Math Connections to Earth and Space Science

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Endeavour

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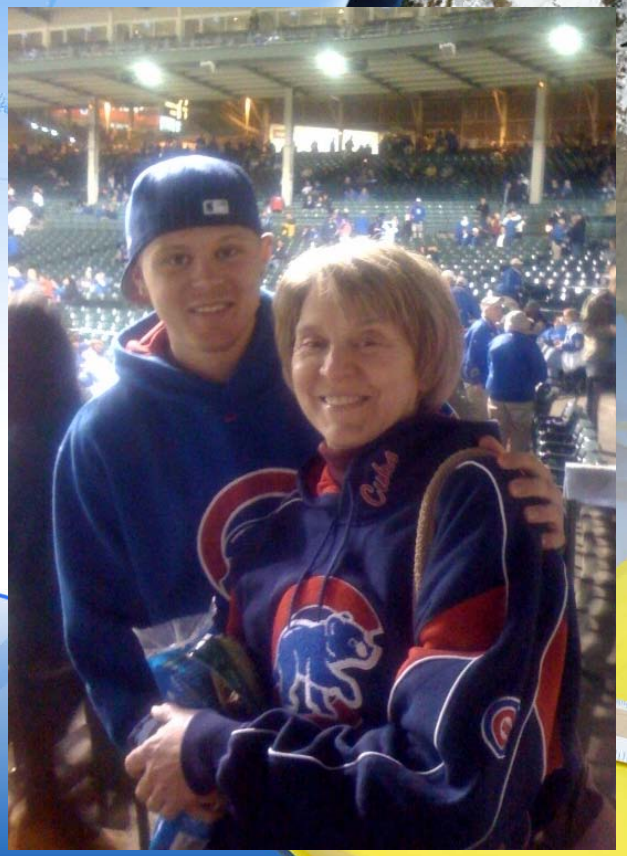


NASA

Modeling

- ***Observe***
- ***Describe***
- ***Look for a trend***
- ***Extend***
- ***Count or measure***
- ***Look for a trend or pattern***
- ***Make a graph***
- ***Describe the graph using words***
- ***Describe with symbols***

Lines on the Globe

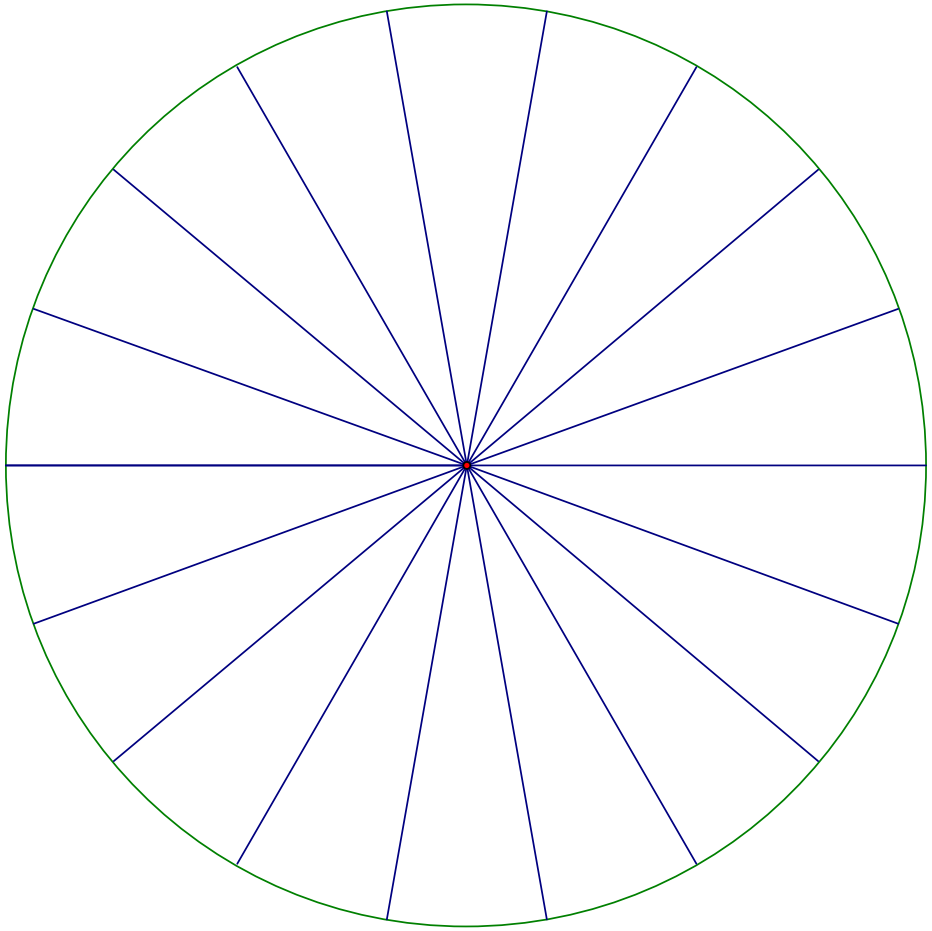
Lines of latitude and longitude are imaginary lines that help us find and describe positions on the Earth.

Why model the Earth with a sphere?

Lines at the North and South Poles

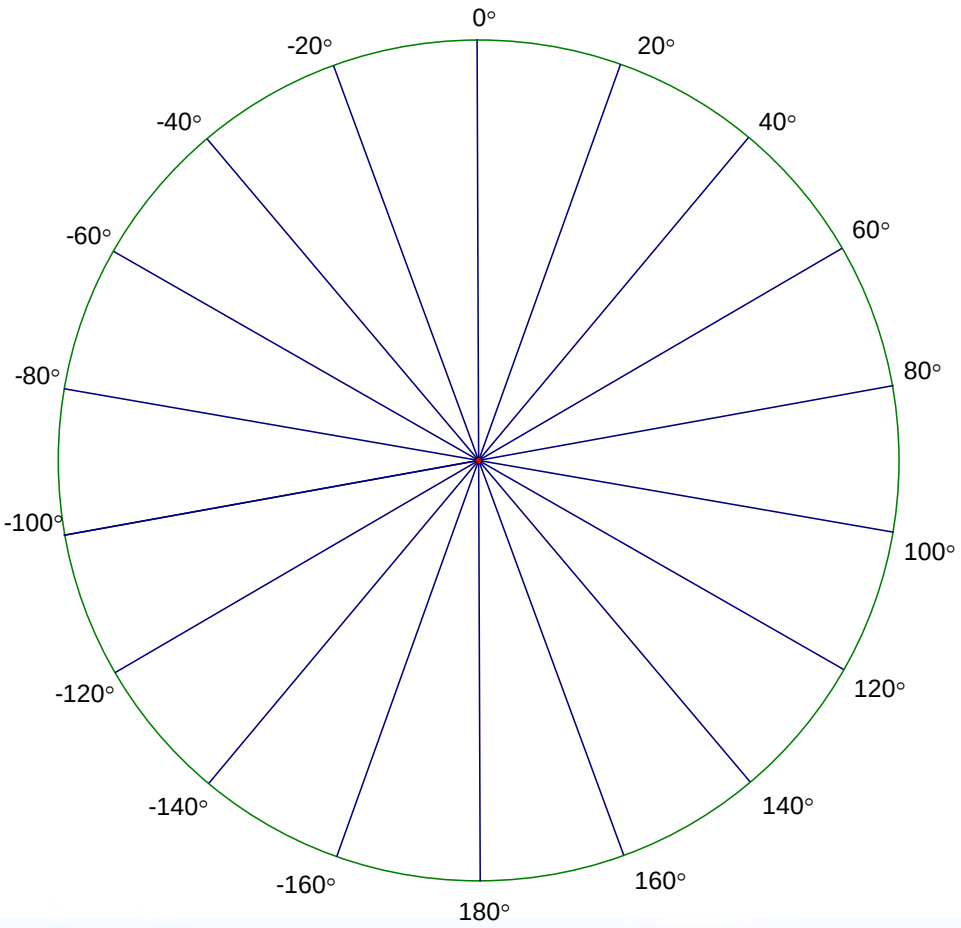
Each line of longitude, or meridian passes through both the North and South poles, and each is a complete circumference of the earth or approximate 25,000 miles long.

A globe may show more or fewer lines of longitude.

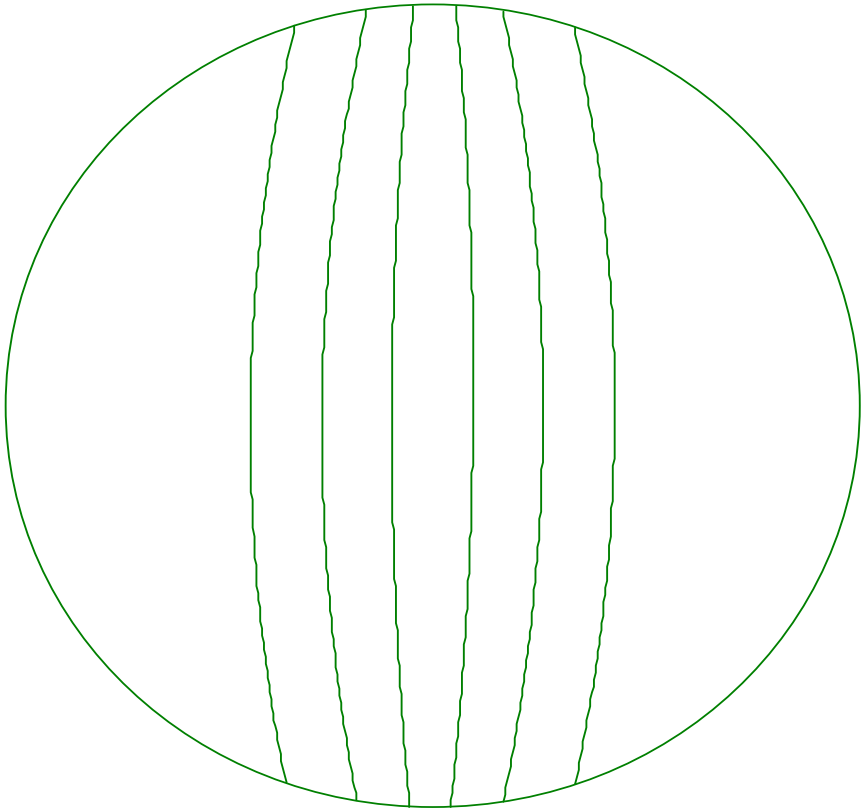


Lines of longitude measure locations east or west of the prime meridian

The prime meridian at 0° passes through Greenwich, England. Each of the lines of longitude shown here shows an angular distance of 20° east or west of the prime meridian.

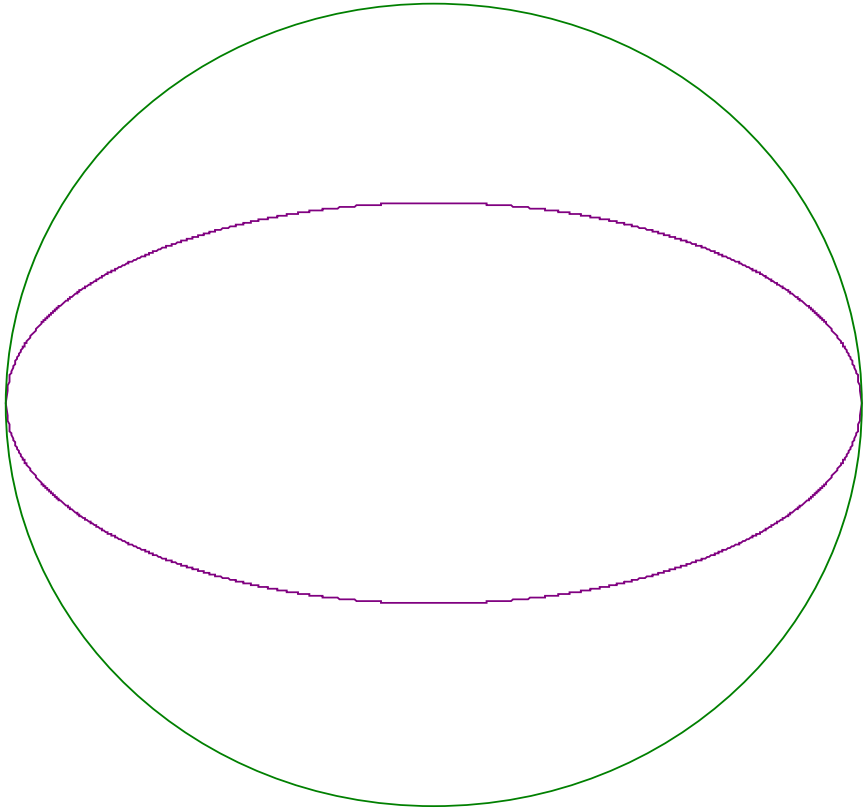


Every line of longitude is a circumference of the Earth, and every line of longitude crosses the equator and goes through both the North and South Poles.



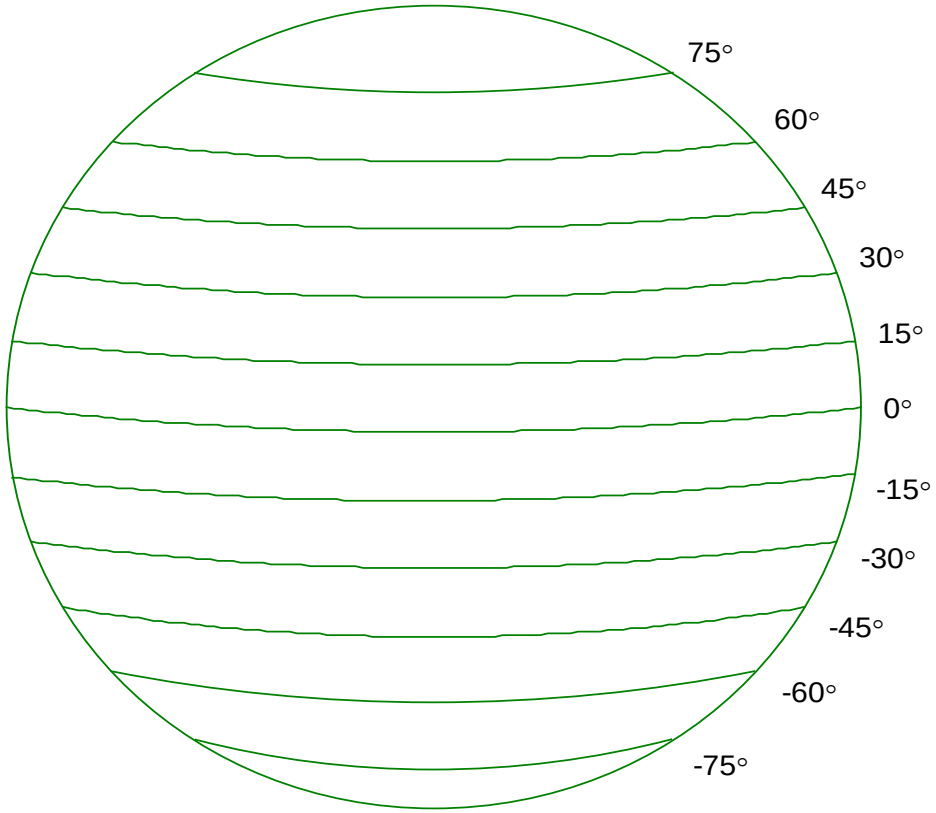
The equator is the only line of latitude that is a circumference of the earth.

Every other latitude line is a smaller circle and parallel to the Equator.



Lines of latitude measure locations north or south of the equator

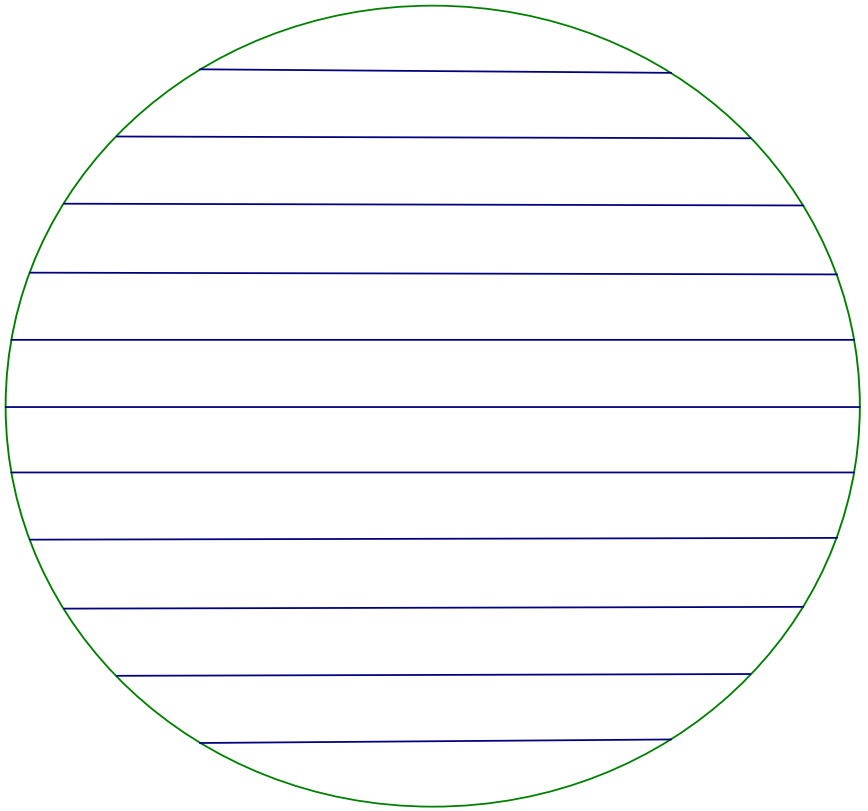
The Equator has latitude 0°. Each of the lines of longitude shown here shows an angular distance of 15° north or south of the Equator. The North Pole is at 90° and the South Pole is at - 90°



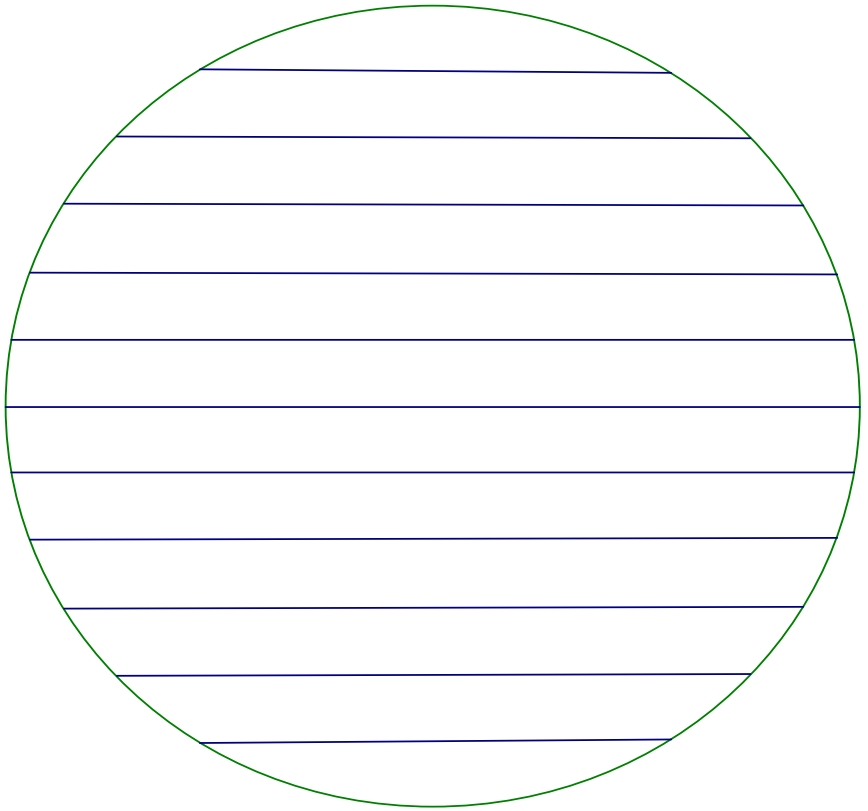
What do you see?

- ***Observe***
- ***Describe***
- ***Look for a trend***
- ***Extend***

Imagine cutting the Earth through the center so the cut face is a circle with a diameter connecting the two edges of the equator and shorter chords connecting the lines of latitude.



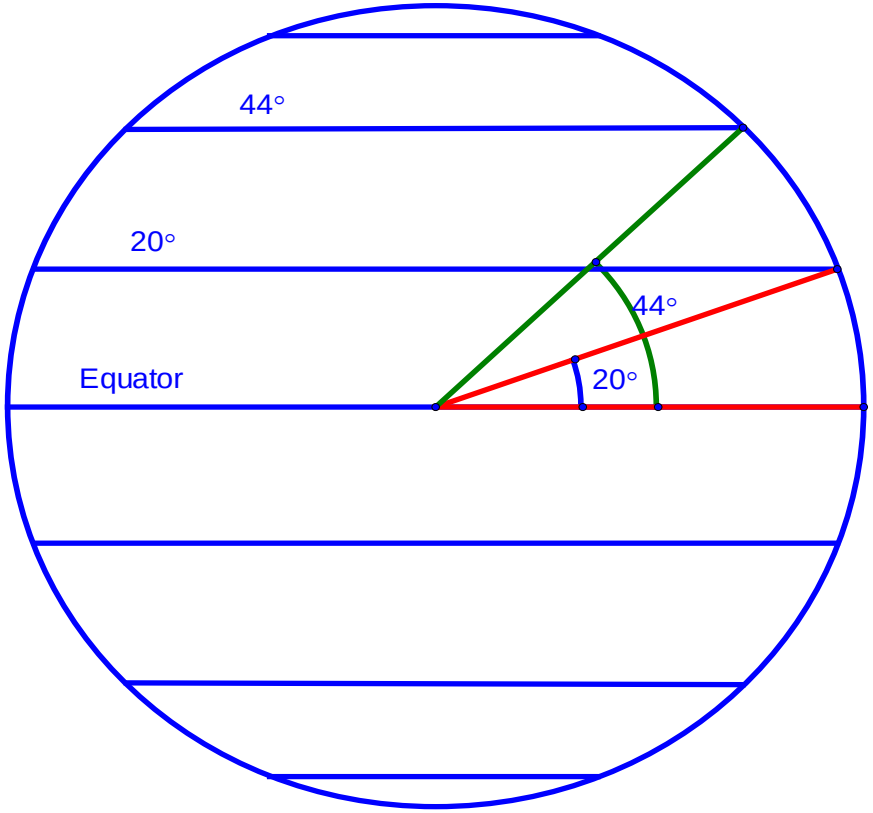
As the lines of latitude get farther from the diameter, they get shorter.



The angles of latitude are measures of from the center of the circle.

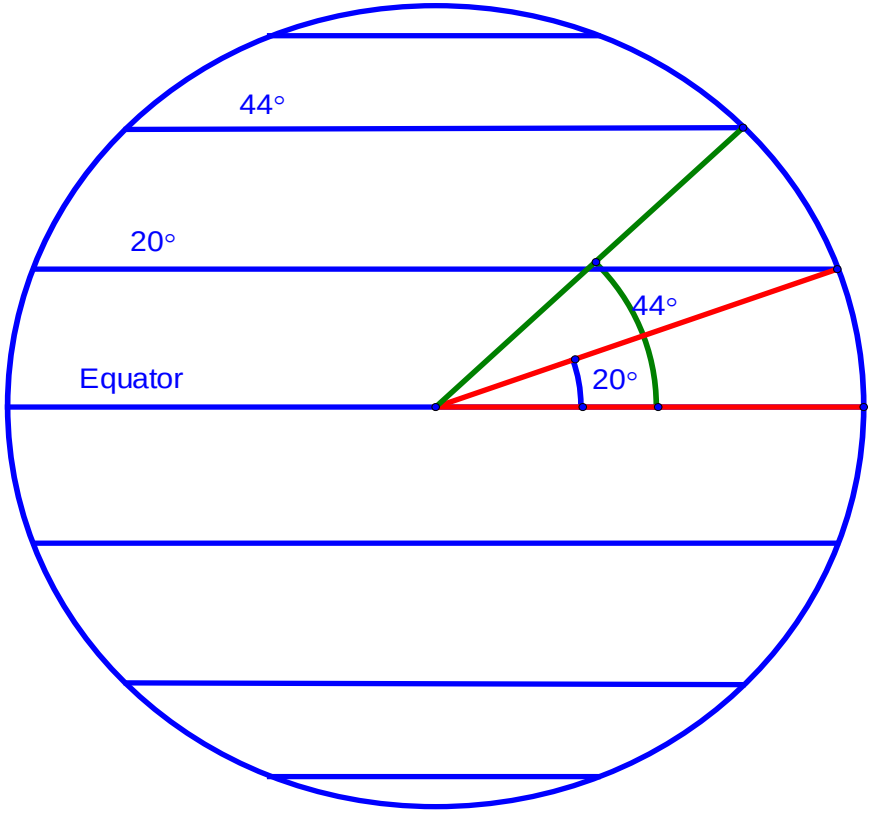
As the angle size increases the parallels of latitude are

_____



The angles of latitude are measures of from the center of the circle.

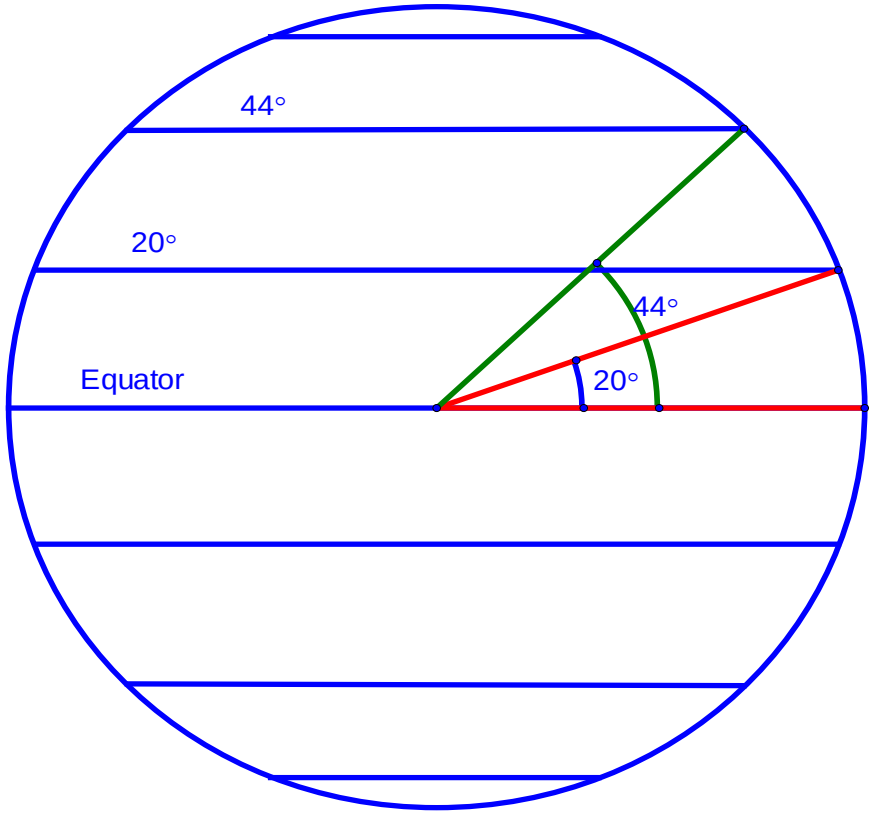
As the angle size increases the parallels of latitude are farther from the Equator and shorter.



What is the circumference of the line of latitude at 44°?

What is the relationship between the degree of latitude and its length?

What is the relationship between the distance from the equator and the length of the parallel?



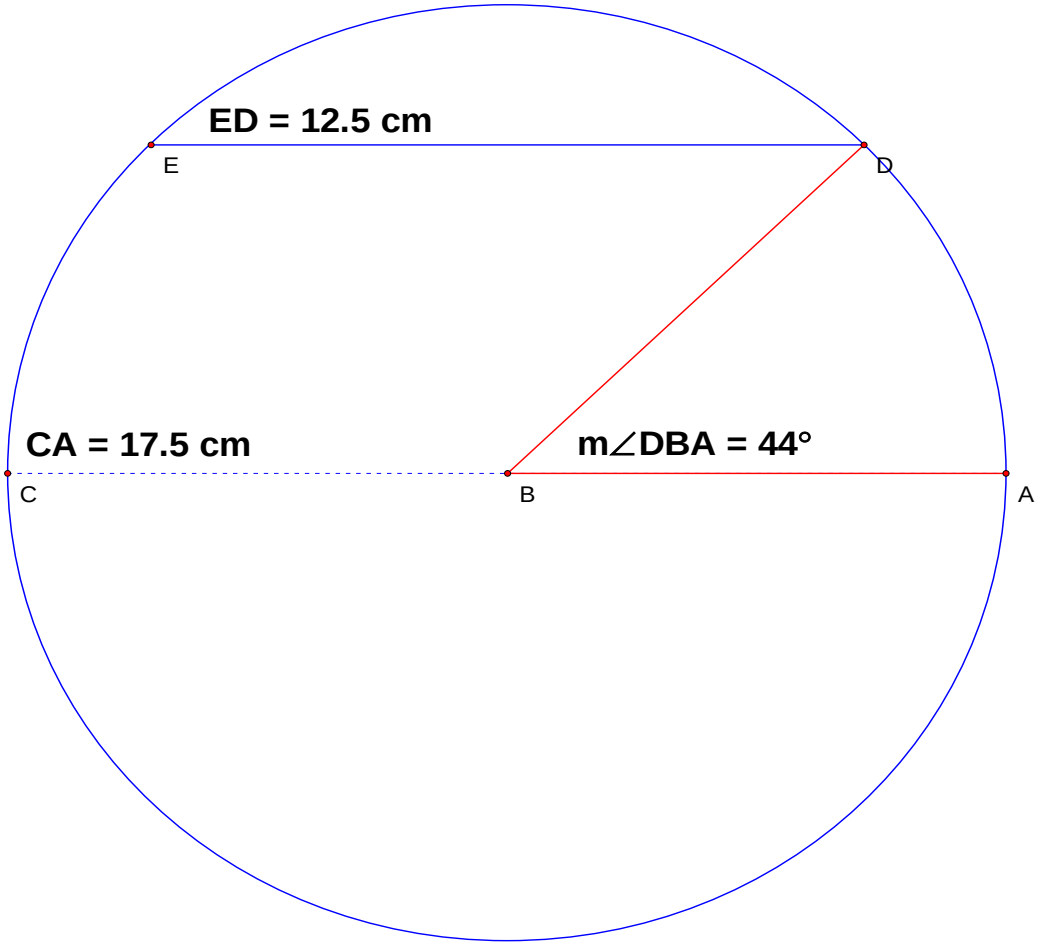
What is the circumference of the line of latitude at 44°?

What strategies are possible?

What is the circumference of the line of latitude at 44°?

The circumference of the earth is about 25,000 miles so the diameter of the Equator is about 8,000 miles.

How can you use a <u>scale drawing</u> to find the length of the 44th parallel?



What is the circumference of the line of latitude at 44°?

Computation techniques give an answer to a single question.

What is the circumference of the line of latitude at 44°?

Look at the green triangle. The circumference of the earth is about 25,000 miles so the diameter of the equator can be found.

C = πd

25000 = 3.14d

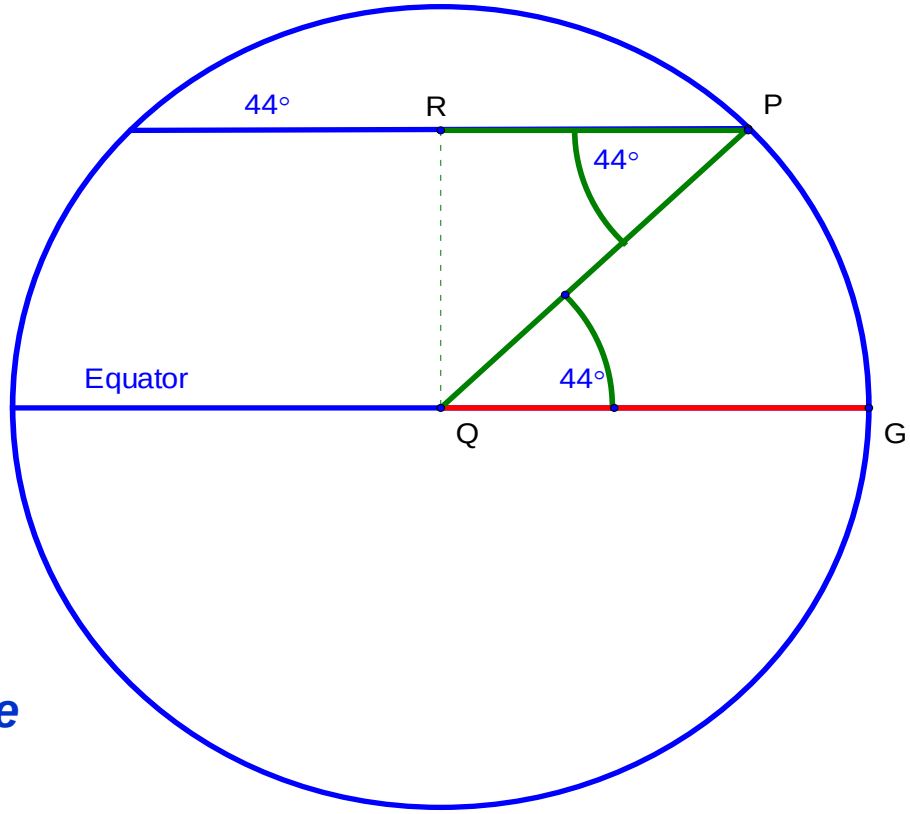
d ≈ 8000 miles

So PQ is about 4000 miles.

cos 44° = $\frac{RP}{}$

.7193 = $\frac{RP}{}$

RP ≈ 2880 so the diameter of the circle of latitude at 44 ° is about 5760 miles and the circumference is 5760π or about 18,000 miles.



What is the circumference of the circle at any degree of latitude?

Make a table of values showing the angles and the diameters of circles of latitude. Look for a pattern.

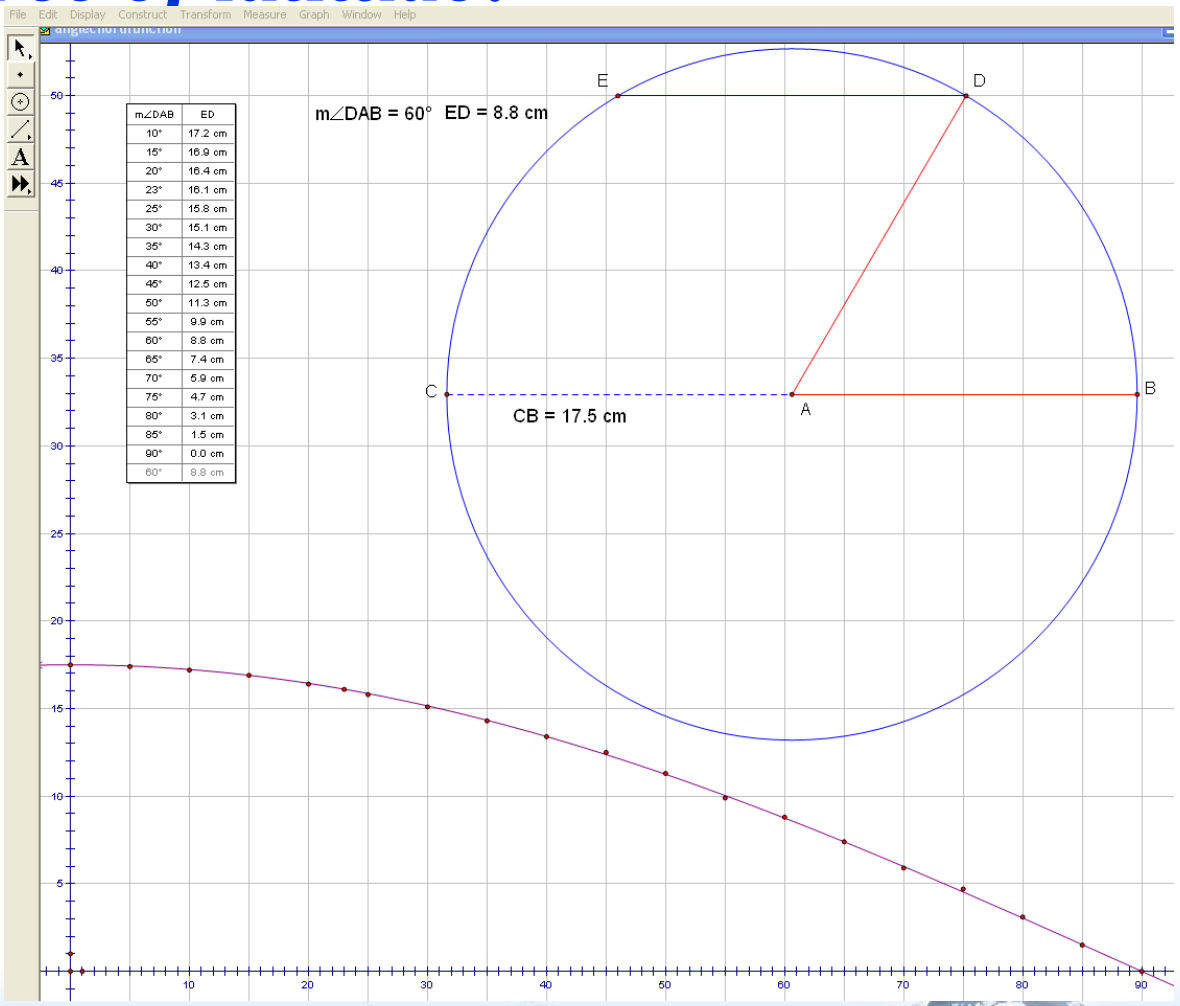
m∠DAB	ED
10 °	17.2 cm
15 °	16.9 cm
20 °	16.4 cm
23 °	16.1 cm
25 °	15.8 cm
30 °	15.1 cm
35 °	14.3 cm
40 °	13.4 cm
45 °	12.5 cm
50 °	11.3 cm
55 °	9.9 cm
60 °	8.8 cm
65 °	7.4 cm
70 °	5.9 cm
75 °	4.7 cm
80 °	3.1 cm
85 °	1.5 cm
90 °	0.0 cm

What is the circumference of the circle at any degree of latitude?

- *Look for a trend or pattern*
- *Make a graph*
- *Describe the graph using words*
- *Describe with symbols*

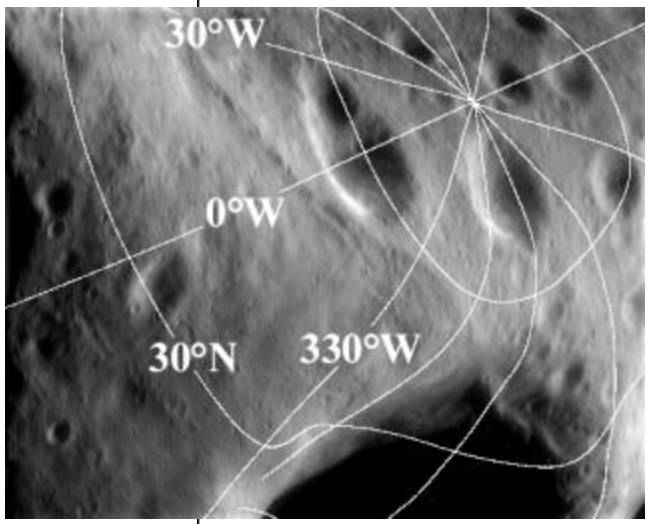
What is the circumference of the circle at any degree of latitude?

Find a relationship between the degree of latitude and its length. Use it to determine the length of any circle of latitude.



Extend the model for Earth

Eros's Lines of Latitude and Longitude



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Title: Eros' Latitude and Longitude Grid

Description: The most familiar reference system for locating places on the surface of a planetary body is latitude and longitude. On a spherical body like Earth, these measures have a comfortable, predictable feel to them - despite the difficulty in showing a spherical planet on a flat map. However, the irregular peanut-like shape of Eros lends the asteroid's latitude-longitude grid a surprising character.

This image of the north polar region was taken from NEAR Shoemaker March 31, 2000, from an orbital altitude of 207 kilometers (129 miles). The image has been overlain with lines of latitude and longitude. Latitude is measured in degrees from the equator to the pole; longitude is measured in degrees west of a "prime meridian." In both cases, the vertex of the angle being measured is the center of Eros. The wandering, curved shapes of the lines are caused by the highly nonspherical and irregular asteroid shape.

Built and managed by The Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, NEAR was the first spacecraft launched in NASA's Discovery Program of low-cost, small-scale planetary missions. See the NEAR web page athttp://near.jhuapl.edu/for more details.

ID: PIA02922

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