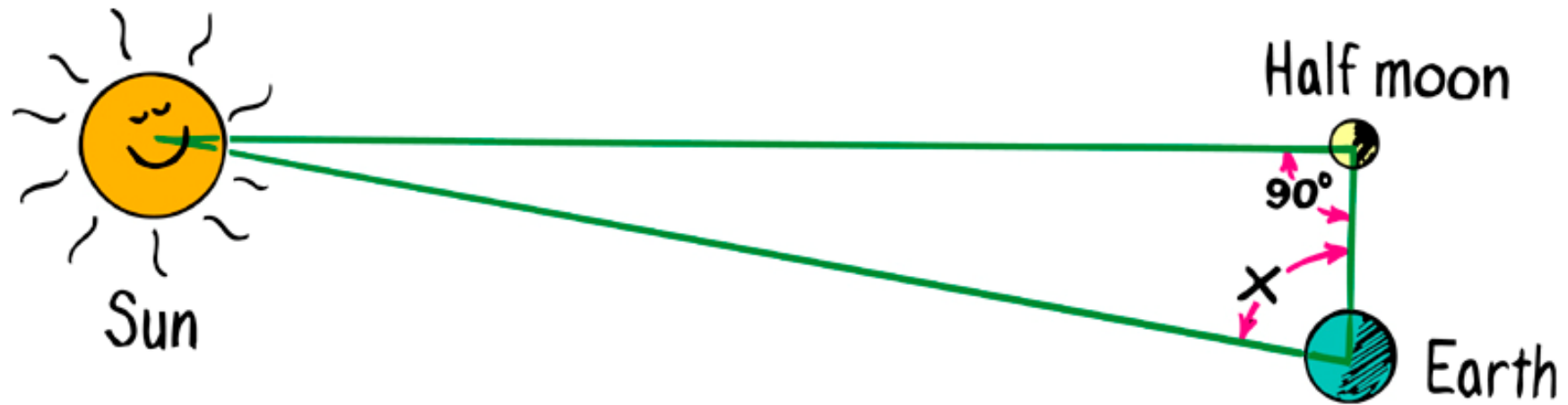
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d_m : earth-moon distance

$$d_m = 110 D_m$$

estimated $d_m = 400,000$ km

actual $d_m = 384,000$ km



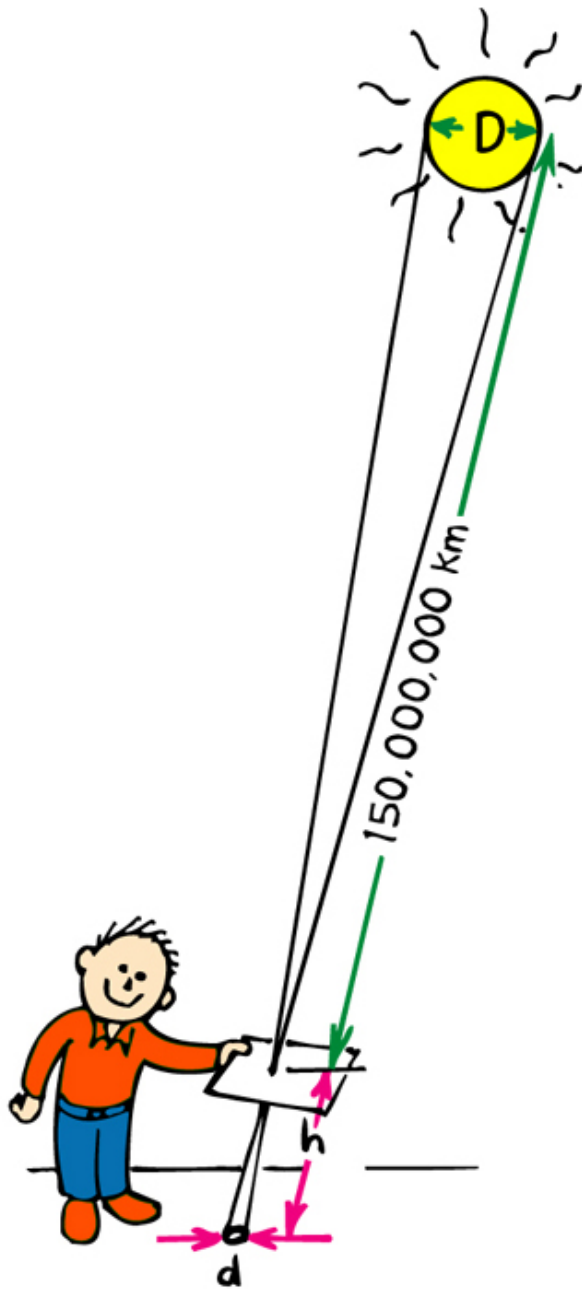
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d_s : earth-sun distance

$$d_m / d_s = \cos x$$

x	d_s
89.82°	1 27,000,000 km
89.84°	1 43,000,000 km
89.86°	1 64,000,000 km

actual $d_s = 1$ A.U. (astronomical unit) = 1 50,000,000 km



$$D / d = 1 \text{ A. U.} / h$$

$$D = 1,400,000 \text{ km}$$

$$h / d = 1 \text{ A.U.} / D$$

$$h = 1.07 \text{ m, if } d = 1 \text{ cm}$$