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Let's go Lat Longing!

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by

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[This is Miss Antipode]

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- 97˚ Longitude

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The line from the equator to the west of the 97th meridian

Stillwater airport (SWO) | ~36.10˚north

Shawnee | ~35.20˚ north

Old air base at Ardmore | ~34.85˚ north

My house (~3.03 sm east) |~33˚.10' north

My house |~33˚10'15.780" N 97˚3'7.020" W

My house |~33.17105 -97.05195

Brownsville | ~25.96˚ north

Tampico | ~23˚ north

Oaxaca, Mexico | ~18˚ north

Equator | 0˚N   97˚W
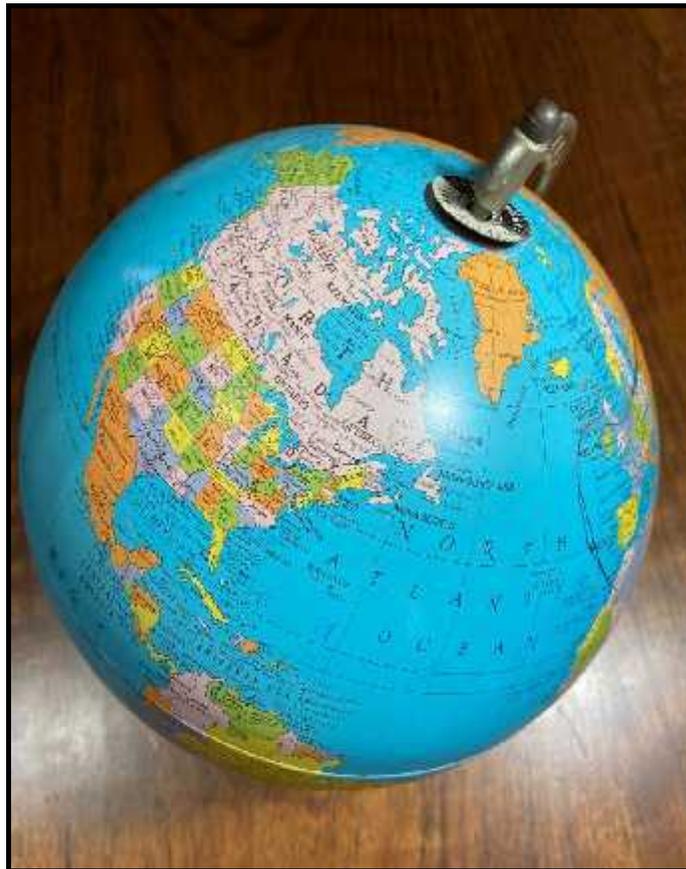
My desk globe

The problem

This research paper (mostly for my education) should be titled "Where are you at?" as they say in Oklahoma. Was looking on Google Maps at an aerial shot (plane view) of my lot out here at Hidden Valley Airpark. I clicked on the picture where I am seated right now and the map spot showed up giving the lat/long of my position. Having written a paper on living within 10 miles or so of the 97th meridian I knew I was around three miles west. There are not numbers on the lat/long readout to suggest three (3) miles.

So, the problem is to find out how to reconcile the lat/long on the Google Map with looking at my navigation chart for this area and come up with the same thing – at least come up with an understanding of the same spot being different numbers.

The answer

This was not easy. I will spend more time on the trek than on determining the numbers holding back as much epistemological humility as I can stand. No, let me just give you the numbers and you tell me how come they are the same…am kidding.

But will try to have some fun with this because we 'should all know the lat/long where we live.'

The Google Map read out says: 33.17105 -97.05195 This is a **Decimal Degree** (DD) answer.

It does not take much for the end numbers to change as a pixel shot one time will be different the next shot – this means we are dealing in feet, yards, and inches when looking down. I may get near the same Monk space here but not zero the chair I am sitting in meaning each shot is a little off.

My cell phone shows: 33° 10' 15.78'' N 97° 3' 7.02'' W – which promptly moved next door with different numbers – which I might say 'adds to my miserable position of trying to pin down where I am breathing.'

This cell phone reading in **Degrees Minutes** S**econds** (DMS)[1] 33° 10' 15.78'' N 97° 3' 7.02'' W

The rest of the paper will be a trek or lesson (again, mostly for me) on "Where am I at?"

History and the trek

This is the fun part. Let me kick around with the route I took, in part at least, on how I came up with these numbers long hand, show some geography, and try to explain more deeply about what lat/long means to us.

(What did you think of Miss Antipode? What has she got to do with anything other than a pretty bottom?)

Let's talk about lat/long.

We first have to go to London. Specifically the Royal Observatory Greenwich, London where the home of the Prime Meridian is located and is a geographical fix where longitude is defined as zero (0°). Note also this is where the Greenwich Mean Time zone starts.

The prime meridian is the dividing of the earth into two 180 degree halves. One goes east and one goes west to add up to 360 degrees. The best way to see this is to go from London (which is 51° north) south

[1] https://www.latlong.net/lat-long-dms.html

to the equator which is a line running 'roughly' through Brighton, Le Havre, Bordeaux, Cartagena, Mascara (Algeria), Accura (Ghana), and into the Gulf of Guinea – thanks to my 1957 Rand McNally "Atlas of Nations."

Going west to hit land at Macapa, Brazil (near Belem) at about 48° west, over to about Quito, Ecuador at 78° west, and then into the Pacific Ocean, through the Archipelago and over to 97° west. Then we turn north to follow the line on page two all the way up to Stillwater, Oklahoma "Home of the Flying Aggies."

At the turning point on the equator let me review a couple of learning points on Lat/Long.
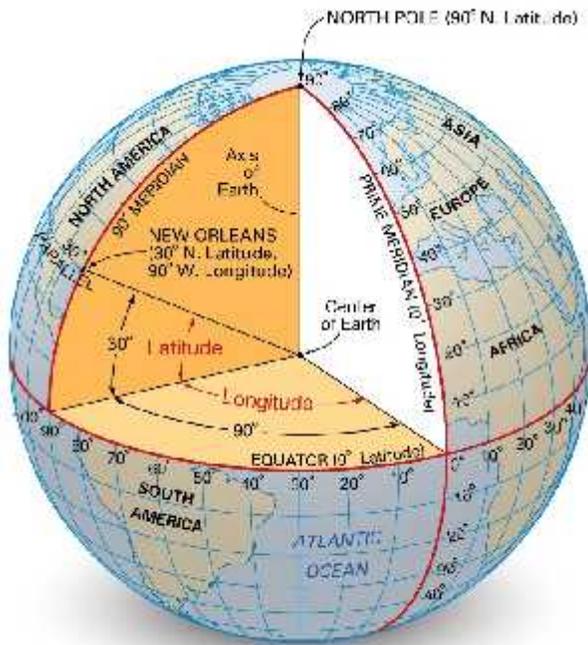
© Encyclopædia Britannica, Inc. Looks a whole lot like my desk globe!

Observe the red Prime Meridian[2] from the north pole (90° north) down to the equator and left or west through South America that I just explained above. What we have is parallels of Latitude and meridians of Longitude. Claire explained this when she was in the ninth grade as a memory jogger of saying Lat = a ladder one can climb.

"The distance per degree of longitude at the Equator is about 111.32 km (69.18 miles) and at the poles, 0" (see Britannica Web site).

Observe this next line. The observation is predicated on the fact the earth is not a perfect sphere.

The length of a degree of arc of latitude is approximately 111 km (69 miles), varying, because of the nonuniformity of Earth's curvature, from 110.567 km (68.706 miles) at the Equator to 111.699 km (69.41 miles) at the poles.

You should be aware of this phenomenon but you don't have to worry about it…for this paper!

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[2] https://www.britannica.com/science/latitude

For grins mostly, but for accuracy really, sometimes they say a mile but don't say a statue or nautical. This means in our case at the equator the distance for one degree is 'about' 69.18 statute miles or 'about' 60 nautical miles.

Therefore, for this paper I want to stay with statute miles as is used on most 'inland areas.'

One statute mile is 5,280 feet or 1760 yards (3 x 1760 = 5280).

Note: one[3] nautical mile = 6076.118 feet.

What learning is there at this point? You should be able to see the vertical lines of meridian meet at the top (and bottom). This means each degree of longitude starting at the equator is less each degree going up (or down).

At the equator one degree is about 69.18 miles[4].

> At 33° one degree is about 68.7 miles.
>
> At 36° one degree is about 56.0 miles.
>
> At 38° one degree is about 54.6 miles.

These four distances show as the latitude goes up (or down) the distance is decreasing between longitudinal degrees. Now, a mile is still a mile. The distance in a mile does not change. This decrease just shows equator has 69.18 miles and each degree the distance between each meridian is less until it gets to 90° north and they join are equal zero (0).

REVIEW – so far

We started at London on the prime meridian, went south to the equator, then west to the 97th (-97), turned north and step laddered up the 97th meridian to Stillwater to show what some of the numbers were fooling around with Lat/Long.

The real problem

Let's go back and expand on what we know so far and I will 'just mention' some of the pains it takes to measure lat/long. I started off measuring on my map the distance from 97° west to my Monk carrel. I say map but the four pilots in the Brigade know it is a chart. Yes, I used a VFR TERMINAL AREA CHART DALLAS – FT. WORTH Lambert Conformal Conic Projection and a SECTIONAL AERONAUTICAL CHART for Dallas – Ft. Worth. It is a chart…am just trying to be cute.

Using my 'aeronautical tools' I measured about three (3.0) miles but the scale 1:250,000 is too much for any real accuracy. I took a Google map picture and measured – after determining where 97° was – and it showed a little over 3 miles or 16,160 feet or 3.06 miles.

Knowing I was within 300 or 400 feet I got me real close plane view of the property and could measure the 50 feet distance on my hangar and the 40 feet on my concrete apron in front which is the southern boundary. Now I can focus a little closer to knowing how far things are like my office from the lot line on the south, distance from the ne corner of the house to the mail box, AND the distance to 97°.

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[3] https://www.boatsafe.com/conversiona-nautical-statute-miles/

[4] https://latlongdata.com/distance-calculator/

First lat/long vs. the two numbers for the same thing or DD vs DMS.

For a while here it will look like the planning board on a U-Boat figuring the torpedo attack toward some ship or it could be doing the flight planning for a 10 hour oceanic crossing…I got the tools, have done some of this but the math is eating my lunch.

As they say on the U-Boat to shoot or fire a torpedo "*Loos!*"

Here is the math to reconcile the two geographic numbers for the same place. Given the lat/long for my home (as given above):
33.17105 -97.05195 This is a **Decimal Degree** (DD) answer.
Degrees Minutes Seconds (DMS)[5] 33° 10' 15.78'' N 97° 3' 7.02'' W

Going from one to the other means dividing the arc by 60 and multiplying by the length of a mile or 5280 feet – or going back to multiply by 60 and dividing by 5280. Here is the process:

33° 10' 15.780'' N	DMS to DD	97° 3' 7.020'' W
15.780/60 = 0.2630		7.020/60 = .1170
10 + .2630 = 10.2630		3 + .1170 = 3.1170
10.2630/60 = .171050		3.1170/60 = .051950
33 + .171050 = 33.171050		97 + .051950 = 97.051950
33° 10' 15.78'' = 33.17105 N		97° 3' 7.02'' W = 97.051950

Or

33.17105 N	DD to DMS	97.051950
.17105 x 60 = 10.2630		.051950 x 60 = 3.1170
.2630 x 60 = 15.780		.1170 x 60 = 7.020
33° 10' 15.780''		97° 3' 7.020''

This drill is to show picking a location showing electronically the lat/long and then tapping the spot to show the lat/long read out. One of the two will appear. Now you know how to go from one to the other.

Ok, so what?

Well, the next problem I had was trying to see or determine how my house location could be determined by looking at one of these numbers and correlate the distance from the 97th meridian. I should have called Ryan (Keith's son-in-law) and paid him to show me as it would have been easier.

Distance from the 97th

This number caused me a lot of pencil, paper, measuring, fingering, fiddling, and swearing to determine. However, my math is close and I understand what the numbers mean but to go down and stand on the east corner of my lot (not knowing exactly where the pin is), taking a cell phone shot of the given lat/long of my mail box, or taking a reading (in yards) with my range finder, or measuring the distances

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[5] https://www.latlong.net/lat-long-dms.html

on a color print out of the Google overhead or plane view and making the numbers come out is in one word: "close." I can't go to six places on paper that match up with the GPS and Google pictures.

But let me tell you how close it is. Maybe you would like to say "I wonder where I am at?" If you do, call Ryan as my work here will be like trying to hit the 10 ring at 25 yards with my JM Pro 930 12 gauge auto – kind of a scattered approach, will hit all the way round the 10 ring lat/long.

My chart measurement from the 97th to here showed about 3 miles – guessing on the large scale 'about' where on the symbol for airport the house would be.

I took a full page color picture of the area from the 97th to here and tried to put some sort of a scale to it and came out with about 16,160 feet guessing to the chart scale and 'adjusting' from the length of the runway for some help. The number here is 3.06 stat miles.

The longitude from the 97th is (as shown above in DD) .051950.
If we multiply this number by the feet in a statue mile or 316,88 the number is 16,457.76 feet. Divide this by 5280 and the miles are 3.12 (3.117) so, am within about 300 feet of my estimate/guess/measure.

Course, this is about the distance to my mail box. Am off about 300 feet. How do I 'make a correction?'

Let's do the math difference between the house lat/long (ne corner of the house where I am at) straight south to the property line and measure in DD and then determine feet.
97.051950 for the House
97.051154 for the mailbox (near pin)
   .000796 difference
.000796 x 316,800 = .4776 x 5280 or 252 feet.

Now we know how to determine the distance using a DD number for lat/long!
Note: my Range finder showed 220 feet and my map showed 236 feet.

Distance from lot line to 'where I am at'
Using the latitude measurement for the house as 33.171050 and subtracting the lot line latitude spot of 33.170381 the difference is .002190.
.000219 x 5280 = 116 feet.
Note my paper measurement was 115 feet so am closer (course, could almost measured with a tape.

Spent some time determining the distance from where I am to the mail box. Had to move outside to go east somewhat to see the mail box behind my hangar. Then could not use the lat/longs I have been working with so I used my range finder and measured from my color copy of the property. The distances can out to be about 260 on the map and 250 on the range finder. The problem here is recording the numbers looking through a shaking range finder…need a bench rest.

Speaking of bench rests[6] I asked John how he measured his berm targets of 25, 50, 100, and 200 as I was not reading exactly what I should be reading when I measured his berms using my range finder. Well, it didn't take long for me to recalibrate my instrument when I found out he used a tape for his markings.

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[6] https://www.rapidtables.com/convert/length/km-to-mile.html?x=1

Lastly

Having profoundly explicated the issues of using lat/long to determine a couple of geographic places let me leave you with a little story and the test question for our research.

When I was enjoying my airline flying with Braniff (first of three Braniff's) my fortune was to fly the Big Orange Boeing 747s (-100, -200, and SP models). Still dream of sitting in one of the three seats up front and traveling to different places – 'the' Intercontinental airplane of all times.

We had inertial navigation systems (INS) on these big ole muthers and when we loaded the three different INSs with the flight plan we wouldn't just load one and copy and paste or transfer. We would load them up manual and then cross check the three to see if an error showed up rather than having all three systems carry the same error – and then let it take us some place or turn us somewhere not on the flight plan.

This meant a lat/long for each of about nine way points (loaded more enroute - if needed) Zero was present position, 1, 2…8 mid points, and 9 was the destination. It was magic…actually PFM. We did not take the process lightly of 'making our nest' a full hour before take-off going anywhere. Some times in flight we would get a clearance to short cut an involved or complicated approach and be given "cleared direct." This was, for our new next leg only a push of ZERO and NINE and the ship would follow 'direct'.

Ten hour flights are just one leg. Sometimes then with a 24 hour layover the next leg home would be the same – more or less, as it depends on the wind and weather.

We flew from Dallas/Ft. Worth (KDFW) to for instance London Gatwick (EGKK). I even have some old flight plans for this way too short time in my life flying to places like Boston, Brussels, Frankfort, Paris, London, Los Angeles, Hawaii, and Santiago.

Drawing lines on a map, loading up the INSs, flying the imaginary line, and keeping up with where I am so that I can get back to where I am at was really a dream come true. The lats and longs were easier then it seems…my cell will not follow instructions like my big ole Orange 74.

Test question:

You are scheduled for a trip to London leaving DFW. The line on your map would cross closest to which city waypoint (lat/long) enroute?
a. Charlotte
b. New York
c. Boston
d. Detroit
       Think great circle…