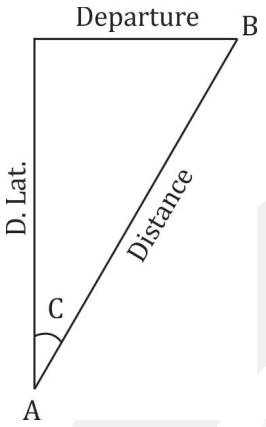
# Plane Sailing




The Plane Sailing method is used to find the approximated course and distance between two positions that are on different latitudes. Since the track is cutting all meridians at the same angle, Plane Sailing is also one of the methods of **Rhumb Line Sailing**. In a short distance, a rhumb line appears as straight line, but the track is actually a curve and, if extended, it will eventually spiral in on the North or South Pole. Because the unit of latitude is not the same as the unit of longitude, the difference of longitude has to be calculated to become departure, which is expressed as a latitude unit. To find the true departure, the middle latitude has to be used, which does not lie between two latitudes. The middle latitude can be found by applying the correction to the mean latitude. This correction can be tabulated in the table reproduced in the nautical table section of this book. However, for a short distance of less than 600 miles, the mean latitude can be used and the error is acceptable. For a longer distance, the Mercator Sailing method should be used.

***Procedure to find the course and distance***

1. Calculate D. Lat., D. Long. and mean latitude ($Lat_m$);
2. Calculate departure by using formula:

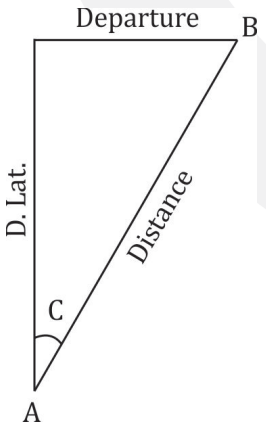
$$\mathbf{Dep. = D.\,Long. \times \cos\left(Lat_m\right)}$$

3. Calculate course (C) and distance (D) by using formula:

$$\mathbf{C = \tan^{-1}\left(\frac{Dep.}{D.\,Lat.}\right)} \qquad \mathbf{D = \frac{D.\,Lat.}{\cos C}}$$

Example 1 Using mean latitude to find the course and distance between:

A: 27°15′N 71°23′W B: 28°22′N 68°18′W




| | | | | | |
|---|---|---|---|---|---|
| $Lat._A$ | 27°15′N | $Long._A$ | 71°23′W | $Lat._A$ | 27°15′N |
| $Lat._B$ | 28°11′N | $Long._B$ | 68°18′W | ½D. Lat. | 28′ |
| D. Lat. | 56′(N) | D. Long. | 185′(E) | $Lat._m$ | 27°43′N |

$$\text{Dep.} = \text{D. Long.} \times \cos\left(\text{Lat}_m\right)$$
$$= 185' \times \cos 27°43' = 163.77'$$

$$C = \tan^{-1}\left(\frac{\text{Dep.}}{\text{D. Lat.}}\right) = \tan^{-1}\left(\frac{163.77'}{56'}\right) = 71.1°$$

$$D = \frac{\text{D. Lat.}}{\cos C} = \frac{56'}{\cos 71.1°} = 173.1\,\text{miles}$$

$\text{Course} = \text{N}71.1^\circ\text{E} = 071.1^\circ\text{T}$

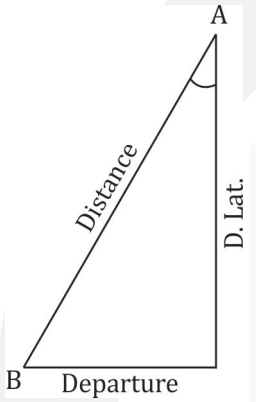
$\text{Distance} = 173.1\,\text{miles}$

Example 2 Using mean latitude and middle latitude to find the course and distance between:

A: 35°15′N 62°23W B: 30°25′N 70°18′W

*Using mean latitude*

| | | | | | |
|---|---|---|---|---|---|
| $\text{Lat.}_A$ | 35°15′N | $\text{Long.}_A$ | 62°23′W | $\text{Lat.}_A$ | 35°15′N |
| $\text{Lat.}_B$ | 30°25′N | $\text{Long.}_B$ | 70°18′W | ½ D. Lat. | 2°25′N |
| D. Lat. | 290′ (S) | D. Long. | 475′ (W) | $\text{Lat.}_m$ | 32°50′N |




$$\text{Dep.} = \text{D. Long.} \times \cos(\text{Lat}_m) = 475' \times \cos 32^\circ 50' = 399.1'$$

$$C = \tan^{-1}\left(\frac{\text{Dep.}}{\text{D. Lat.}}\right) = \tan^{-1}\left(\frac{399.1'}{290'}\right) = 54^\circ$$

$$D = \frac{\text{D. Lat.}}{\cos C} = \frac{290'}{\cos 54^\circ} = 493.4\,\text{miles}$$

$\text{Course} = \text{S}54^\circ\text{W} = 234^\circ\text{T}$

$\text{Distance} = 493.4\,\text{miles}$

*Using middle latitude*

| | |
|---|---|
| Mean Lat. | 32°50′ N |
| Correction | −24′ N |
| Middle Lat. | 32°26′ N |

$$\text{Dep.} = \text{D. Long.} \times \cos(\text{Lat}_m) = 475' \times \cos 32^\circ 26' = 400.9'$$

$$C = \tan^{-1}\left(\frac{\text{Dep.}}{\text{D. Lat.}}\right) = \tan^{-1}\left(\frac{400.9'}{290'}\right) = 54.1^\circ$$

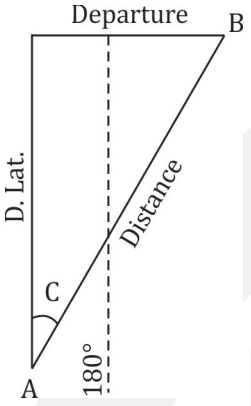
$$D = \frac{\text{D. Lat.}}{\cos C} = \frac{290'}{\cos 54.1^\circ} = 494.8\,\text{miles}$$

$\text{Course} = \text{S}54.1^\circ\text{W} = 234.1^\circ\text{T}$

$\text{Distance} = 494.8\,\text{miles}$

The result between using mean latitude and middle latitude is slightly different, but not significant.

Example 3 A vessel steams a course 050°T, distance 500 miles, from position 40°25′S 175°50′E. Find final position:




*Final Latitude*

$$\text{Distance} = \frac{\text{D. Lat.}}{\cos C}$$

$$\text{D.Lat.} = \text{Distance} \times \cos C$$

$$\text{D.Lat.} = 500 \times \cos 50° = 321.39' = 5°21.39'(\text{N})$$

| | |
|---|---|
| Initial Latitude | 40°25.00′S |
| D.Lat. | 5°21.39′(N) |
| Final Latitude | 35°03.61′S |

*Final Longitude*

$$\text{Dep.} = \text{D. Lat.} \times \tan C = 321.39 \times \tan 50° = 383.02'$$

$$\text{Mean Lat.}(\text{Lat}_m) = 40°25' - \frac{5°21.39'}{2} = 37°44.31'$$

$$\text{D.Long.} = \frac{\text{Dep.}}{\cos \text{Lat}_m} = \frac{383.02}{\cos 37°44.31'} = 484.34' = 8°04.34'(\text{E})$$

| | |
|---|---|
| Initial Longitude | 175°50.00′E |
| D.Long. | 8°04.34′(E) |
| | 183°54.34′ |
| | 360°00.00′ |
| Final Longitude | 176°05.66′W |

Final Position: 35°03.61′S 176°05.66′W