Using the rotary "hex-pen" grid for instant distance and area approximations

The "hex-pen" grid can be superimposed onto an antipodes map of congruent size to approximate distances and areas on the earth. But it should be remembered that the distances and areas are given in the context of a "flat" earth where the oceans and continents are at sea-level. If the rotary grid is placed over the map as shown in the earlier article distances between places and areas of places that come within its ambit could be approximated. Distances between places are classified below under the various arc-angles as given in "The arc-angle distances and areas table". The arc-angle distances are accurate within the ranges stated only if the places are located exactly at the strategic points at the tips of the arc-angles. However, since very few places are sited exactly at the strategic points (i.e. having the same geographic co-ordinates as the points) the grid can only be used to gauge distances and areas in an approximate manner. Hence the distances between the places and the various areas given in the table below are only approximate. If the grid is turned to another position over the map a host of other places could come within the ambit of its use.

Areas of the earth are approximated with reference to the hexagons and pentagons of the grid. Thus area measurement seem to have a unified scale in the use of equal hexagons and equal pentagons; just like distance measurement using the unified scale of arc-angles. The earth's superficial area is equivalent to the area of about 28 hexagons or about 42 pentagons. One hexagon is slightly more than 1.5 pentagon in area. The areas of the various places given below with reference to the hexagons and pentagons can be figured out using "The arc-angle distances and areas table". The values are only approximate.

Instant distances and areas approximations table with reference to the "hex-pen" grid superimposed onto the antipodes map

Approximate distances between few places close to the tips of the arc-angles of the grid

Arc-angle 16.01° (1779.24 – 1782.23 kms.)
Culiacan – Merida
Antofagasta – Bahia Blanca
Guiyang – Ho Chi Minh

Arc-angle 19.71°(2190.44 – 2194.11 kms.)
North Pole – Wrangle
Guiyang – Nagasaki
Amundsen-Scott – Alexander Is.
Culiacan – Billings

Arc-angle 21.14°(2349.36 – 2353.30 kms.)
London – Athens
Maracaibo – Galapagos Is.
Recife – Macapa
Guam – Manado

Arc-angle 24°(2667.20 – 2671.67 kms.)
Bathurst Inlet – Wrangel
Ulan Bator –Poronaysk
Puerto Aisen – Porto Alegre

Arc-angle 35.72°(3969.68 – 3976.34 kms.)
Luanda – Tristan da Cunha
Kafia Kingi – Yerevan
Ulan Bator – Ho Chi Minh

Arc-angle 36°(4000.80 – 4007.51 kms.)
Macapa – Galapagos Is.
Kirensk – Multan
Mauritius – Addis Ababa

Arc-angle 37.15°(4128.60 –4135.53 kms.)
Antofagasta – Maracaibo
Charleville – Guam

Arc-angle 37.68°(4187.50 - 4194.53 kms.)
Bathurst Inlet – Murmansk
Kerman – Kafia Kingi
Nagasaki – Kathmandu

Arc-angle 42.28°(4698.71 – 4706.60 kms.)
Guam – Poronaysk
Merida – Macapa
London – Omsk
Recife – Maracaibo

Arc-angle 48°(5334.40 –5343.35 kms.)
Las Palmas – Luanda
Nagasaki – Wrangel
Ulan Bator – Yalta
Pensacola – Angmagssalik

Arc-angle 63.42°(7048.07 – 7059.90 kms.)
Culiacan – Antofagasta
Guiyang – Charleville

Arc-angle 90°(10002.00 – 10018.79 kms.)
Macapa – Moscow
Durban –Manado
Galapagos Is. – Amundsen-Scott
Nauru – North Pole

Arc-angle 180°(20004.00 – 20037.58 kms.)
London – Antipodes Is.
Singapore – Quito
Nagasaki – Porto Alegre
Perth – Bermuda
Macapa – Manado

Great circle 360°(40008.00 –40075.16 kms.)

Areas of continents and oceans with reference to the areas of the hexagons and pentagons of the grid

Australia	7,687,000 sq. kms.*	0.42 H	or 0.63 P
Europe	9,957,000 ,,	0.54 H	,, 0.82 P
Antarctica	14,100,000 ,,	0.77 H	,, 1.16 P
South America	17,793,000 ,,	0.97 H	,, 1.47 P
North America	24,241,000 ,,	1.33 H	,, 2.00 P
Africa	30,302,000 ,,	1.66 H	,, 2.50 P
Asia	44,500,000 ,,	2.44 H	,, 3.68 P
Arctic Ocean	14,090,000 sq. kms.*	0.77 H	or 1.16 P
Indian Ocean	73,917,000 ,,	4.05 H	,, 6.11 P
Atlantic Ocean	92,373,000 ,,	5.06 H	,, 7.64 P
Pacific Ocean	179,679,000 ,,	9.84 H	,,14.87 P

* values taken from Philip's Atlas of the World, 1998 edition
H for hexagon, P for pentagon

Areas bordered by the great circles of the grid

Each of the great circles of the grid divide the earth into equal hemispheres. Imaginary great circles going through South Georgia, Puerto Aisen and Alexander Island could border an equilateral triangular area that is about 1/6 of a hexagon (3,042,150.18 sq.kms.) In the same way great circles going through Nagasaki, Ulan Bator and Guiyang could border a triangular area that is slightly more than 1/5 of a pentagon (2,416,858.34 sq. kms.)

The area of a 1° longitudinal segment is 1,416,859.78 sq. kms. from pole to pole, and 708,429.89 sq. kms. from a pole to the equator.

Using the unitary arc-angle to approximate distances between places along a polar or equatorial circumference

In order to approximate the distances between such places, the said places should be along a north/south polar alignment (a meridian and its anti-meridian) or along the east/west alignment of the equator. The places should not deviate more than 1° from their respective alignments for reliable distance estimations. The difference in latitude between the places along a polar circumference, or the difference in longitude between them along the equator can be used to calculate the approximate distances between them, as shown in the examples given below, using the geographic coordinates* of the places. In each case the angular difference is multiplied by the correct unitary arc-angle value to figure out the respective distance approximations.

Berlin – 52.5° N, 13.41°E
Luanda – 8.83° S, 13.25° E
difference in latitude is 61.33°
arc-angle distance is 61.33x111.13=6815.6 kms.
deviation in longitudinal alignment is 0.16°

Petropavlovsk K. – 53.05° N, 158.71° E
Reykjavik – 64.16° N, 21.95° W
difference in latitude is 62.79° across the north pole
arc-angle distance is 62.79x111.13=6977.85 kms.
deviation in longitudinal alignment is 0.66°

Liberville – 0.41° N, 9.43° E
Macapa – 0.08° N, 51.06° W
difference in longitude is 60.49°
arc-angle distance is 60.49x111.32=6733.74 kms.
deviation in equatorial alignment is 0.33°

* The geographic coordinates are from Philip's Atlas of the World, 1998 edition after conversion to decimalised degrees.