or Motion of the Body (for 1 minute) = 15 × *cos*(Latitude) × *cos*(270–Azimuth) – (*cos*(True Course – Azimuth) × Groundspeed ÷ 60)

$$\text{Rhumb line} = .146\left(\frac{GS}{100}\right)^2(\sin TC)(\tan LAT)$$

or Rhumb Line = 0.146 × (Groundspeed ÷100)^2 × *sin*(True Course) × *tan*(Latitude)

$$\text{Coriolis} = (.0265)(GS)(\sin LAT)$$

or Coriolis = 0.02625 × Groundspeed × *sin*(Latitude)

$$\text{Coriolis} = \cos(90 - TC - Zn)(.0265)(GS)(\sin LAT)$$

or Coriolis = *cos*(90 – True Course – Azimuth) × 0.02625 × Groundspeed × *sin*(Latitude)

$$\text{Coriolis/rhumb line} = [(.0265)(GS)(\sin LAT)] + \left[(.146)\left(\frac{GS}{100}\right)^2(\sin TC)(\tan LAT)\right]$$

or Coriolis = 0.02625 × Groundspeed × *sin*(Latitude) + [0.146 × (Groundspeed ÷100)^2 × *sin*(True Course) × *tan*(Latitude)]

Great Circle Planning

Variables

L_1 = Departure Latitude (N and W = +)
L_2 = Destination Latitude (S and E = –)
λ_1 = Departure Longitude
λ_2 = Destination Longitude
L_i = Intermediate Latitude
λ_i = Intermediate Longitude
H_i = Initial True Heading
D = Distance
H = Heading Angle
Δt = Time between positions
GS = Groundspeed
TC = True Course

$$D = 60\cos^{-1}[(\sin L_1)(\sin L_2) + (\cos L_1)(\cos L_2)\cos(\lambda_2 - \lambda_1)]$$

Distance=60 × *acos*((*sin*(Departure Latitude) × *sin*(Destination Latitude)) + (*cos*(Departure Latitude) × *cos*(Destination Latitude) × *cos*(Destination Longitude – Departure Longitude)))

$$H = \cos^{-1}\left[\frac{\sin L_2 - \sin L_1 \cos\left(\frac{D}{60}\right)}{\sin\left(\frac{D}{60}\right)\cos L_1}\right]$$

or Heading Angle = *acos*((*sin*(Destination Latitude) – *sin*(Departure Latitude) × *cos*(Distance ÷ 60)) ÷ (*sin*(Distance ÷ 60) × *cos*(Departure Latitude)))

$H_i = H \qquad \sin(\lambda_2 - \lambda_2) < 0$
$H_i = 360 - H \qquad \sin(\lambda_2 - \lambda_1) > 0$

This formula computes the latitude of L_i where λ_i intersects the great circle defined by (L_1, λ_1) and (L_2, λ_2). This formula can be very useful when matching charts of different projections or scales.

$$L_i = \tan^{-1}\left[\frac{(\tan L_2)\sin(\lambda_i - \lambda_2) - (\tan L_1)\sin(\lambda_i - \lambda_2)}{\sin(\lambda_i - \lambda_2)}\right]$$

or Intermediate Latitude = *atan*((*tan*(Destination Latitude) × *sin*(Intermediate Longitude – Departure Longitude) – *tan*(Departure Latitude) × *sin*(Intermediate Longitude – Destination Longitude)) ÷ *sin*(Destination Longitude – Departure Longitude))

Computing Position By Dead Reckoning:

$$L_2 = \left(\frac{(\Delta t)(GS)(\cos TC)}{60}\right) + L_1$$

or DEST Latitude = (Elapsed Time × Groundspeed × *cos*(True Course)) ÷ 60 + Departure Latitude

$$\lambda_i = \lambda_2 - \left(\frac{(\Delta t)(GS)(\sin TC)}{60 \cos L_1}\right)$$

TC = 90°, 270°

or DEST Longitude = Departure Longitude – ((Elapsed Time × Groundspeed × *sin*(True Course)) ÷ (60 × *cos*(Departure Latitude)))

Otherwise

$$\lambda_2 = \lambda_1 - \frac{180}{\pi}\{(\tan TC)[L_n \tan(45 + \tfrac{1}{2}L_2)) - (L_n \tan(45 + \tfrac{1}{2}L_2))]\}$$

or DR Longitude = Departure Longitude – (180 ÷ 3.14159) × (*tan*(True Course) × Ln (*tan*(45 + 0.5 × Destination Latitude)) – Ln (*tan*(45 + 0.5 × Departure Latitude))

NOTE: The flightpath may not cross either pole.

For long distances, use formula below:
DR Latitude = 90.0 – *acos*(*sin*(– Departure Latitude) × *cos*(Distance ÷ 60.0) + *cos*(– Departure Latitude) × *sin*(Distance ÷ 60.0) × *cos*(True Course))

DR Longitude = Departure Longitude +/– *acos*((*cos*(Distance ÷ 60.0) –*sin*(– DR Latitude) × *sin*(– Departure Latitude)) ÷ (*cos*(– DR Latitude) × *cos*(– Departure Latitude)))

NOTE: Distance can be replaced with (Groundspeed × Elapsed Time) where Elapsed Time is in hours.

Rhumb Line Planning

Variables

Δt = Time between positions
C = Rhumb line True Course
D = Rhumb line Distance
π = Pi (»3.14159)

$$C = \tan^{-1}\left[\frac{\pi(\lambda_2 - \lambda_1)}{180L_n \tan(45 + \tfrac{1}{2}L_2) - (L_n \tan(45 + \tfrac{1}{2}L_1)}\right]$$

or True Course = *atan*((3.14159 × (Departure Longitude – Destination Longitude)) ÷ (180 × Ln (*tan*(45 + 0.5 × Destination Latitude)) – Ln(*tan*(45 + 0.5 × Departure Latitude)))

$$D = 60(\lambda_2 - \lambda_1)\cos L_1$$

C = 0

or Distance = 60 × (Destination Longitude – Departure Longitude) × *cos*(Departure Latitude)

$$D = \frac{60\,(L_2 - L_1)}{\cos C}$$

C = 0