

## **Different Coordinate systems!**

**You will need to see either a graphics calculator or use an online calculator such as Desmos (use this link):**

**<https://www.desmos.com/calculator/ms3eghkkgz>**

**If you are using a graphics calculator, you will need to change the type of graph to  $r=$**

**Activity 1: You are going to explore Polar graphs. In particular, you are going to look at graphs with the equation  $r = \cos(n\theta)$**

**Explore this set of graphs by typing in the equation with different values of  $n$**

**e.g.  $r = \cos(2\theta)$**

**$r = \cos(6\theta)$**

**What happens? What changes? What remains the same? What if you use fractions for the value of  $n$ ?**

**Now look at graphs with the equation  $r = \sin(n\theta)$ . What happens?**

**Activity 2): There are 2 ways of pinpointing a position on a map:**

- 1) Map reference: This uses Cartesian coordinates. These are the coordinates you used in GCSE.  $(x, y)$**
- 2) Bearing and distance from a landmark: This uses polar coordinates.  $(r, \theta)$**

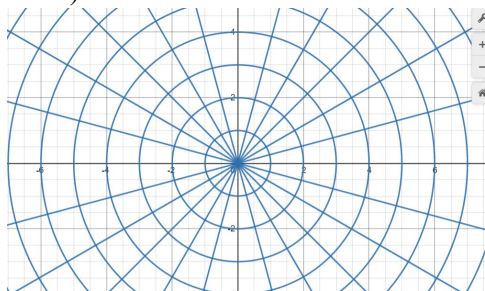
**Polar coordinates are written in brackets as  $(r, \theta)$  where  $r$  is the distance and  $\theta$  is the angle.**

**The distance is measure from an origin (called the Pole).**

**The angle is measured from the positive  $x$ -axis (called the Initial line)**

**e.g. Plot the graph  $r = 2 + \cos(\theta)$**

- 1) Choose the angles you are going to use**
- 2) Calculate the distance from the origin by substituting the angle into the equation**
- 3) Use the angles 30, 45, 60, 90, 120, 135, 150, 180, 210, 225, 240, 270, 300, 315, 330, and 360.**
- 4) Use a scale to measure the distance calculated**



**Activity 3) Summer work:** For your summer work, I would like you to research other coordinate systems.

Two mathematicians, Gregoire de Saint-Vincent and Bonaventura Cavalieri, introduced the concepts of the polar coordinate system independently in the mid-seventeenth century. Cavalieri used them to solve a problem involving the area within an Archimedian spiral. Blaise Pascal used them to calculate the lengths of parabolic arcs such as those found on bridges.

Coordinate systems are used to locate the position of a point in space. Explore coordinate systems that can be used effectively in three-dimension, for example, the spherical coordinate system commonly used by mathematicians. You should also research cylindrical coordinate systems often used by engineers. Explore when and why these systems are used.

Different coordinate systems are used in other subject areas. For example, geographers use a geographical coordinate system, and space scientists and astronomers use a celestial coordinate system. Explore the advantages and disadvantages of these systems