

Solutions to Homework Problem Set 1

1. Theories can make predictions, which can be checked with observations or experiments.
2. (a) 1×10^7 (b) 6×10^4 (c) 4×10^{-3} (d) 3.8×10^{10} (e) (if your age is 21-year) $21 \times 12 = 252 = 2.52 \times 10^2$ months
3. Suppose that in the scale model, the distance of Proxima Centuri is d , then the scaling relationship is as follows:

$$\frac{d}{30 \text{ cm}} = \frac{4.2 \text{ ly}}{1.4 \times 10^{11} \text{ cm}}$$

leading to

$$d = 30 \text{ cm} \frac{4.2 \text{ ly}}{1.4 \times 10^{11} \text{ cm}} = 4.2 \text{ ly} \frac{30 \text{ cm}}{1.4 \times 10^{11} \text{ cm}} = 9 \times 10^{-10} \text{ ly} = 9.0 \times 10^{-10} \text{ ly} \frac{9.46 \times 10^{12} \text{ km}}{1 \text{ ly}} = 8.5 \times 10^3 \text{ km}$$

So in the scale model, the distance of the Proxima Centuri would be 8.5×10^3 km.

4. Use the small angle formula:

$$D = \frac{\alpha d}{206265}$$

where D is the diameter, d is the distance, and α is the angular size in arcsec. In this problem, we are going to find α given d and D , so the formula can be re-written as

$$\alpha = 206265 \times \frac{D}{d}$$

The distance of Venus is $d = 0.869 \text{ AU} = 1.3 \times 10^8 \text{ km}$, and the diameter of Venus is $D = 12104 \text{ km}$, so the angular size of Venus is

$$\alpha = 206265 \times \frac{12104 \text{ km}}{1.3 \times 10^8 \text{ km}} \approx 19.'' = 0.3'$$

So the angular size of Venus on that day is about 0.3 arcminutes.