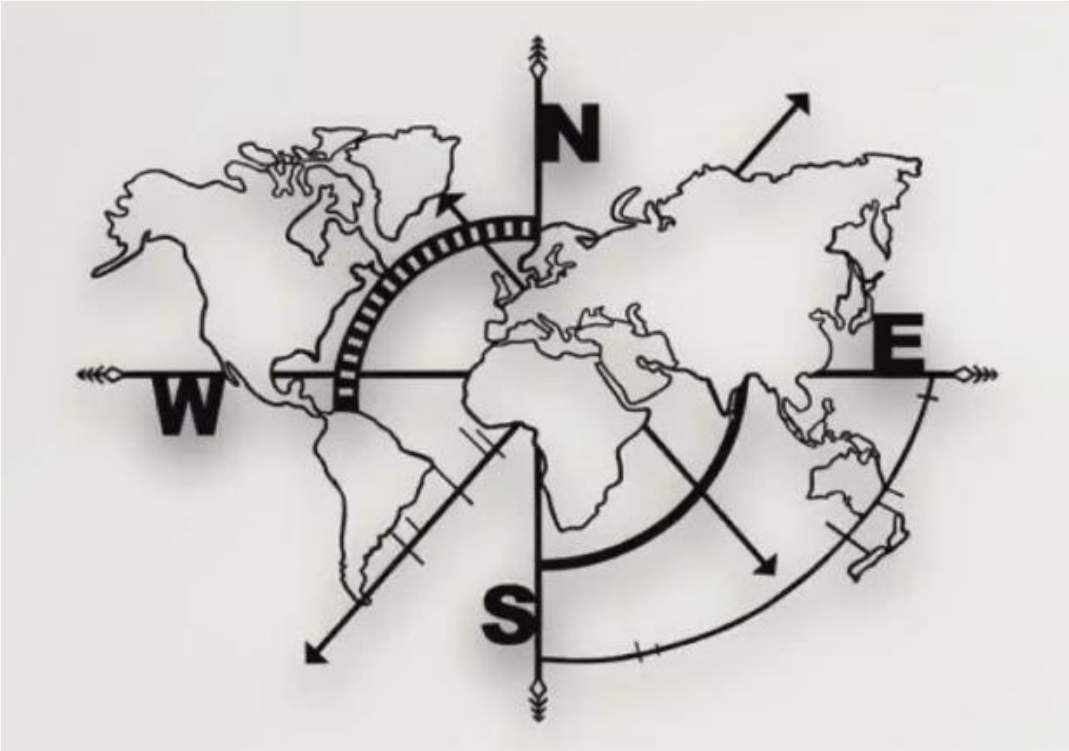
Bearings and Distances



Bearing and Distances

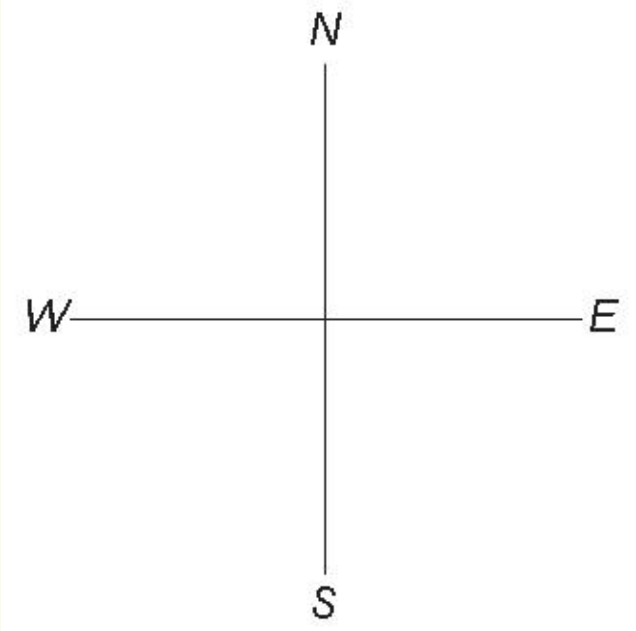
Bearing, in mathematics, means the direction a point is from another point. It is measured in degrees (°). It could be represented using the azimuth system or reduced bearing system. Distance is the space between two points. It is measured in meters.

The azimuth system (or whole circle bearing) measures bearing as a part of a whole circle, 360°, while the reduced bearing system measures bearing as a part of a quadrant, 90°, from either North or South.

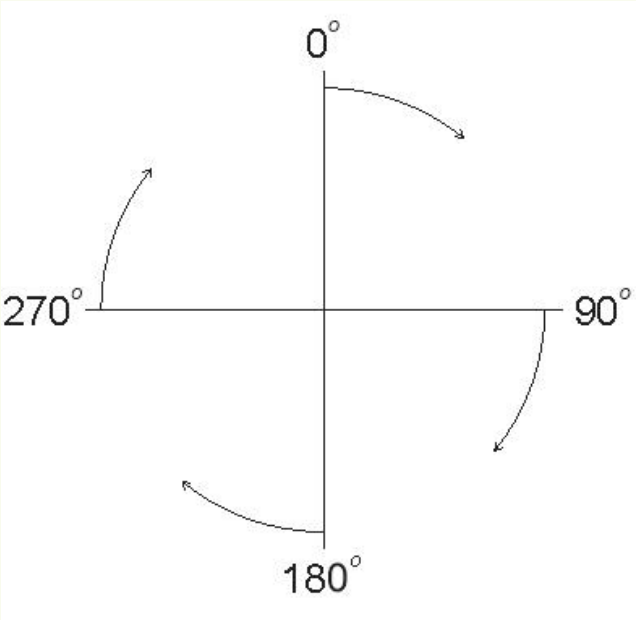
Examples of the azimuth system are 030°, 135°, 220°, 280°; while examples of the reduced bearing system are $N\,30^\circ E$, $S\,45^\circ E$, $S\,40^\circ W$, $N\,80^\circ W$.

Illustration of Bearings

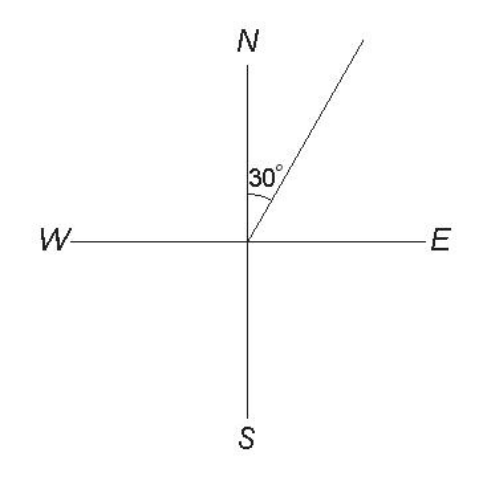
Bearings are represented on a four cardinal plane comprising North (N), South (S), West (W), and East (E), using the **Azimuth (whole circle) system** or **the Reduced bearing (quadrantal) system.**



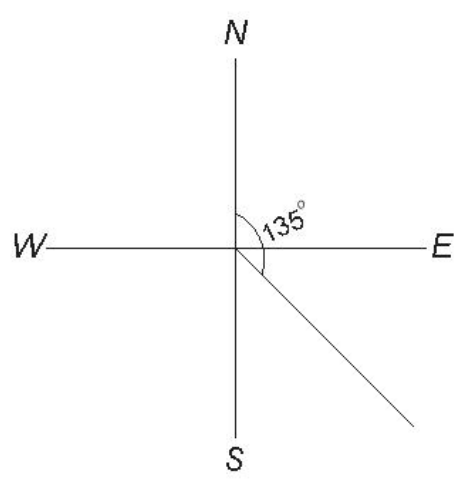
Azimuth bearing start at o° North and reads clockwise through the cardinal plane.



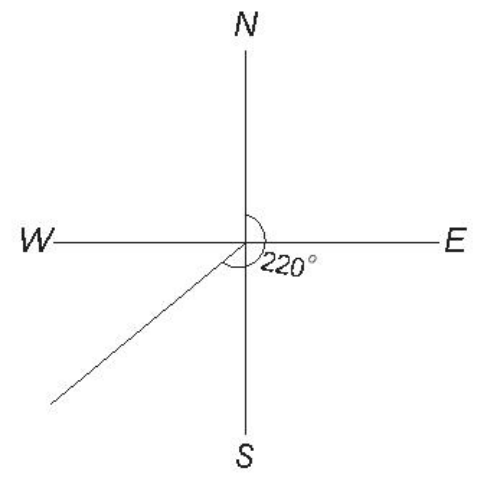
See how angles 030°, 135°, 220°, and 280° are represented on the cardinal plane.



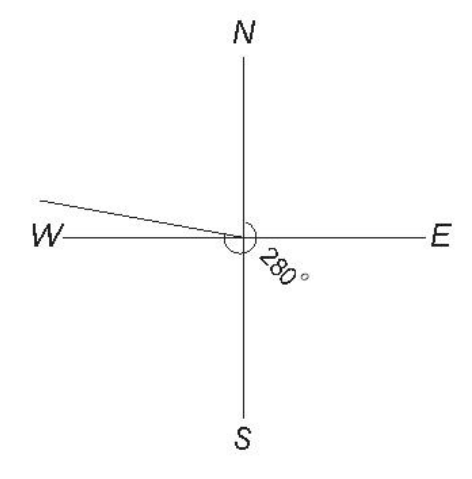
030°



135°

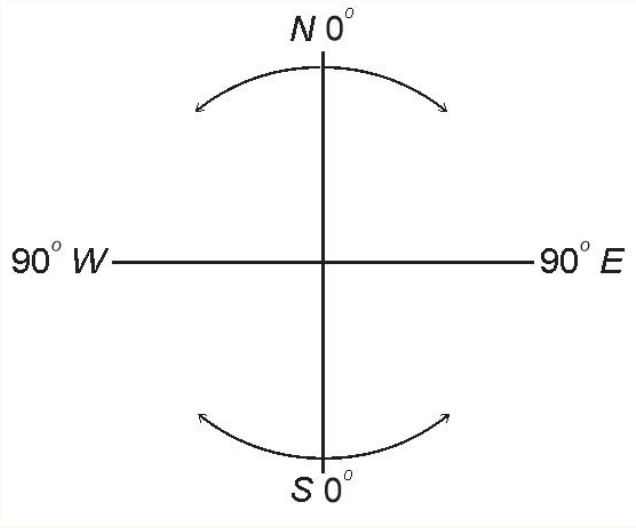


220°

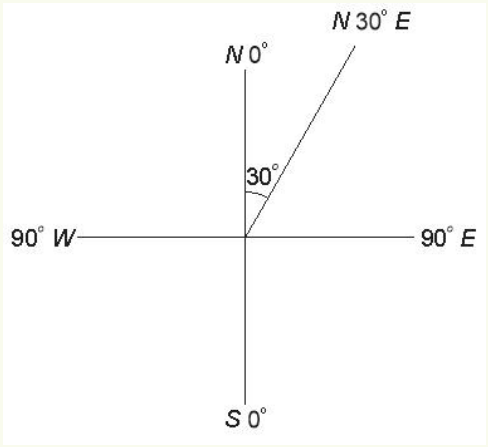


280°

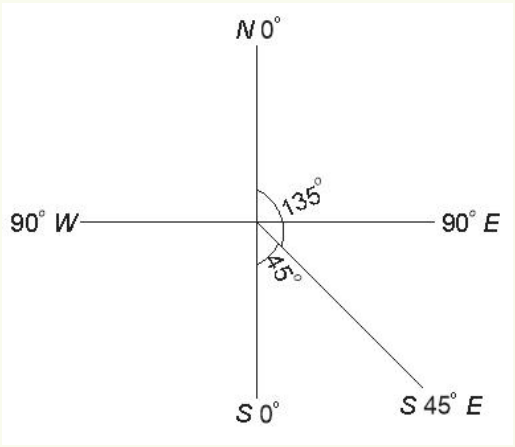
Reduced bearing starts at either *S* 0° or *N* 0° and gets read either clockwise or anticlockwise depending on whether the bearing is to the East or to the West.



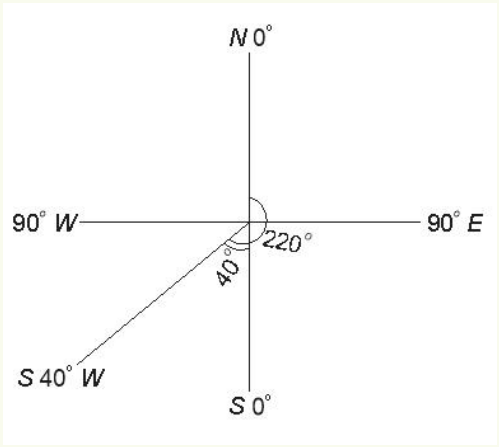
See how angles 030°, 135°, 220°, and 280° are represented on the cardinal plane and their reduced bearing equivalent.



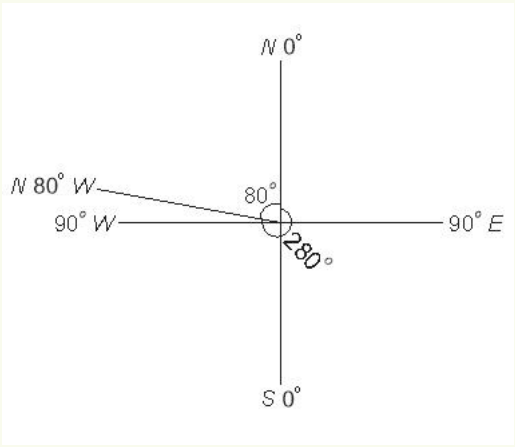
030° = $N\,30°\,E$



135° = $S\,45°\,E$



220° = $S\,40°\,W$

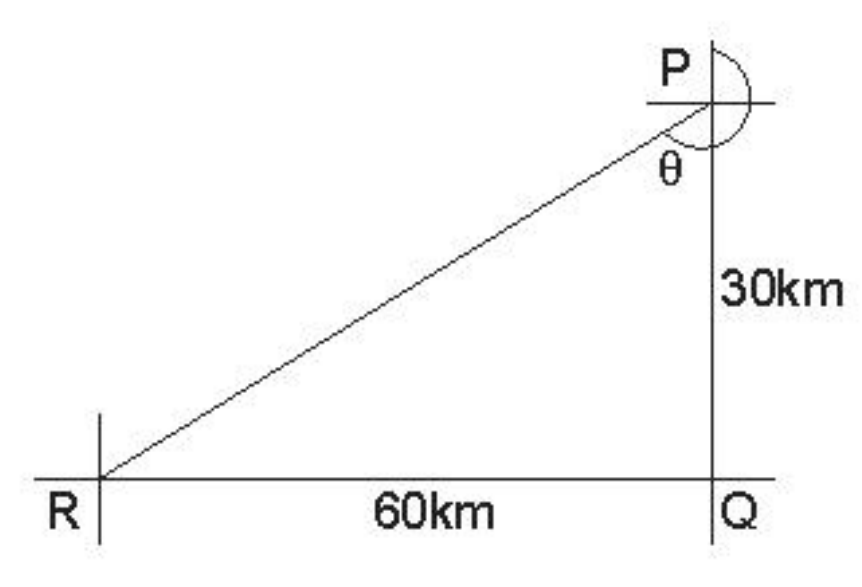


280° = $N\,90°\,W$

Questions and Solving:

Q1. A ship leaves a port P and sails 30 km due South to a point Q. It then sails 60 km due West to another port R. What is the bearing of R from P?

Solving



Q is 90° (South is perpendicular to West)
PQ = 30km (distance travelled due South)
QR = 60km (distance travelled due West)

Bearing of R from P = 180 + θ

$$tan\theta = \frac{opp}{adj} = \frac{60}{30} = 2$$

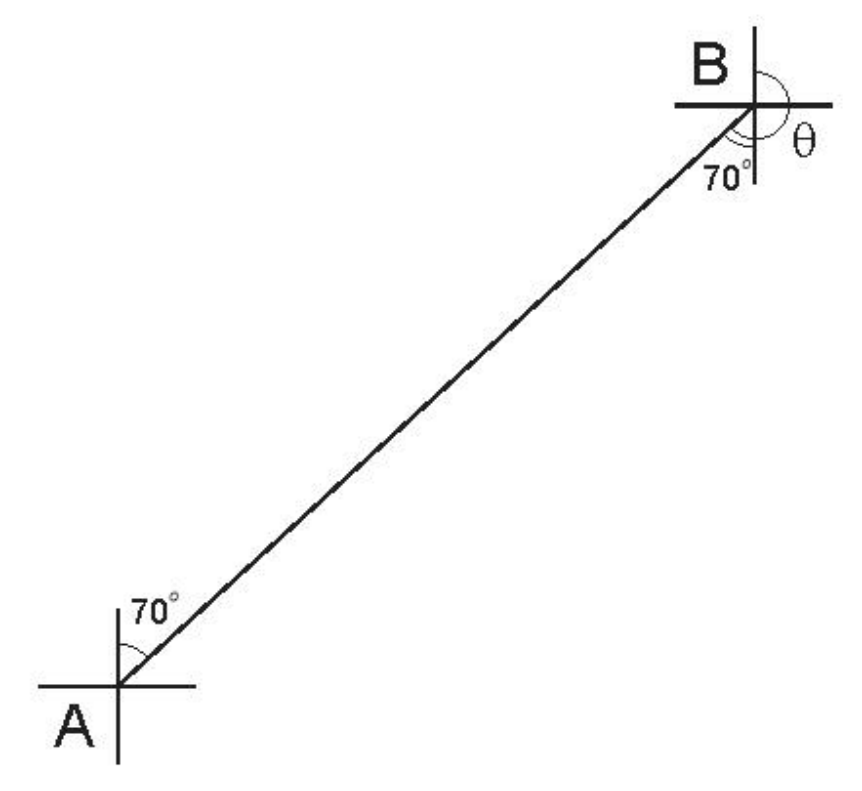
$$\theta = \tan^{-1} 2 = 63.43^{o}.$$

Bearing of R from P = 180 + θ = 180 + 63.43 = 243.43°.

This implies that the bearing of R from P is approximately 243.43°.

Q2. If the bearing of *B* from *A* is 070°, what is the back bearing (the bearing of *A* from *B*)?

Solving

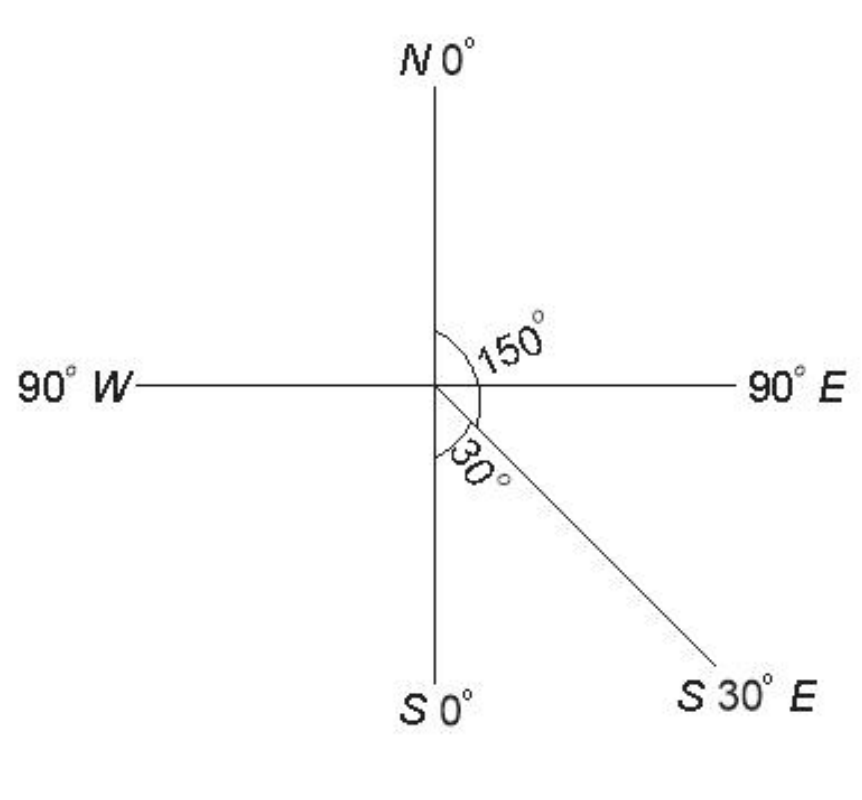


$\theta = 180 + 70 = \ 250^{o}$

This implies that the back bearing is 250°.

Q3. Rewrite 150° in the reduced bearing system.

Solving



From the diagram, the equivalent quadrantal reading can be deduced: *S* 30° *E*.

To calculate, find the quadrant

$\theta \,\%\, 90 = 150 \,\%\, 90 = 1 \,\%\, 60$

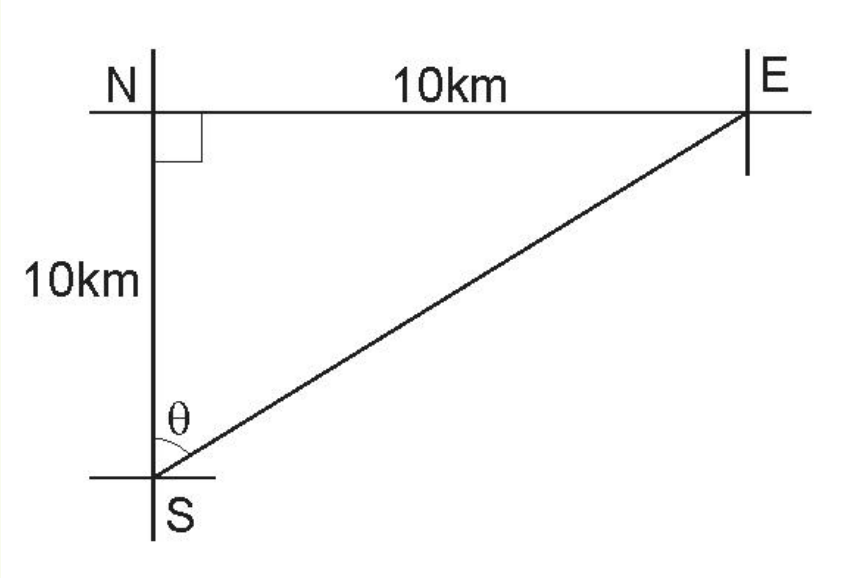
This implies the angle falls in to second quadrant (*SE*). For angles in the second quadrant, the formula is

$\gamma = 180 - \theta = 180 - 150 = 30^{o}$

This implies 150° is equivalent to *S* 30° *E*.

Q4. A ship sails 10 km due North and then 10 km due East. What is the bearing of the ship from its starting point?

Solving



From the illustration above, you find

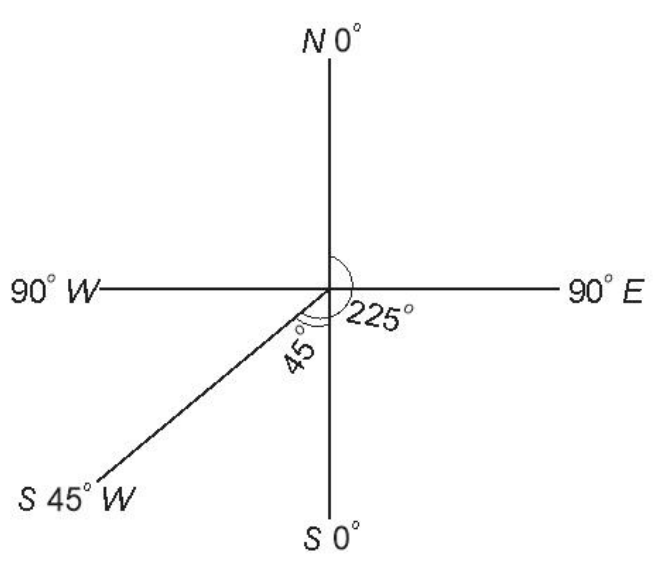
$$tan\theta = \frac{opp}{adj} = \frac{10}{10} = 1$$

$$\theta = \tan^{-1} 1 = 45^{o}$$

This implies the bearing of the ship from its starting point is 45^{o}.

Q5. A hiker travels from A to B on a bearing of 225°. What direction is the hiker traveling in cardinal terms?

Solving



From the diagram, the equivalent quadrantal reading can be deduced: $S\ 45^{o}\ W$.

To calculate, find the quadrant

$\theta\ \%\ 90 = 225\ \%\ 90 = 2\ \%\ 45$

This implies the angle falls in to third quadrant (SW). For angles in the third quadrant, the formula is

$\gamma = \theta - 180\ = 225 -\ 180\ = 45^{o}$

This implies 150° is equivalent to $S\ 45^{o}\ W$.