


Data information center / How to calculate distances



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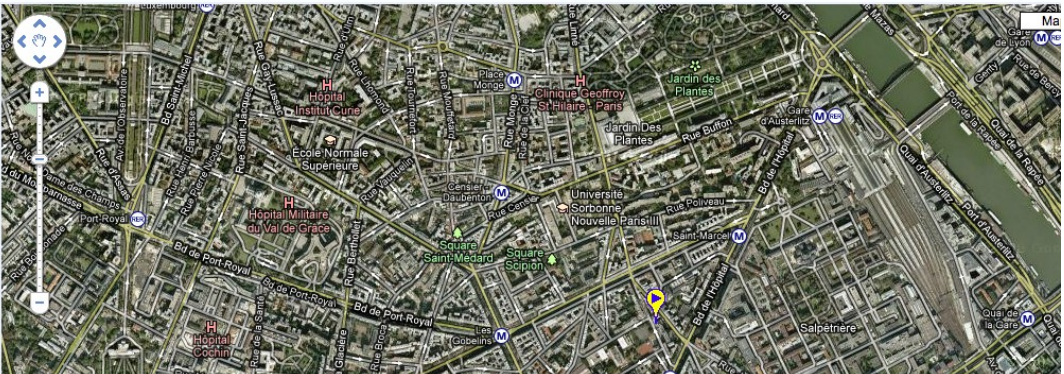
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MEGAUPLOAD - The leading Calculate distance and bearing Calculator of earth coordinates

www.sunearthtools.com/dp/tools/pos_earth.php



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This uses just one trig and one sqrt function – as against half-a-dozen trig functions for cos law, and 7 trigs + 2 sqrts for haversine. Accuracy is somewhat complex: along meridians there are no errors, otherwise they depend on distance, bearing, and latitude, but are small enough for many purposes* (and often trivial compared with the spherical approximation itself).

Bearing

In general, your current heading will vary as you follow a great circle path (orthodrome); the final heading will differ from the initial heading by varying degrees according to distance and latitude (if you were to go from say 35°N,45°E (Baghdad) to 35°N,135°E (Osaka), you would start on a heading of 60° and end up on a heading of 120°!).

This formula is for the initial bearing (sometimes referred to as forward azimuth) which if followed in a straight line along a great-circle arc will take you from the start point to the end point:¹

Formula: $\theta = \text{atan2}(\sin(\Delta\text{long})\cos(\text{lat}_2), \cos(\text{lat}_1)\sin(\text{lat}_2) - \sin(\text{lat}_1)\cos(\text{lat}_2)\cos(\Delta\text{long}))$

JavaScript:

```
var y = Math.sin(dLon) * Math.cos(lat2);
var x = Math.cos(lat1)*Math.sin(lat2) -
    Math.sin(lat1)*Math.cos(lat2)*Math.cos(dLon);
var brng = Math.atan2(y, x).toDeg();
```

Excel: $=\text{ATAN2}(\text{COS}(\text{lat1})*\text{SIN}(\text{lat2})-\text{SIN}(\text{lat1})*\text{COS}(\text{lat2})*\text{COS}(\text{lon2}-\text{lon1}), \text{SIN}(\text{lon2}-\text{lon1})*\text{COS}(\text{lat2}))$

* Note that Excel reverses the arguments to ATAN2 – see notes below

Since atan2 returns values in the range -n ... +n (that is, -180° ... +180°), to normalise the result to a compass bearing (in the range 0° ... 360°, with -ve values transformed into the range 180° ... 360°), convert to degrees and then use $(\theta + 360) \% 360$, where % is modulo.

For final bearing, simply take the *initial* bearing from the *end* point to the *start* point and reverse it (using $\theta = (\theta + 180) \% 360$).



Baghdad to Osaka

Midpoint

This is the half-way point along a great circle path between the two points.¹

Formula: $Bx = \cos(\text{lat}_2)\cos(\Delta\text{long})$
 $By = \cos(\text{lat}_2)\sin(\Delta\text{long})$