GO THERE— HOW BIG IS THE EARTH?—LETS MEASURE!!!

In order to size up our planet, we must first measure its circumference, and lets begin by measuring ¼ of the polar circumference. ***GOOGLE EARTH*** limits linear measurements to less than ½ of the globe (i.e. 180°), so the ¼ circumference measurement will make it easy to see how big the world really is.

Open ***GOOGLE EARTH***. In the ***SEARCH PANEL*** located on the ***SIDEBAR*** (Upper Left Corner), you will see three tabs: ***FLY TO***, ***FIND BUSINESSES***, and ***DIRECTIONS***. On the FLY TO TAB, type in the latitude/longitude coordinates of the intersection of the Prime Meridian and the Equator (i.e. 0,0), and click the ***SEARCH BUTTON***  . If you really wanted to visit this location, how would you get there? Record your proposed methods of travel to arrive at that point in the box below.

The following two paragraphs document appropriate latitude and longitude notation for ***GOOGLE EARTH***.

Latitude values are listed first. Latitude is measured from the equator (0) either north or south (N or S; or + equals North, - equals South), and range from 0 to 90 degrees. If latitude is designated using North or South (i.e. N or S), the designation must follow the value and is separated from it by a space. If the symbols + or – are used to delineate North or South respectively, the + or – must precede the latitude value. If the + symbol is omitted in the notation, ***GOOGLE EARTH*** will automatically assume the latitude value is north. Default settings in ***GOOGLE EARTH*** are in decimal degrees, which can be changed to other standard systems under ***VIEW OPTIONS***.

Longitude values are separated from the latitude values using a comma. Longitude is measured from the Prime Meridian (0) either east or west, and range from 0 to 180 degrees. If longitude is designated using East or West (i.e. E or W), the designation must follow the value and is separated from it by a space. If the symbols + or – are used to delineate East or West respectively, the + or – must precede the latitude value. If the + symbol is omitted in the notation, ***GOOGLE EARTH*** will automatically assume the longitude value is east.

CLICK on the ***RULER*** which opens the ***MEASUREMENT BOX***. Using the ***LINE TAB***, carefully center the ***CROSSHAIR MEASUREMENT BOX*** over the c***ROSSHAIR-MARKED LOCATION*** at the intersection of the Prime Meridian and the Equator, and ***CLICK*** it. A ***RED DOT*** will indicate the beginning of your line. Now ***STRETCH*** your line all the way to the North Pole, where you should end it. You will need to ***ZOOM OUT*** incrementally as you ***STRETCH*** the line. By ending the line with a second ***CLICK*** (forms a second ***RED DOT*** connected to the first with a ***YELLOW LINE***), you can ***CENTER*** your ***CROSSHAIR ICON*** over the ***DOT***, and it will be replaced with a ***POINTED FINGER*** and the ***DOT*** will shift color to green, meaning you can ***CLICK*** and ***DRAG*** it to a new location. In addition to using the ***ZOOM*** controls, you may use whichever ***NAVIGATION CONTROLS*** you find most comfortable to complete your task. Those controls include ***MOUSE NAVIGATION*** (enabled in the ***RULER BOX***, which enables you to ***GRAB AND DRAG*** the ***VIEW,*** the ***NAVIGATION CONTROLS*** (either the ***ONSCREEN JOYSTICK*** or the ***DIRECTIONAL ARROWS)***. As you ***STRETCH*** your line from (0,0), you should pay attention to the coordinates of the end of your line on the ***STATUS BAR*** at the bottom of the ***3D VIEWER WINDOW***. To accurately pinpoint the North Pole, as you get close, type in the lat/long coordinates (90,0), and center the endpoint of your line on that coordinate at the highest ***ZOOM*** (= lowest ***EYE ALTITUDE***) possible. Record your measurement in the box below.
The length of that line is neither the Earth's radius nor its diameter. It is ¼ of the polar circumference. Use the length of the line you just measured to calculate the polar circumference in both miles and kilometers. Record your calculations and results in the box below. Hint: change the unit values on the ***MEASURE TOOL*** from miles to kilometers for ease of calculation, and multiply that value by four. ***CLEAR*** your tool after you are finished.

Airline travelers frequently accrue "airline mile awards" for flights they have purchased. These awards can be redeemed for "free" tickets when enough miles have been logged with the airline. About how many WHOLE flights between LAX and JFK (i.e. Los Angeles to New York City) would you have to take in order to accrue the same number of miles on a single polar circumglobal flight? Record your calculations in the box below.
How long would it take for a jet airplane traveling along that polar circumglobal path if the jets average cruising velocity is 500 mph, assuming the jet had enough fuel to do it without landing? Record your calculations in the box below.
Now let's see how symmetrical the Earth actually is—we usually define its shape not as perfectly spherical, but as spheroidal. The Greek suffix "oid" is usually added to a term to indicate that it is similar to, but not exactly, the term that it modifies. So, just what makes the Earth a spheroid, especially since it looks so perfect in the Google Earth Viewer Window?!! Using the same measurement process you just completed, let's measure ¼ of the distance around the world along the equator, i.e. its equatorial circumference. Fly to the intersection of the 90th Meridian west of the Prime Meridian at the Equator (i.e. 0 N, 90 W). That location is in the Pacific Ocean separating the volcanic isles of the Galapagos off the west coast of Ecuador in South America. Using the Ruler, precisely measure the distance from that point to the intersection of the Prime Meridian and the Equator (0 N, 0 W) in the African Atlantic. Record your measurement in this box..

The length of that line is neither the Earth's radius nor its diameter. It is ¼ of the equatorial circumference. Just what is the equatorial circumference? Use the length of the line you just measured to calculate the equatorial circumference in both miles and kilometers. Record your calculations and results in the box below. Hint: Use the same procedure as you did for calculating the polar circumference, and ***CLEAR*** your tool after you are finished.
Airline travelers frequently accrue "airline mile awards" for flights they have purchased. These awards can be redeemed for "free" tickets when enough miles have been logged with the airline. About how many WHOLE flights between PHL and CDG (i.e. Philadelphia, Pennsylvania to Paris, France) would you have to take in order to accrue the same number of miles on a single equatorial circumglobal flight? Record your calculations in the box below.
How long would it take for a jet airplane traveling along that polar circumglobal path if the jets average cruising velocity is 500 mph, assuming the jet had enough fuel to do it without landing? Record your calculations in the box below.
Which round the world flight, circumpolar or circumequatorial, would accrue the most miles, and what is the difference? Would it really matter? Explain below.

Earth's radius is essentially the distance from the surface of the planet to the center of the Earth. Just how does this compare with the circumference we just measured? To calculate the depth to the center of the Earth, we use a simple geometric relationship: the ratio of a perfect circle's circumference to its diameter is always a number often referred to as Pi (π). The Greek philosopher Archimedes of Syracuse (c. 287 to 212 BCE) calculated the value of pi between $^{22}/_{7}$ and $^{223}/_{71}$. Remember that those fractions or ratios represent $^{\text{circumference}}/_{\text{diameter}}$. Today we typically use the approximations $^{22}/_{7}$ and $^{355}/_{113}$, realizing that the second ratio is little more accurate. Pi (π) is an irrational number (i.e. it has no end…and cannot be solved with even the largest number-crunching computers), but approximates to about 3.14159. Check out the cool graphics on Pi (π) at Wikipedia (http://en.wikipedia.org/wiki/Pi).

Using the formula for π (pi = circumference/diameter), we can solve for the diameter of the Earth quite easily, now that we know its circumference. This modified equation is diameter = $^{\text{circumference}}/_{\text{pi}}$, noting that one diameter is two radii.

Now, calculate Earth's polar radius to the nearest mile in the following box.

Calculate the Earth's equatorial radius to the nearest mile in the following box.

If you were to dig a hole to the very center of the planet, in which direction, polar or equatorial, would the hole be the deepest and by how much?

Since you are probably online anyway, open another browser window and check the Earth's Polar and Equatorial Diameters. Use ***WIKIPEDIA*** (http://en.wikipedia.org/wiki/Earth) if desired. What is the difference between polar and equatorial diameters as they are documented on the internet? (Hint: You will probably have to convert kilometers to miles using the standard conversion factor 1 mile = 1.6 kilometers) Record that number in the box below for both kilometers and miles.
How does the difference between your measurements (i.e. equatorial minus polar radii) compare to the accepted values you found on the web which were determined from surveying the actual surface of the Earth long before ***GOOGLE EARTH*** was invented?
Do you think the programmers for ***GOOGLE EARTH*** used the actual surveyed measurements of Earth's circumference in their programming, or does the similarity/discrepancy in your measurements on ***GOOGLE EARTH*** with accepted surveyed values indicate that ***GOOGLE EARTH*** is an acceptable means of measuring distances on our planet?

Postulate a natural reason why the Earth has different equatorial and polar diameters. You may want to draw a simple sketch to help with your explanation.

References

United Airlines Website. 2008. Retrieved from http://www.united.com
Earth. 2008. Retrieved from http://en.wikipedia.org/wiki/Earth

NONSTOP FLIGHT MILES

DNV to ATL (Denver to Atlanta) 1709 miles
JFK to FRA (NYC to Frankfurt, Germany) 3855 miles
IAD to LHR (Washington/Dulles International to London Heathrow) 3677 miles
PHL to CDG (Philidelphia to Charles De Gaulle, Paris, France) 3729 miles
LAX to AKL (LA to Auckland, NZ) 6502 miles
LAX to SYD (LA to Sydney AU) 7483 miles (Longest nonstop regular flight in the world)
LAX to HNL (LA to Honolulu, HA) 2556 miles