

GEO-50 Version 1.3

by Jacob Wall

GEO-50 is a mostly UserRPL library written for the HP 49g+/50g calculators. All angular input is in the format DDD.MMSSss, North Latitude is entered and displayed as positive, and East Longitude is entered and displayed as positive. Distances are metric.

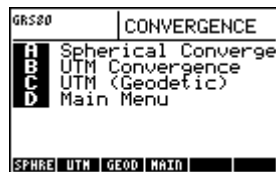


The main menu lists the 5 sub menus that the programs are grouped into:

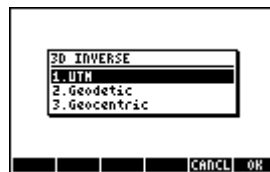
A. Coordinate transformations



B. Convergence calculations



C. 3D inverses



D. Lat/Arc calculations



E. Tools



Within these 5 menus are programs capable of performing geodetic calculations including:

1. Transform UTM to geodetic and vice versa
2. Transform geodetic to geocentric coordinates (x,y,z) and vice versa
3. Transform spherical coordinates from geographic to cartesian and vice versa
4. Calculate UTM and spherical convergence
5. Perform 3D inverses between UTM, geodetic or geocentric coordinates
6. Calculate latitude with given meridinal arc length or vice versa
7. Solve spherical triangles
8. Perform direct or inverse calculations on the ellipsoid with Bowring's equations
9. Choose one of three ellipsoids to use: WGS84, GRS80 or Clarke 1866 Spheroid

1. Transform UTM to geodetic and vice versa

a. UTM to Geodetic - Enter the UTM coordinates in the input form as shown. The results are displayed with North Latitude positive and East Longitude positive, and elevation, scale (grid), and combined factors.

UTM + GEODETIC	GEODETIC COORDINATES
Northing: 5351000.132	Latitude: 48°48'41.072517"
Easting: 468512.134	Longitude: -123°25'28.83836"
Ell. Ht.: 35.145	ElFactor: 0.99999448449
UTM Zone: 10	ScFactor: 0.99961230482
	Combined: 0.99960663145
EDIT	GRAPH
CANCEL	OK

b. Geodetic to UTM - Enter Latitude and Longitude as DDD.MMSSsss format and an ellipsoid height to calculate UTM coordinates and elevation, scale and combined factors.

GEODETIC + UTM	UTM COORDINATES
lat: 48.1515	Northing: 5344628.28998
lon: -123.2535	Easting: 468249.885358
he: 18.5	UTM Zone: 10
	ElFactor: 0.99999709668
	ScFactor: 0.99961233092
	Combined: 0.99960942872
LATITUDE	GRAPH
EDIT	OK
CANCEL	

2. Transform geodetic to geocentric and vice versa

a. Geodetic to geocentric - Enter a latitude, longitude and ellipsoid height to calculate geocentric x,y,z coordinates.

GEODETIC → GEOCENTRIC		GEOCENTRIC COORDINATES	
φ: 48.1515		x: -2343758.33344	
λ: -123.2535		y: -3550936.30164	
h: 18.5		z: 4735754.12273	
LATITUDE			
EDIT	CANCL OK	GRAPH	OK

b. Geocentric to geodetic - Enter x,y,z coordinates to calculate Latitude, Longitude and ellipsoid height.

GEOCENTRIC → GEODETIC		GEODETIC COORDINATES	
x: -2343758.33344		φ: 48°15'15.000000"	
y: -3550936.30164		λ: -123°25'35.000000"	
z: 4735754.12273		h: 18.5000000000	
EDIT	CANCL OK	GRAPH	OK

3. Transform spherical coordinates from geographic to cartesian and vice versa

a. Geographic to cartesian - Similar to geodetic/geocentric transformations but with sperical coordinates, enter radius, longitude, latitude and sphere height to calculate x,y,z cartesian coordinates.

GEOGRAPHIC → CARTESIAN		CARTESIAN COORDINATES	
Radius: 6372000.		x: -2337136.22509	
Latitude: 48.1515		y: -3540903.40508	
Longitude: -123.2535		z: 4754199.94381	
Sphere Height: 18.5			
EDIT		CANCL	OK
		GRAPH	OK

b. Cartesian to geographic - Enter x,y,z cartesian coordinates to calculate spherical geographic coordinates.

CARTESIAN → GEOGRAPHIC		GEOGRAPHIC COORDINATES	
R: 6372000.		φ: 48°15'15.000000"	
x: -2337136.22509		λ: -123°25'35.000000"	
y: -3540903.40508		h: 18.5000000000	
z: 4754199.94381			
RADIUS			
EDIT	CANCL OK	GRAPH	OK

4. Calculate UTM and spherical convergence

a. Spherical convergence - Enter spherical geographic coordinates for two points to calculate spherical meridinal convergence that affects the line connecting the points.

SPHERICAL CONVERGENCE	
Pt.1 Latitude:	48.1515
Pt.1 Longitude:	-123.2535
Pt.2 Latitude:	48.1525
Pt.2 Longitude:	-123.3005
EDIT CANCEL OK	

SPHERICAL CONVERGENCE	
Δ Long :	0°04'30.000000"
Σ Lat :	48°15'20.000000"
Converg.:	0°03'21.4529231"
GRAPH OK	

b. UTM convergence - Enter UTM coordinates and zone to calculate UTM grid convergence.
(Geodetic North = Grid North + Convergence)

UTM CONVERGENCE	
Northing:	5351000.132
Easting:	468512.134
UTM Zone:	10.
EDIT CANCEL OK	

UTM CONVERGENCE	
C:	0°13'01.7003156"
GRAPH OK	

c. UTM convergence from geodetic coordinates - Enter geodetic coordinates to calculate grid convergence and UTM zone.

GEODETIC COORDINATES	
#:	48.1841072517
λ:	-123.252883836
LATITUDE	
EDIT CANCEL OK	

UTM CONVERGENCE	
Convergence:	0°13'01.7003181"
UTM Zone:	10
GRAPH OK	

5. Perform 3D inverses between UTM, geodetic or geocentric coordinates

a. UTM – Enter UTM coordinates and ellipsoidal heights for two points to calculate grid azimuth and distance, as well as scale factors, ground-level distance and sea-level distance.

3D INVERSE UTM	
N1:	5351000.132
E1:	468512.134
Z1:	18.5
N2:	5351234.564
E2:	468899.471
Z2:	13.461
Pt.1 NORTHING	
EDIT CANCEL OK	

INVERSE UTM	
GridAz:	52°48'57.527139"
GridDist:	452.756251308
E1Factor:	0.99999749308
ScFactor:	0.99961205561
Combined:	0.99960954866
GridDist:	452.932002823
SeaDist:	452.952064363
GRAPH OK	

b. Geodetic – Enter geodetic coordinates and ellipsoidal heights for two points to calculate slope distance between the two points (Dist), geodetic azimuth from Point 1 to Point 2, and from Point 2 to Point 1, as well as ellipsoidal distance (s).

3D INVERSE GEODETIC #1: 48.1515 λ1: -123.2535 h1: 18.5 #2: 48.1501 λ2: -123.2656 h2: 45.127 Pt. 1 LATITUDE EDIT CANCL OK	INVERSE GEODETIC Dist: 1726.13338295 α12: 75°29'54.396754" α21: 255°28'53.96402" s: 1725.91340949 GRAPH OK
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c. Geocentric – Enter geocentric coordinates for two points to calculate slope distance between the two points (Dist), geodetic azimuth from Point 1 to Point 2, and from Point 2 to Point 1, as well as ellipsoidal distance (s).

3D INVERSE GEOCENTRIC x1: -2343758.33344 y1: -3550936.30164 z1: 4735754.12273 x2: -2345340.20445 y2: -3550299.62243 z2: 4735486.0553 EDIT CANCL OK	INVERSE GEOCENTRIC Dist: 1726.13338295 α12: 75°29'54.395467" α21: 255°28'53.96273" s: 1725.91341238 GRAPH OK
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6. Calculate latitude with given meridinal arc length or vice versa

a. Known Latitude – Enter latitude and choose type of latitude (geodetic, geocentric or parametric) to calculate meridinal arc length.


CALCULATE ARC LENGTH Latitude: 15.1515 Type: Geodetic CHOOSE TYPE CHOOS CANCL OK	MERIDIAN ARC LENGTH Sm: 1607113.11458 GRAPH OK
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b. Known arc length – Enter meridinal arc length to calculate latitude, since the calculation is iterative; the result from each iteration is displayed.

CALCULATE LATITUDE Arc Length: 100000. ENTER ARC LENGTH EDIT CANCL OK	GEODETTIC LATITUDE #1: 0°53'59.3633289" #2: 0°54'15.6451287" #3: 0°54'15.7263294" #4, #: 0°54'15.7274005" GRAPH OK
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7. Solve spherical triangles


The new spherical triangle solver in Version 1.2 solves all 6 different cases of spherical triangles where 3 parts are known. Enter 3 known parts to solve for the remaining parts, spherical excess (E) and Omega $((A+B+C)-\pi)$. Enter a Radius value to also calculate area.

Spherical Triangle Solver	
Angle A: 102.501	
Side c: 0.	
Angle B: 76.095	
Side a: 0.	
Angle C: 127.3306	
Side b: 0.	
Radius: 6372000.	
[EDIT] [CANCL] [OK]	

Triangle Solution	
a: 119°59'59.72527"	
b: 60°00'00.274730"	
c: 135°00'00.06162"	
E: 127°33'06.00000"	
Ω: 2.22619654975	
Area: 9.03888871724E13	
[CANCL] [OK]	

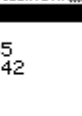
8. Perform direct or inverse calculations on the ellipsoid using Bowring's equations

a. Direct – Enter latitude and longitude of Point 1, geodetic distance (s) and geodetic azimuth to Point 2 to calculate latitude and longitude of Point 2 and geodetic azimuth from Point 2 to Point 1.

BOWRING: DIRECT CALCULATION	
#1: 50.01	
λ1: -97.2	
s: 804.635	
α12: 90.3	
Pt 1: Latitude (+)North (-)South	
[EDIT] [CANCL] [OK]	

BOWRING: DIRECT SOLUTION	
#1: 50°01'00.000000"	
λ1: -97°20'00.000000"	
s: 804.635000000	
α12: 90°30'00.000000"	
#2: 50°00'59.770785"	
λ2: -97°19'19.585142"	
α21: 270°30'30.96712"	
[CANCL] [OK]	

b. Inverse – Enter latitude and longitude of two points to calculate geodetic azimuths for both directions and geodetic distance.

BOWRING: INVERSE CALCULATION	
#1: 50.01	
λ1: -97.2	
#2: 50.0059770785	
λ2: -97.1919585142	
Pt 1: Latitude (+)North (-)South	
[EDIT] [CANCL] [OK]	

BOWRING: INVERSE SOLUTION	
#1: 50°01'00.000000"	
λ1: -97°20'00.000000"	
#2: 50°00'59.770785"	
λ2: -97°19'19.585142"	
α12: 90°29'59.998199"	
α21: 270°30'30.96532"	
s: 804.634996503	
[CANCL] [OK]	

9. Choose one of three ellipsoids to use: GRS80, WGS84 or Clarke 1866 Spheroid

GRS80 TOOLS	
A	CHOOSE ELLIPSOID
B	1. GRS80
C	2. WGS84
D	3. Clarke Spheroid 1866
E
[CANCL] [OK]	

Please report any bugs you may find by email to: jacobw@surv50.ca

Visit <http://surv50.ca> for more information about some of my other free and also commercial software for the HP 49g+/50g calculators.