Space geometry test

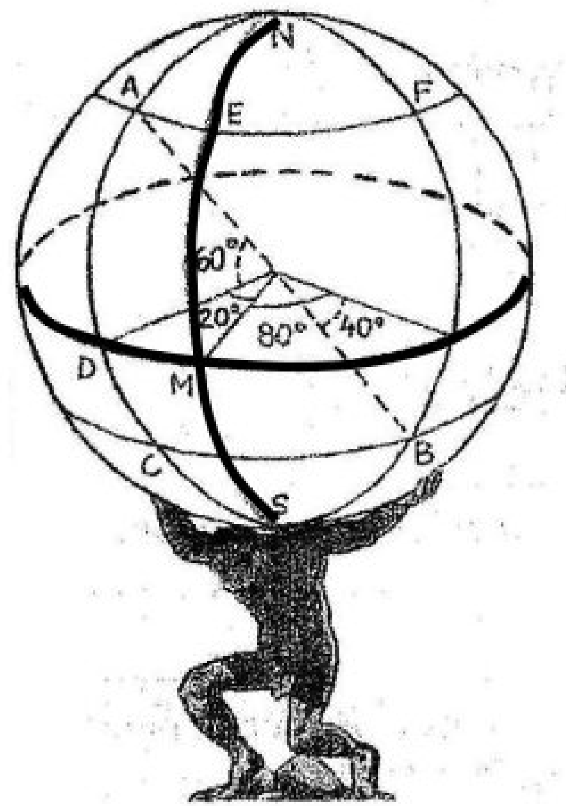
Mon 7th January 24

Exercise 1. We are interested in four solids: a 6-cm-high pyramid whose rectangular base has sides of lengths 3 cm and 6 cm; a cylinder with a radius of 2 cm and a height of 3 cm; a cone of radius and height 3 cm each; a ball of radius 2 cm.

1. *Draw each of these solids (not necessarily to scale) indicating the data deemed relevant.*
2. *Order these solids by increasing volume.*

Exercise 2.

On the figure opposite, point M lies on both the equator and Greenwich's meridian.



1. *Give the geometrical coordinates of points A to F inclusive.*
2. *During a race, a sailor indicates their position to be* $80°\,\mathrm{E}$ *and* $40°\,\mathrm{S}$. *On which point of the globe above does the sailor lie?*
3. *Another sailor, of English nationality, is located at '*$37°\,\mathrm{W}\ \ 41°\,\mathrm{N}$*'. In which ocean can they be located?*

Exercise 3. The *meter* was originally defined as one millionth of the length of an imaginary line drawn from the equator to a pole. We will keep this definition here.

The *time zones* are twenty-four zones delimited by as many meridians evenly spaced around the Earth, including that of Greenwich.

The equator is evenly divided into three hundred and sixty arcs, each called a *degree of arc*. Each degree of arc is evenly divided into sixty *minutes of arc*. The length of such a minute of arc is called a *nautical mile*.

1. *Using an explicit and motivated hypothesis, evaluate the length of the Earth's equator. How many degrees of arc does the latter have?*
2. *Round to the nearest kilometer the length of a portion of the equator included in a time zone. How many degree(s) of arc does such a portion have?*
3. *Determine the nautical mile to the nearest meter.*

Exercise 4. The standard diameter of a tennis ball is 6.54 cm. Tennis balls are stored in groups of four in straight cylindrical boxes whose axis passes through the centers of the balls. When we shake such a box (full and closed), the centers of the balls it contains cannot move relatively to the box's frame of reference.

1. *Determine the radius and height of the boxes.*
2. *We decide to paint the (exterior) side face of a box as well as the balls that can fit inside. Do we need more paint for the face or for the balls?*