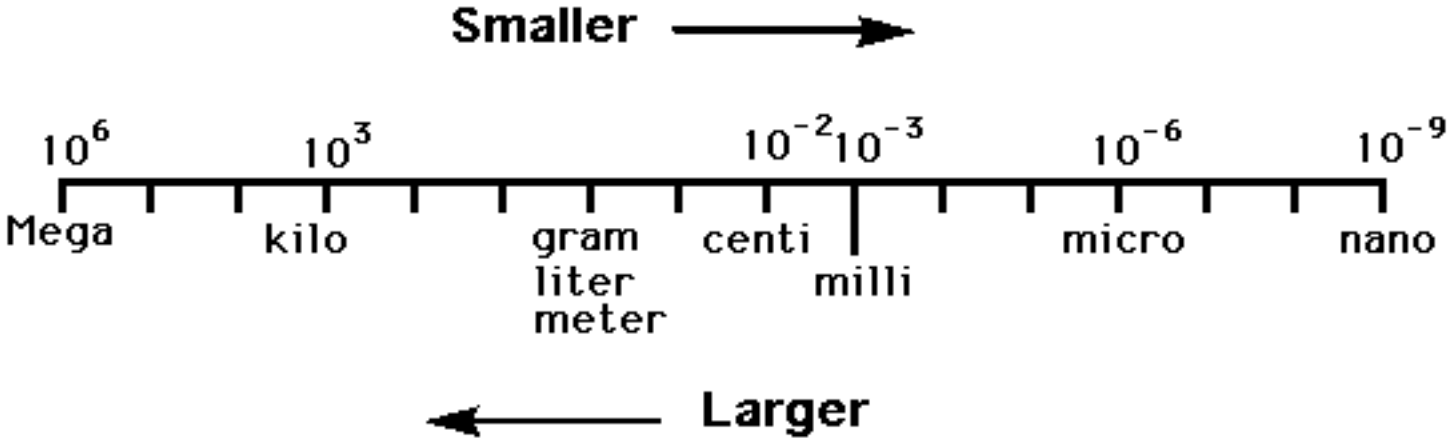
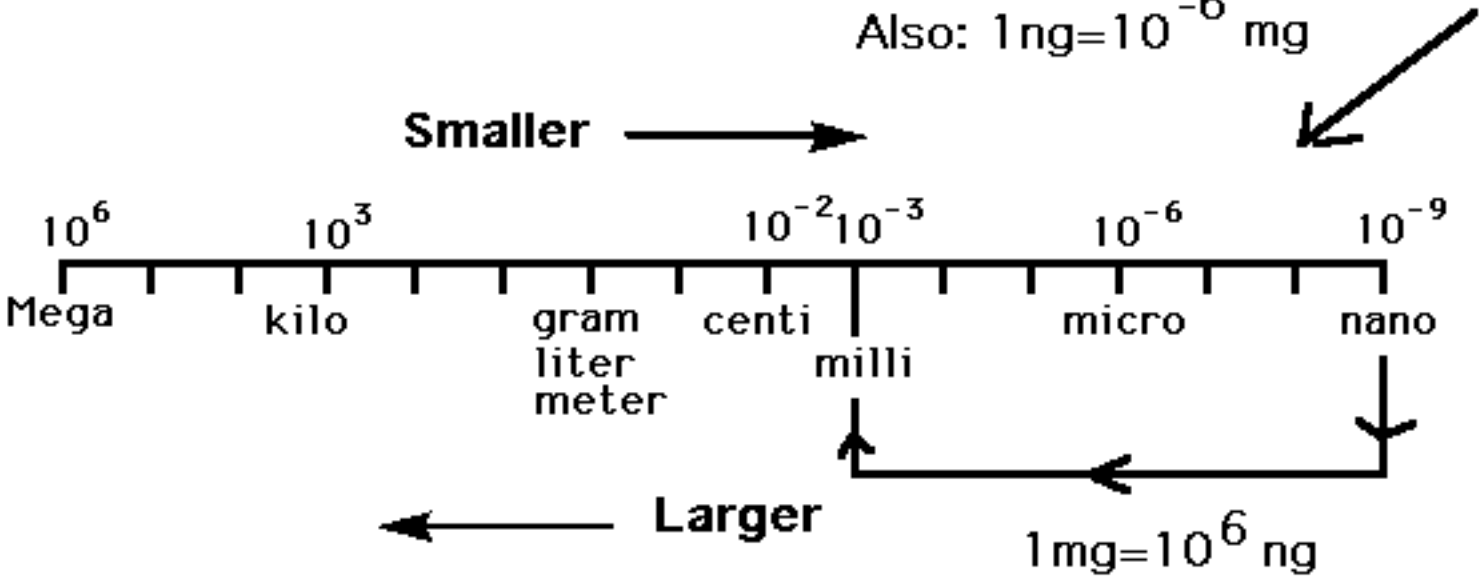

Smaller
10^{6}
10^{3}
10^{-2} 10^{-3}
10^{-6}
10^{-9}
Mega
kilo
gram
liter
meter
centi
milli
micro
nano
Larger

Convert nanograms to milligrams:

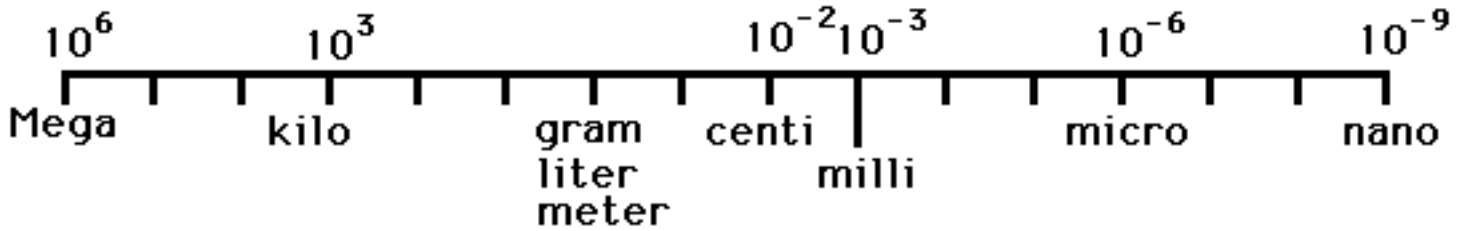


Convert nanograms to milligrams:

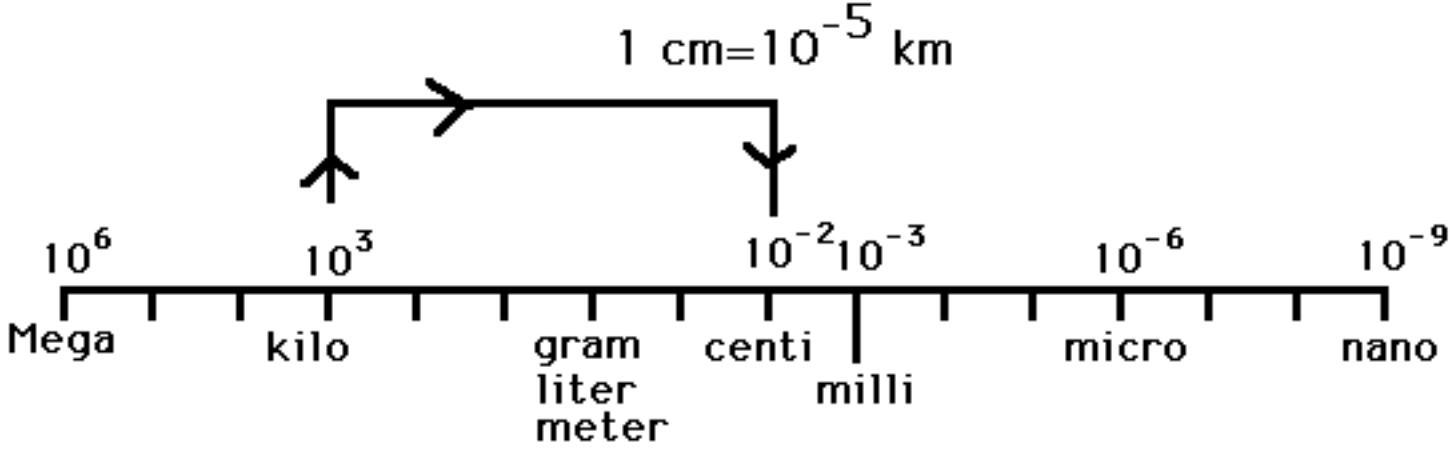
$26\ ng = ?\ mg$ $\qquad 1ng = 10^{-6}\ mg$

$26\ ng = 26 \times 10^{-6}\ mg$

$= 2.6 \times 10^{-5}\ mg$



Convert kilometers to centimeters:



Also: 1 km= 10^{5} cm

Conversion factors (page 4)

Length: 1 meter = 1.094 yards; 1 yard = 0.914 meters

Volume: 1 liter = 0.264 gal; 1 gal = 3.79 liter

Mass: 1 kilogram = 2.205 lb; 1 lb = .453 kg = 453 g

Convert 5 gal to liters:

5 gal x 3.79 liter/gal = 18.95 l

Many of the quantities which we deal with in science are interrelated by mathematical formulas. An example is the formula for the circumference of a circle which is equal to 2 x pi x the radius:

$$C = 2\pi r \quad \text{or} \quad r = C/2\pi$$

Likewise many scientific theories and laws can be expressed in terms of mathematical relationships. A familiar example is Einstein's famous equation relating energy to mass:

$$E = mc^2$$

Which demonstrates that energy and mass are interconvertible and exactly how much energy we can get from a given mass.

Scientists can often use an equation to make a prediction about some physical phenomena even though they are not completely familiar with theory associated with it. When an object is dropped off a tall building, the distance fallen after a given time may be calculated by:

$$d = \frac{1}{2} g t^2 \quad \text{where } g = 9.8 \frac{m}{sec^2}$$

Thus, if we wish to calculate how far a body will have fallen in three seconds we simply have to plug into the equation:

$$d = \frac{1}{2} \times 9.8 \frac{m}{sec^2} \times (3\ sec)^2 = 44.1 m$$

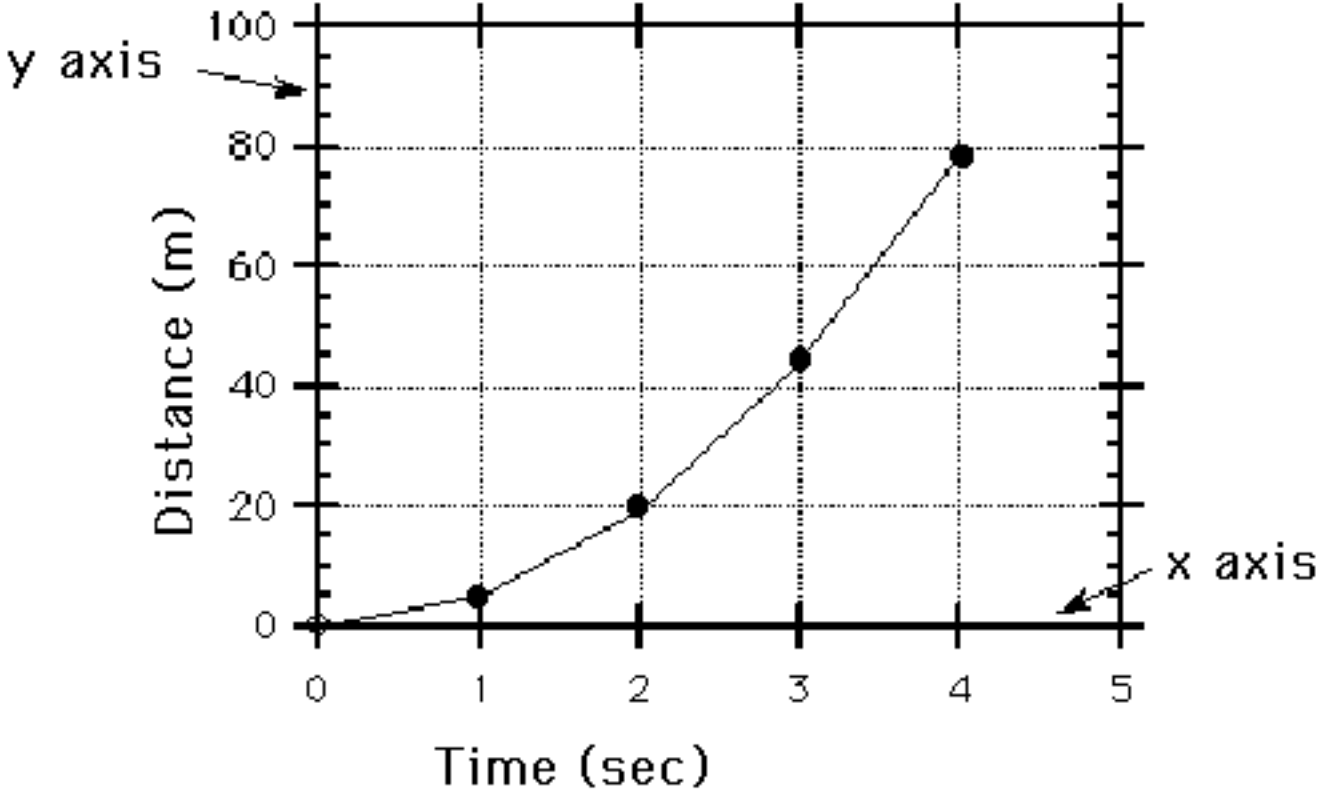
Graphical Representation of Data

In the example of a falling body, we could deduce the equation for distance as a function of time by measuring the distance a body has fallen after a series of times:

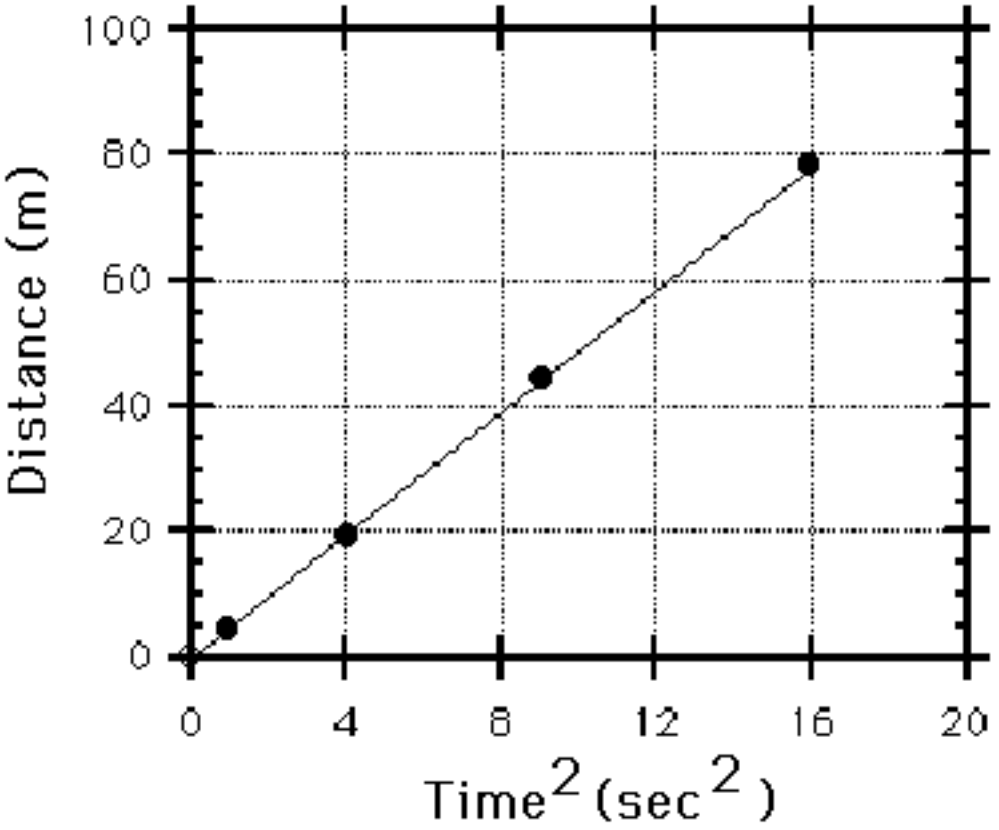
Time (sec)	Distance (m)
0.0	0.0
1.0	4.9
2.0	19.6
3.0	44.1
4.0	78.4

These data may be plotted as distance vs. time or distance vs. $(\text{time})^2$

Distance is not a linear function of time:



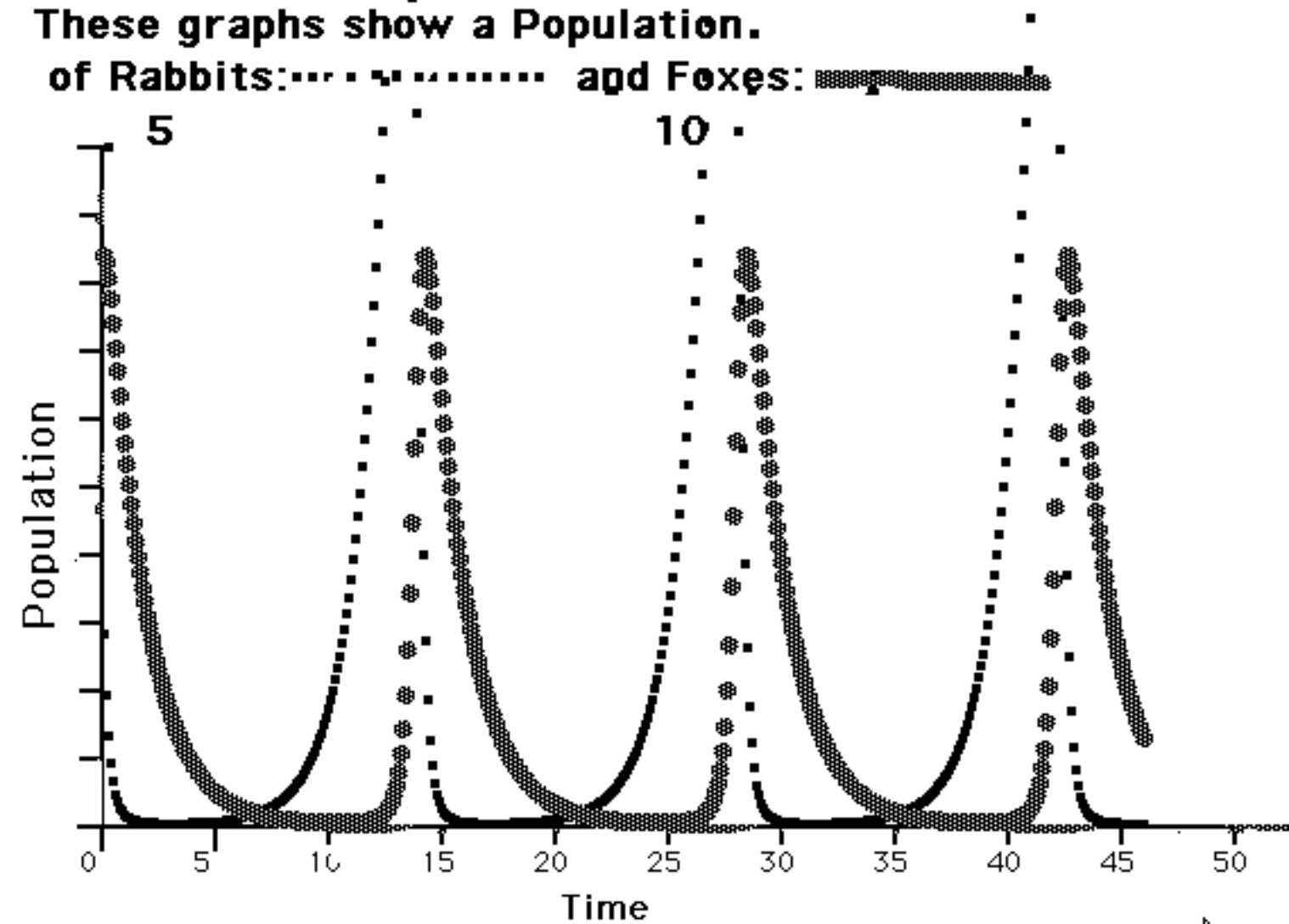
Distance is a linear function of (time)^2



$$d = \frac{1}{2} g t^2$$

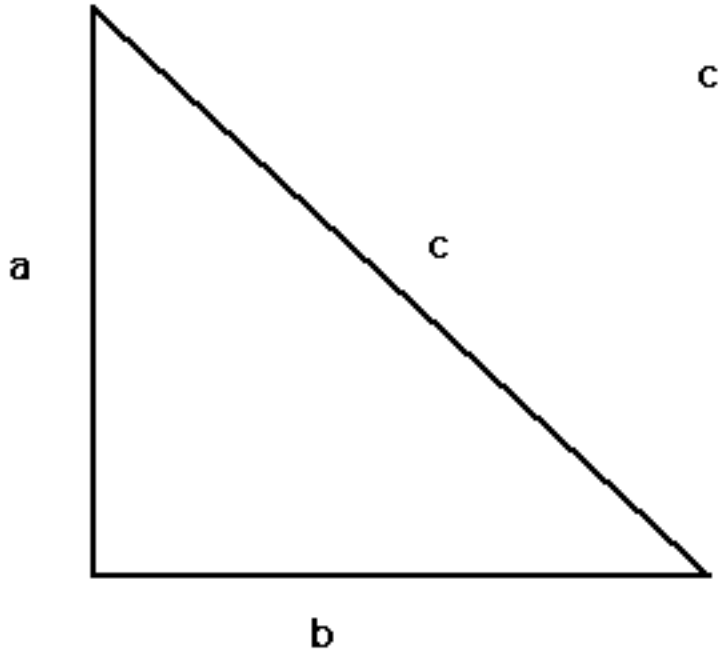
$$\text{Slope} = \frac{1}{2} g$$

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$


These graphs show a Population.
of Rabbits: and Foxes:
5
10
Population
0
5
10
15
20
25
30
35
40
45
50
Time

As an example of data collection in science, we shall attempt to determine the general relationship between a, b and c in a right triangle. However, we shall not do this in the conventional manner which you learned in geometry class. Instead, we shall measure a series of right triangles and try to deduce the relationship between a, b and c.

We shall consider the two possibilities: $c = a + b$ and



$$c^2 = a^2 + b^2$$

Data will be collected and graphed using a separate program

Open Program

Pythagorean Thorem

Views of the structure of the solar system

1. The nature of a scientific theory
    a. Competing scientific theories:

        Geocentric vs Heliocentric

    b. The impact of Copernicus
    c. Galileo's observations
    d. Kepler's laws
    e. Newtonian Physics

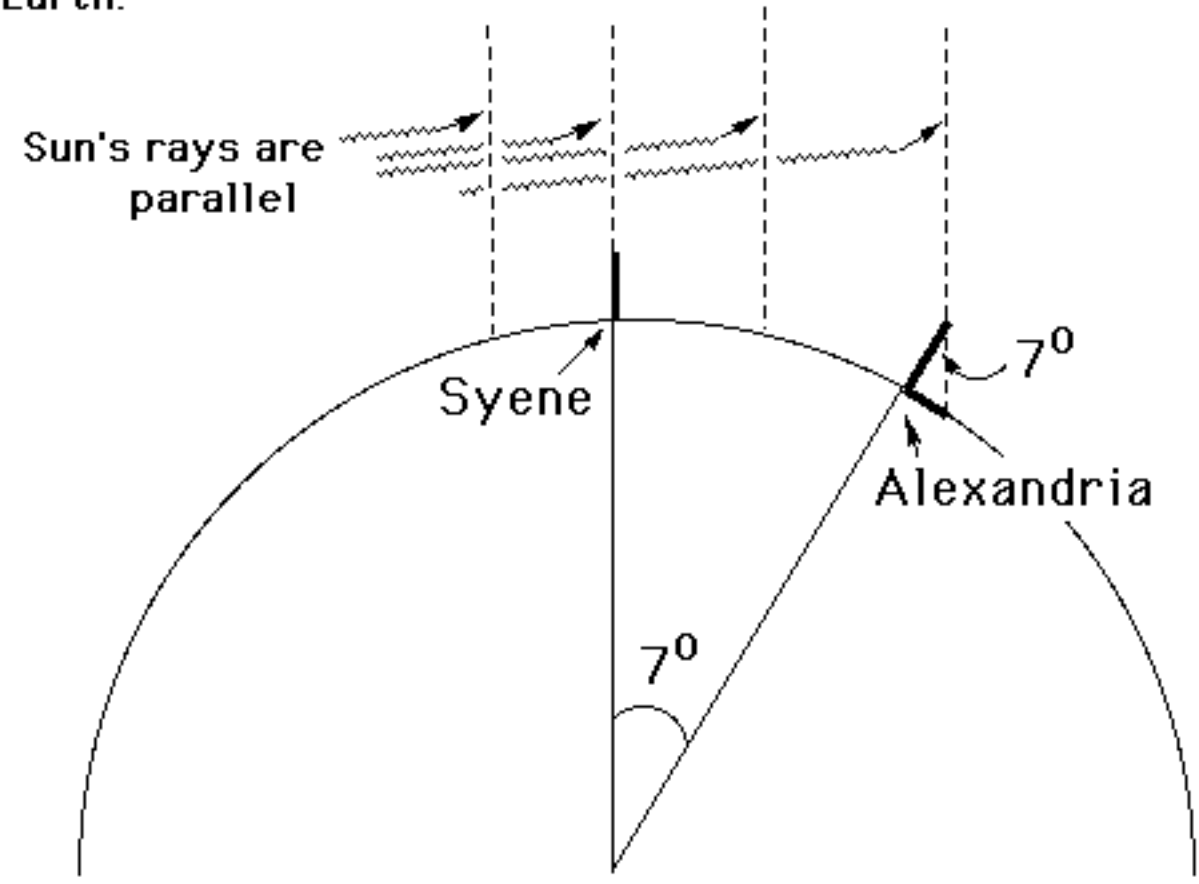
As an example of the way in which science is often done we shall examine two competing theories of the solar system

1. In the geocentric theory the sun and the planets rotate around the earth

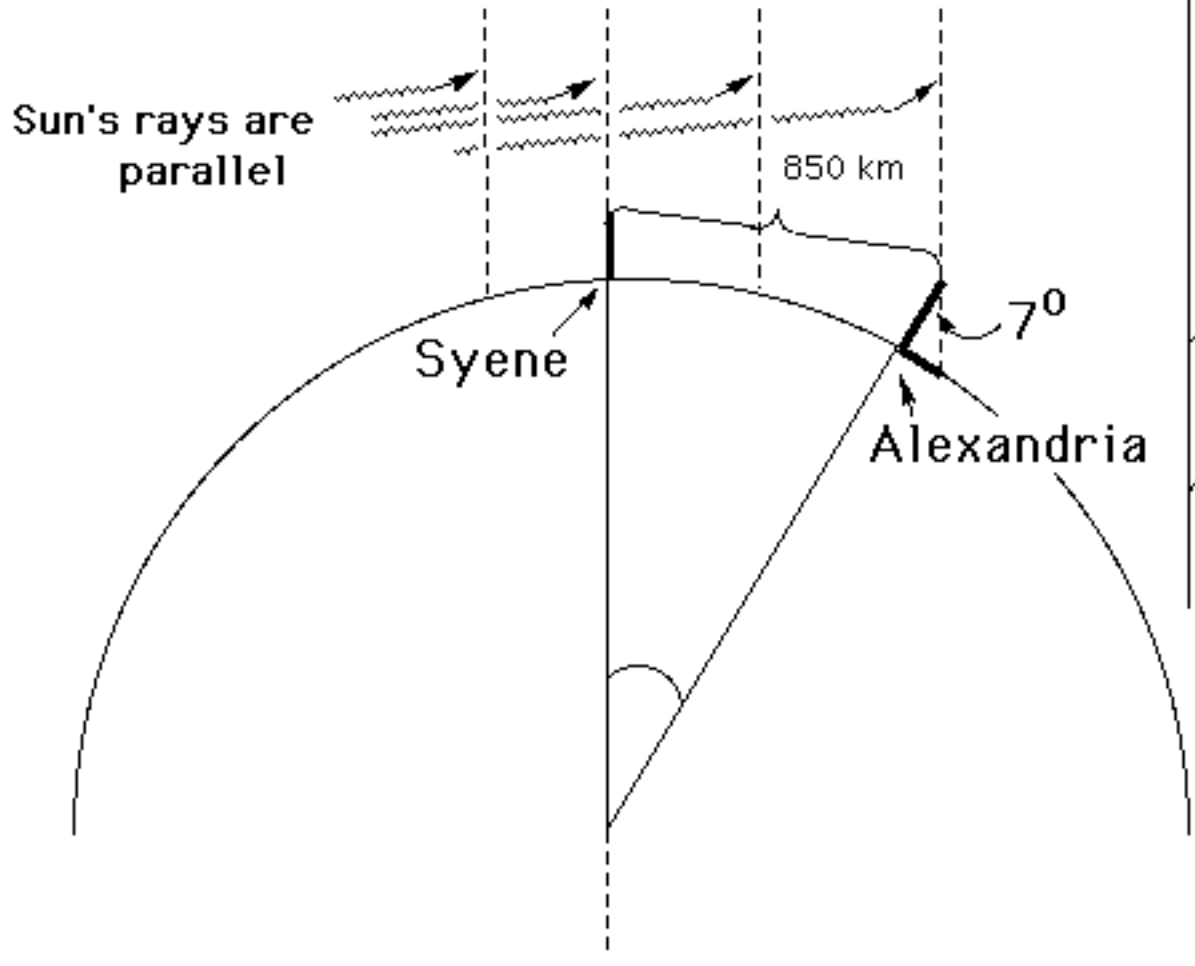
2. In the heliocentric theory the sun is the center of the solar system

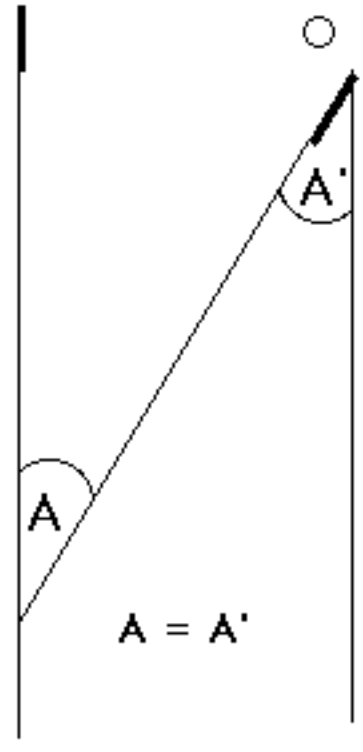
Although we all know that the heliocentric theory is correct, what evidence can you cite to support it?

Eratosthenes (276-195 BC) Measures the Circumference of the Earth:

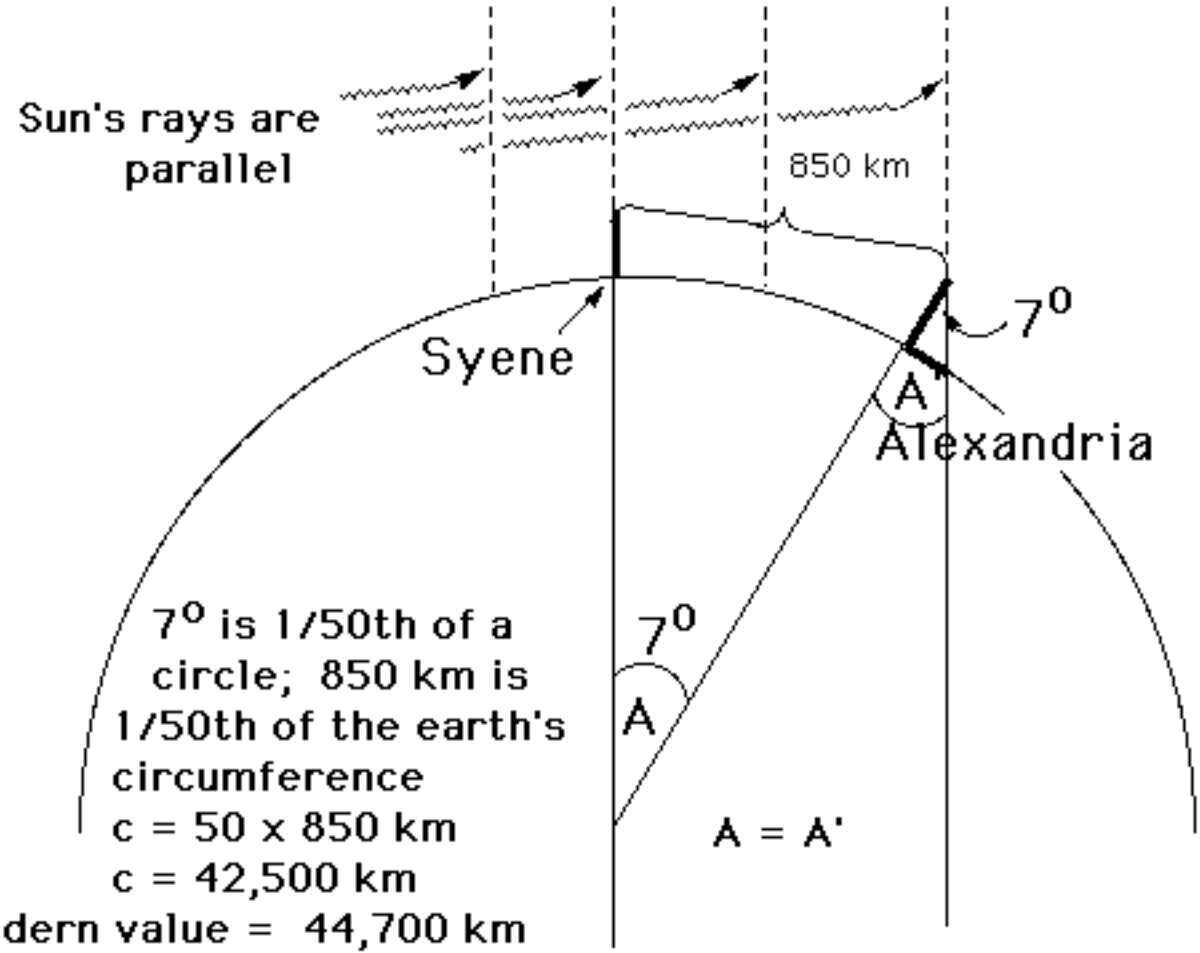


If two parallel lines are transacted by a third line, alternate interior angles are equal





If two parallel lines are transacted by a third line, alternate interior angles are equal



A SIMPLIFIED SKETCH OF THE PTOLEMAIC SYSTEM