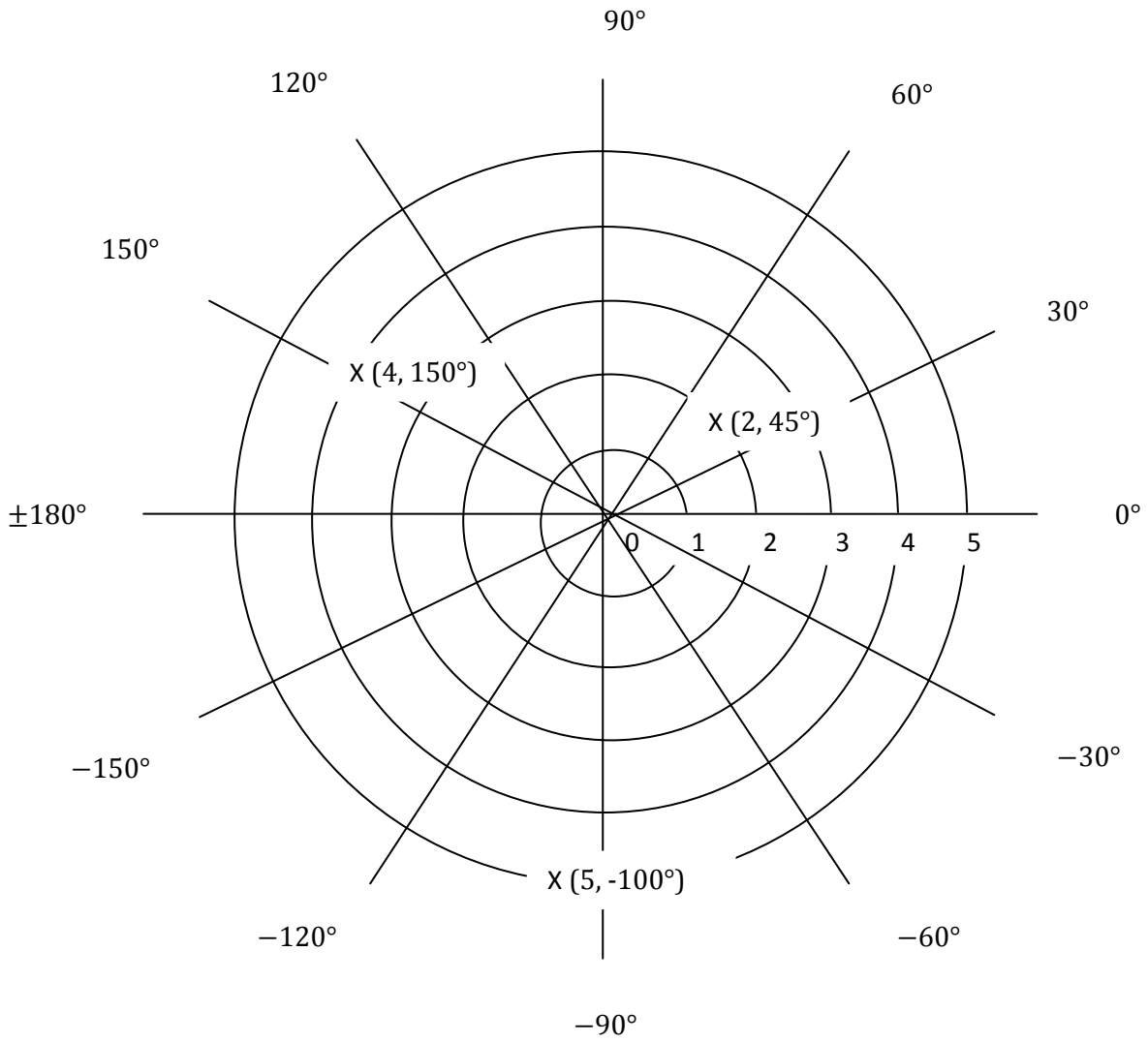
Polar Coordinate System

The polar coordinate system is an alternative to the more common Cartesian coordinate system which we use to define points on a plane. In the polar coordinate system each point on a plane is referenced by two quantities. If we imagine a line linking the origin or pole to a point then the first quantity – the radial coordinate- represents the length of the line or the distance from the pole to the point. The second quantity – the angular coordinate, polar angle or azimuth - represents the angle[1] that the line makes with a reference line.

For example the points (r,ϑ)= (2, 45°) , (4, 150°) and (5,-100°) are shown on the following polar plot.



Conversion to Cartesian Coordinates

Using simple trigonometry[2], any polar coordinate (r, θ) can be converted into Cartesian coordinates by $(x, y) = (r\cos(\theta),\ r\sin(\theta))$.

[1] Angles
[2] Trigonometry

For example the points *(r,ϑ)=* (2, 60°) can be converted into Cartesian coordinates (2sin(60˚), 2cos(60˚)).

Alternatively, any point in Cartesian coordinates can be converted to a point in polar coordinates. We can say that tan(θ)=y/x and that $r^2 = x^2 + y^2$. However, although we can deduce that $r = \sqrt{x^2 + y^2}$, we need to be careful to conclude that $\theta = \tan^{-1}(\frac{y}{x})$. The latter only works if the coordinate is in the right hand side of the axis. Many calculators, spreadsheets and programming languages have an '*atan2'* function, in which case we can write $\theta = \text{atan2}(y, x)$.