

Traverse Tables

Traverse tables are designed mainly for solving Parallel Sailing and Plane Sailing without major calculations. For plane sailing, the tables are tabulated from right-angled triangles and cover a distance of up to 600 miles, which is the limit for plane sailing.

In Norie's Nautical Tables, the traverse tables are named from 0° to 45° at the top of the pages, and 45° to 90° at the bottom of the pages. These figures of degrees are represented courses in Plane Sailing and latitude in Parallel Sailing.

Parallel Sailing with Traverse Tables

As mentioned above, the figure of degree of each table is represented for latitude. The columns with the header *D. Long.* or *D'Long.*, and *Dep.*, which are normally printed in italics, are used to find the Departure from a given Different of Longitude (D. Long).

Procedure to use Traverse Tables for Parallel Sailing

1. Locate the table that has the whole number of degrees of the latitude. If the latitude is greater than 45°, then it's located at the foot of the table and the column header should be read from the bottom;
2. In the column headed in italics *D. Long.*, locate the value of D. Long.;
3. Extract the value of Departure in the column header *Dep.* against the value of D. Long. This value of Departure is also the distance in parallel sailing.

Example 1

A ship is steaming along latitude 47°, from longitude A: 175°25' E to longitude B: 176°35' W. Find the distance.

$$\begin{array}{r}
 \text{Long.}_A \quad 175^\circ 25' \text{ E} \\
 \text{Long.}_B \quad 176^\circ 35' \text{ W} \\
 \hline
 \text{D. Long.} \quad \quad 480' \text{ (E)}
 \end{array}$$

1. Locate the table 47° which is the same as table 43°, but the column header is read from the bottom of the table;
2. In the column headed *D. Long.*, from the bottom of the table, locate the value 480;
3. Extract the value against the value 480 of D. Long, which is also located in the column that has the column header *Dep.*, from the bottom of the table. The departure is 327.4, so the distance is 327.4 miles.

479	350.3	326.7
480	351.0	327.4
Dist.	Dep.	D. Lat.
<i>D. Long.</i>		<i>Dep.</i>

Traverse Table 47°

Plane Sailing with Traverse Tables

For plane sailing, these figures of degrees are the courses expressed in appropriate quadrants as cardinal compass. For example, the table named 35° is for the courses N35°E (035°T), S35°E (145°T), S35°W (215°T), and N35°W (325°T). Three-figure notation (0°-360°) is also indicated on the table; easterly courses are placed on the right, and westerly courses on the left of the table. The three-figure notation (θ°) course is converted into a quadrantal notation course (Ω°) as follows:

1 st Quadrant (0° - 90°)	2 nd Quadrant (90° - 180°)	3 rd Quadrant (180° - 270°)	4 th Quadrant (270° - 360°)
Ω° = θ°	Ω° = 180° - θ°	Ω° = 180° + θ°	Ω° = 360° - θ°
N Ω° E	S Ω° E	S Ω° W	N Ω° W

Example 2

- 1st quadrant 075° = N75°E
- 2nd quadrant 125° = S55°E
- 3rd quadrant 245° = S65°W
- 4th quadrant 330° = N30°W

The row with the heading Dist. D. Lat. Dep. in the table is represented for Distance, Difference of Latitude, and Departure in plane sailing triangle. If the course is between 0° to 45°, then the columns must be used with the name Dist. D. Lat. Dep. on the top of the page; if the course exceeds 45°, then the columns must be used from the bottom of the table, where the quantities of D. Lat and Dep. are reversed. This is the most common mistake made by navigators; to avoid it when using the traverse table, the navigator should have a piece of paper handy; when working with a course of more than 45°, the paper is used to cover the column heading on the top; when working with a course of less than 45°, the bottom column heading is covered.

Procedure to find the difference of latitude (D. Lat.) and departure (Dep.) from given course and distance

1. Change the course to quadrantal notation;
2. Locate the table that has the whole number of degrees of the course;
3. In the column headed Dist., locate the value of the given distance. If the value of the distance is not a whole number, then the distance can be multiplied by 10 or 100 to remove the decimal place and the new value used as the distance value;

4. Extract the D. Lat. and Departure values against the given distance value. If the distance value was multiplied by 10 or 100 to remove the decimal place, then the values of D. Lat. and Departure must be divided by 10 or 100 to get the correct values. The Difference of Latitude and the Departure are named, accordingly, the quadrantal course.

If the course is not a whole number, repeat the procedure with the table 1° higher, then interpolate two results to find the final answers.

Example 3 A ship made good with a course of 033°T over a distance of 250 miles. Find the Difference of Latitude and Departure:

1. Course is N33°E;
2. Locate the table 33°;
3. From the column headed Dist. on top of the table, locate the value 250;
4. Extract the values of D. Lat. 209.7'(N) and Dep. 136.2'(E). The Difference of Latitude is named N and departure is named E, because the course is NE.

	<i>D. Long.</i>		<i>Dep.</i>
<i>Dep.</i>	<i>Dist.</i>	<i>D. Lat.</i>	<i>Dep.</i>
..
..
..	249	208.8	135.6
..	250	209.7	136.2
..	251	210.5	136.7

Traverse Table 33°

Example 4 A ship made good with a course of 265° T over a distance of 450 miles. Find the Difference of Latitude and Departure:

1. The course is in the 3rd quadrant, so the quadrantal course is S 85° W;
2. Locate the table 85°, which is at the bottom of the page 5°;
3. From the column headed Dist. at the bottom of the table, locate the value 450;
4. Extract the values of D. Lat. 39.2'(S) and Dep. 448.3'(W). The Difference of Latitude is named S and Departure is named W, because the course is SW.

..	449	447.3	39.1	..
..	450	448.3	39.2	..
..	451	449.3	39.3	..
..
..
D. Lat.	Dist.	Dep.	D. Lat.	Dist.
<i>Dep.</i>	<i>D. Long.</i>		<i>Dep.</i>	<i>D. Long.</i>

Traverse Table 85°

Example 5 A ship made good with a course of 330° T over a distance of 54.5 miles. Find the Difference of Latitude and Departure:

1. The course is in the 4th quadrant, so the quadrantal course is N 30° W;
2. Locate the table 30°;
3. The distance is 54.5 miles; multiply it by 10 to get the whole number 545 miles. From the column Dist. at the top of the table, locate the value 545;
4. Extract the values of D. Lat. 472' and Dep. 272.5'. Divide both values by 10 to get the correct D. Lat. 47.2'(N) and Dep. 27.25'(W). The Difference of Latitude is named N and Departure is named W, because the course is NW.

	<i>D. Long.</i>	<i>Dep.</i>	
Dep.	Dist.	D. Lat.	Dep.
..
..
..	544	471.1	272.0
..	545	472.0	272.5
..	546	472.8	273.0

Traverse Table 30°

Procedure to find the course and distance from given Difference of Latitude (D. Lat.) and Departure (Dep.)

1. Note the difference between given D. Lat. and Dep.
 - If the values of Dep. and D. Lat. are near one another, then the course is approaching 45°. Additionally, if Dep. is greater than D. Lat., then the course is greater than 45°; if Dep. is less than D. Lat., then the course is less than 45°.

$Dep. \approx D.Lat. \leftrightarrow Course \approx 45^\circ$

(1) $Dep. \geq D.Lat. \leftrightarrow Course \geq 45^\circ$

(2) $Dep. \leq D.Lat. \leftrightarrow Course \leq 45^\circ$

- If the value of D. Lat. is nearly double the value of Dep., then the course is approaching 26° . Additionally, if the value of Dep. is greater than $\frac{1}{2}$ the value of D. Lat., then the course is greater than 26° ; and if the value of Dep. is less than $\frac{1}{2}$ the value of D. Lat., then the course is less than 26° .

$$\text{Dep.} \approx \frac{1}{2}\text{D.Lat.} \leftrightarrow \text{Course} \approx 26^\circ$$

$$(1) \text{ Dep.} \geq \frac{1}{2}\text{D.Lat.} \leftrightarrow \text{Course} \geq 26^\circ$$

$$(2) \text{ Dep.} \leq \frac{1}{2}\text{D.Lat.} \leftrightarrow \text{Course} \leq 26^\circ$$

- If the value of Dep. is nearly double the value of D. Lat., then the course is approaching 64° . Additionally, if the value of $\frac{1}{2}$ of Dep. is greater than D. Lat., then the course is greater than 64° ; and if $\frac{1}{2}$ of Dep. is less than D. Lat., then the course is less than 64° .

$$\frac{1}{2}\text{Dep.} \approx \text{D.Lat.} \leftrightarrow \text{Course} \approx 64^\circ$$

$$(1) \frac{1}{2}\text{Dep.} \geq \text{D.Lat.} \leftrightarrow \text{Course} \geq 64^\circ$$

$$(2) \frac{1}{2}\text{Dep.} \leq \text{D.Lat.} \leftrightarrow \text{Course} \leq 64^\circ$$

Remember that the courses 26° and 64° are in the same table, but that the quantities of the values D. Lat. and Dep. are reversed; it depends how you read the column header on the top or the bottom of the table.

2. Pick out the table you think near the course. Locate the value of D. Lat. as closely as possible, then check the value of Dep. against the value of D. Lat. Compare the extracted value of Dep. from the table with the given one. Keep turning the page until you get as near as possible. Remember that as the course increases, the value of Dep. also increases. Extract the value of distance and course; some interpolation is needed to get accurate distance and course.

Example 6 The ship made good on a SW course with D. Lat. of 521.8', Dep. of 277.5'. Find the course and distance:

1. Compare the value of D. Lat. and Dep.; the value of D. Lat. is nearly double the value of Dep., so the course is close to 26° . However, the value of Dep. is greater than $\frac{1}{2}$ of D. Lat., so the course must be greater than 26° .
2. Let's start from the table 27° , and look down the D. Lat. column to find the value closest to 521.8; it is 522.1, against the value of Dep. of 266.0, which is still smaller than 277.5. Let's turn to the next table, which is 28° ; we find the value of D. Lat. is 521.8, against the exact value of Dep. of 277.5. Extract the value of the distance, which is 591. So the course must be $S28^\circ W$ ($208^\circ T$), and the distance is 591 miles.

	<i>D. Long.</i>	<i>Dep.</i>	
Dep.	Dist.	D. Lat.	Dep.
..
..
..	590	520.9	277.0
..	591	521.8	277.5
..	592	522.7	277.9

Traverse Table 27°

Procedure to find Departure from corresponding D. Long., and vice versa

This operation is often used in plane sailing. By knowing the Departure, we can convert it into D. Long. to find the position; or, we can convert the D. Long. into Departure to find the course and distance.

1. Calculate the mean latitude or middle latitude; then locate the table which has the whole number of degrees of the latitude.
2. Use the column with the header *D. Long. Dep.*, which is printed in italics. Look down the column to locate the nearest value of Departure, and extract the value of D. Long., or vice versa. The interpolation might be needed to get an accurate result.

If the latitude is not the whole number, then repeat the procedure with the table 1° higher, then interpolate two results to get the final answers.

Example 7 D. Long. is 457' and mean latitude is 37°. Find the Departure:

1. Locate the table 37°.
2. From the column headed *D. Long.* in italics on the top of the table, locate the value 457; extract the value on the column headed *Dep.*, printed in italics. The Departure is 365'.

	<i>D. Long.</i>	<i>Dep.</i>		<i>D. Long.</i>
Dep.	Dist.	D. Lat.	Dep.	
..
..
..	456	364.2	274.4	..
..	457	365.0	275.0	..
..	458	365.8	275.6	..

Traverse Table 37°

Example 8 A ship departs from position A: 20°30'N 115°20'E bound for position B: 06°30'N 108°40'E. Find the course and distance.

Lat. _A	20°30'N	Long. _A	115°20'E	Lat. _A	20°30'N
Lat. _B	13°30'N	Long. _B	108°40'E	½D.Lat.	3°30'N
D.Lat.	420'(S)	D.Long.	400'(W)	Lat. _m	17°00'N

Convert D. Long. into
Departure

$$\left. \begin{array}{l} \text{Mean Lat.} = 17^{\circ}00' \\ \text{D. Long.} = 400' \end{array} \right\} \Rightarrow \text{Dep.} = 382.5'$$

	D. Long.	Dep.		D. Long.
Dep.	Dist.	D. Lat.	Dep.	
..
..
..	399	381.6	116.7	..
..	400	382.5	116.9	..
..	401	383.5	117.2	..

Traverse Table 17°

Find course and
distance

The values of D. Lat and Dep. are close together, so the course is approaching about 45°. But the value of departure is less than the value of D. Lat, so the course is less than 45°.

In the table 43°:

$$\left. \begin{array}{l} \text{Dist.} = 574 \quad \text{D.Lat.} = 419.8 \quad \text{Dep.} = 391.5 \\ \text{Dist.} = ? \quad \text{D.Lat.} = 420.0 \quad \text{Dep.} = ? \\ \text{Dist.} = 575 \quad \text{D.Lat.} = 420.5 \quad \text{Dep.} = 392.1 \end{array} \right\} \begin{array}{l} \text{If D.Lat.} = 420 \\ \text{then Dist.} = 574.3 \\ \text{and Dep.} = 391.7 \end{array}$$

	D. Long.	Dep.	
Dep.	Dist.	D. Lat.	Dep.
..
..
..	573	419.1	390.8
..	574	419.8	391.5
..	575	420.5	392.1
..	576	421.3	392.8

Traverse Table 43°

In the table 42°:

$$\left. \begin{array}{l} \text{Dist.} = 565 \quad \text{D.Lat.} = 419.9 \quad \text{Dep.} = 378.1 \\ \text{Dist.} = ? \quad \text{D.Lat.} = 420.0 \quad \text{Dep.} = ? \\ \text{Dist.} = 566 \quad \text{D.Lat.} = 420.6 \quad \text{Dep.} = 378.7 \end{array} \right\} \begin{array}{l} \text{If D.Lat.} = 420 \\ \text{then Dist.} = 565.1 \\ \text{and Dep.} = 378.2 \end{array}$$

	<i>D. Long.</i>		<i>Dep.</i>
<i>Dep.</i>	<i>Dist.</i>	<i>D. Lat.</i>	<i>Dep.</i>
..
..
..	564	419.1	377.4
..	565	419.9	378.1
..	566	420.6	378.7
..	567	421.4	379.4

Traverse Table 42°

Now we have:

$$\begin{array}{l}
 \text{Course} = 43^\circ \quad \text{Dist.} = 574.3 \quad \text{Dep.} = 391.7 \\
 \text{Course} = ? \quad \text{Dist.} = ? \quad \text{Dep.} = 382.5 \\
 \text{Course} = 42^\circ \quad \text{Dist.} = 565.1 \quad \text{Dep.} = 378.2
 \end{array}
 \left. \begin{array}{l} \\ \\ \end{array} \right\} \begin{array}{l} \text{If Dep.} = 382.5 \\ \text{then Course} = 42.32^\circ \\ \text{and Dist.} = 568.0 \end{array}$$

$$\begin{aligned}
 \text{Course} &= 42.32^\circ = S42^\circ 19' W = 222^\circ 19' \\
 \text{Distance} &= 568 \text{ miles}
 \end{aligned}$$

Example 9 A ship departs from position $20^\circ 45' S$ $036^\circ 55' E$ with a course $150^\circ T$ at speed 21 knots. Find the position of the vessel after 15 hours.

$$\text{Course} = 150^\circ T = S30^\circ E \qquad \text{Distance} = 21 \times 15 = 315 \text{ miles}$$

In the table headed 30° :

$$\text{Dist.} = 315 \text{ miles}; \text{ D. Lat.} = 272.8' (S); \text{ Dep.} = 157.5' (E)$$

<i>D. Long.</i>			<i>Dep.</i>
<i>Dist.</i>	<i>D. Lat.</i>	<i>Dep.</i>	<i>Dist.</i>
..
..
314	271.9	157.0	..
315	272.8	157.5	..
316	273.7	158.0	..

Traverse Table 30°

Find mean latitude

Departure Latitude	$20^\circ 45.0' S$
$\frac{1}{2}$ D. Lat.	$36.4'$
Mean Latitude	$23^\circ 01.4' S$

Convert Departure
into D. Long.

From the table 23°:

$$\left. \begin{array}{l} \text{Dep.} = 157.4' \quad \text{D. Long.} = 171' \\ \text{Dep.} = 158.3' \quad \text{D. Long.} = 172' \end{array} \right\} \begin{array}{l} \text{If } \text{Dep.} = 157.5' \\ \text{then } \text{D. Long.} = 171.1' \end{array}$$

	D. Long.	Dep.		D. Long.
Dep.	Dist.	D. Lat.	Dep.	
..
..
..	170	156.5	66.4	..
..	171	157.4	66.8	..
..	172	158.3	67.2	..

Traverse Table 23°

From the table 24°:

$$\left. \begin{array}{l} \text{Dep.} = 157.1' \quad \text{D. Long.} = 172' \\ \text{Dep.} = 158.0' \quad \text{D. Long.} = 173' \end{array} \right\} \begin{array}{l} \text{If } \text{Dep.} = 157.5' \\ \text{then } \text{D. Long.} = 172.4' \end{array}$$

	D. Long.	Dep.		D. Long.
Dep.	Dist.	D. Lat.	Dep.	
..
..
..	171	156.2	69.6	..
..	172	157.1	70.0	..
..	173	158.0	70.4	..

Traverse Table 24°

Now we have:

$$\left. \begin{array}{l} \text{Mean Lat.} = 23^\circ \quad \text{D. Long.} = 171.1' \\ \text{Mean Lat.} = 24^\circ \quad \text{D. Long.} = 172.4' \end{array} \right\} \begin{array}{l} \text{If } \text{Mean Lat.} = 23^\circ 01.4' \\ \text{then } \text{D. Long.} = 171.1'(\text{E}) \end{array}$$

Find the final position

$$\begin{array}{r} \text{Departure Latitude } 20^\circ 45.0'S \\ \text{D. Lat. } \quad \quad \quad 272.8'(S) \\ \hline \text{Final Latitude } \quad 25^\circ 17.8'S \end{array}$$

$$\begin{array}{r} \text{Departure Longitude } 036^\circ 55.0'E \\ \text{D.Long. } \quad \quad \quad 171.1'(E) \\ \hline \text{Final Longitude } \quad 39^\circ 46.1'E \end{array}$$

Final position: 25°17.8'S 39°46.1'E