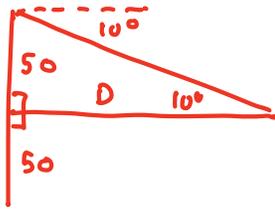


Astronomy Problems I

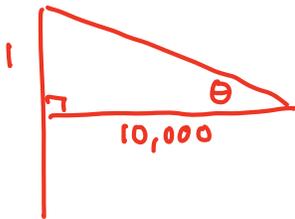
1. How far away is an object if its parallax is 10° , as measured with a 100 meter baseline?



$$\tan 10 = \frac{50}{D}$$

$$D = \frac{50}{\tan 10} = \boxed{284 \text{ m}}$$

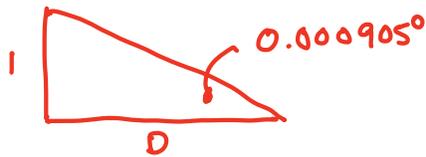
2. If a star were 10,000 AU away, what would be its parallax, using the diameter of the earth's orbit around the sun as the baseline? (1 AU is the average distance to the sun.)



$$\tan \theta = \frac{1}{10,000}$$

$$\boxed{\theta = 0.00573^\circ} \quad (= 0.344' = 20.6'')$$

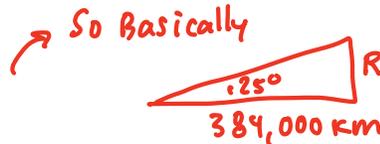
3. The closest star is Proxima Centauri, and has a parallax of 0.000905° . How far away is it, in AU?



$$\tan(0.000905) = \frac{1}{D}$$

$$\boxed{D = 63,300 \text{ AU}}$$

4. Given that the average distance to the Moon is 384,000 km and its angular size is 0.5° , what is the Moon's diameter?



$$R = 1676 \text{ km}$$

$$\text{So } \boxed{D = 3350 \text{ km}}$$

$$\tan(.25) = \frac{R}{384,000}$$

5. If the sun is 20 times farther than the moon, how big is the sun? (Note: the sun is a LOT farther than this, and so is a LOT bigger than your answer.)

Since the same angular size as moon, if it is

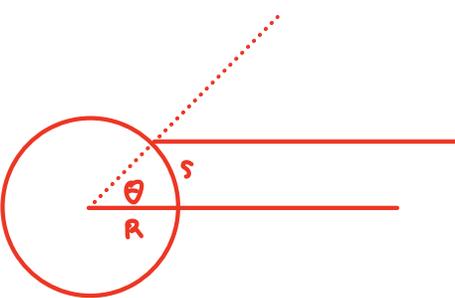
20 x farther, it is 20x bigger

$$= 67,000 \text{ km (diameter)}$$

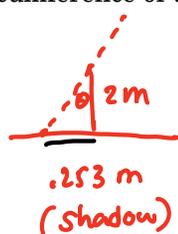
[Note: Actual size is 1.39 million km)

Astronomy Problems I

6. In the city of Alexandria, a 2 meter tall vertical stick casts a shadow that was 25.3 cm long. At the exact same moment, a vertical stick in the town of Syene, 5000 stadia south of Alexandria, does not have a shadow. What was the circumference of the earth in stadia?



$S = 5000 \text{ stadia}$



$\tan \theta = \frac{.253}{2}$
 $\theta = 7.2^\circ = 0.126 \text{ rad}$

$S = r\theta$
 $5000 = R(.126)$
 $R = 39,740$

$C = 2\pi R$
 $C = 250,000 \text{ stadia}$

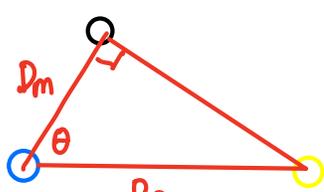
7. Imagine you live on another planet and observe your moon when it is at quarter phase and measure the sun and moon to be 88° apart. You also know that the sun is twice the size of the moon in the sky.

- a. How much farther away is the sun compared to the moon?

@ quarter phase

$\cos \theta = \frac{D_m}{D_s}$

$D_m = \text{distance to moon}$
 $D_s = \text{distance to Sun}$



So $D_s = \frac{1}{\cos \theta} D_m = \frac{1}{\cos 88^\circ} D_m = 28.7 D_m$

- b. How much bigger is the sun than the moon?

If the sun & moon were the same angular size in the sky, the sun would be 28.7 x larger (because it is 28.7 x farther away). Since sun is twice angular size, it will be twice that, so $57.3 \times$

- Answers: 1) 284 m 2) 0.0057° 3) 63,300 AU 4) 3350 km 5) 67,000 km
 6) 250,000 stadia 7. a) 28.7x b) 57.3x