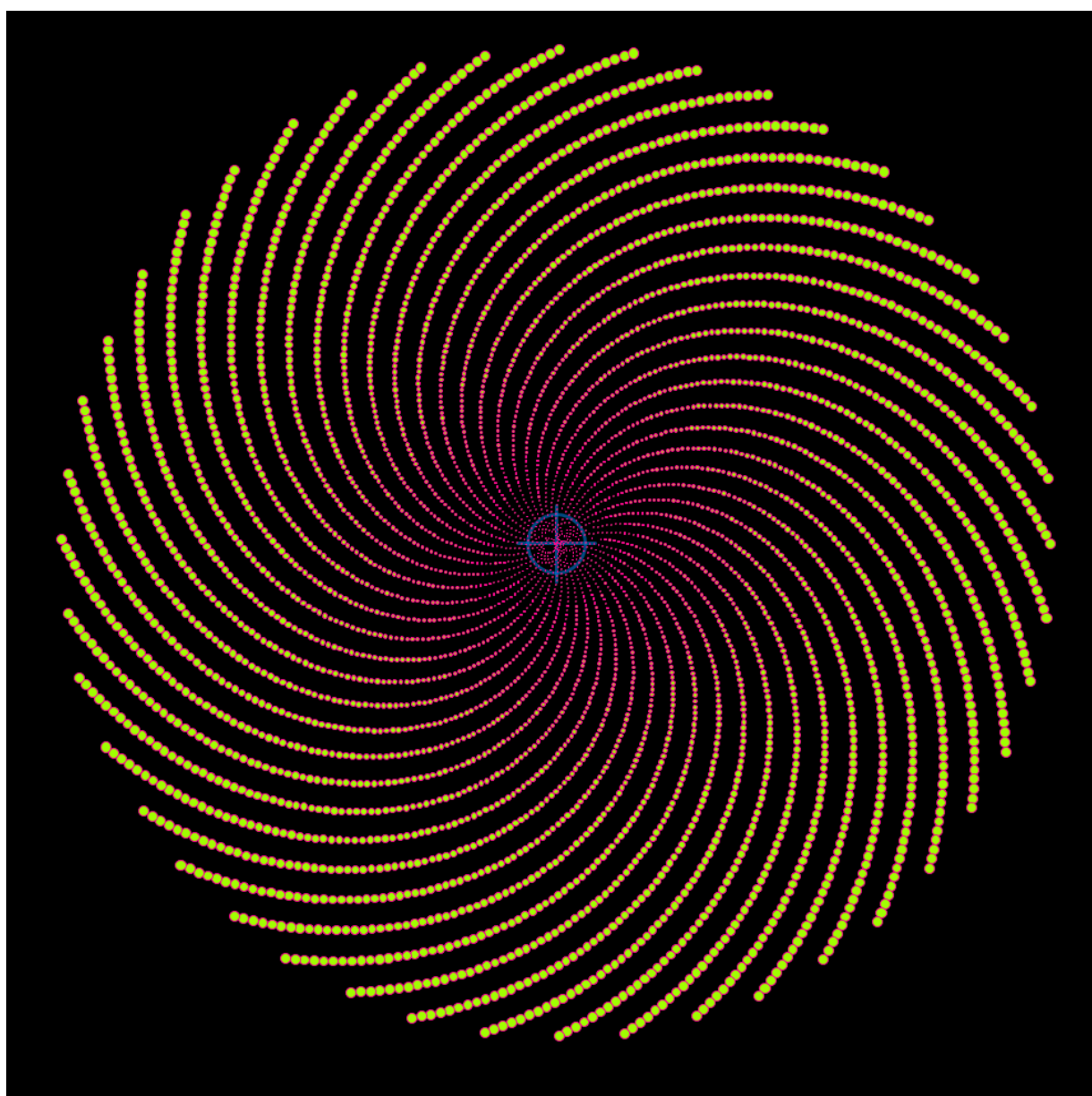Further Pure A-Level Mathematics
Compulsory Course Component
Core 2

# POLAR

# COORDINATES



Artwork made using Polar Coordinates

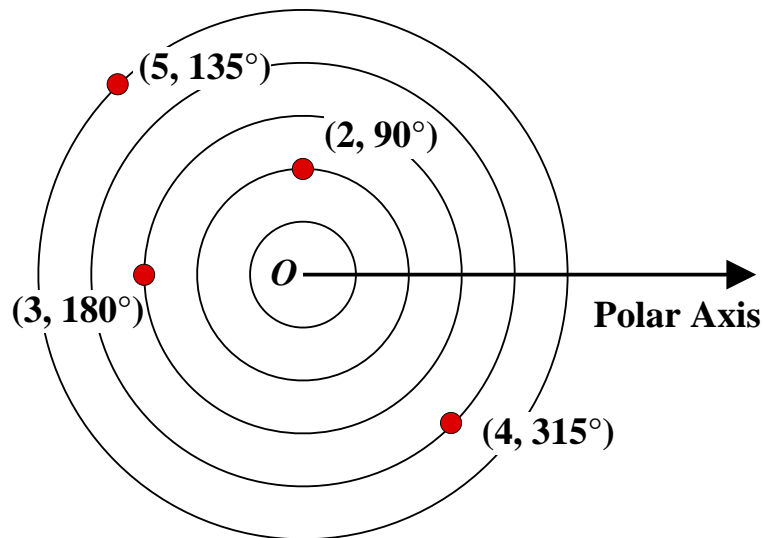# POLAR COORDINATES

**Lesson 1**

### 1.1  The Polar Coordinate System

The polar coordinates of a point describe its position in terms of a distance, $r$, from the origin, $O$, (called the "pole") and an angle, $\theta$, measured anticlockwise from the polar axis. Usually the polar axis is in the same direction as the positive $x$-axis when using Cartesian coordinates.



The diagram shows four point along with their polar coordinates.
Here, degrees have been used but often radians are preferred.

### 1.2  Plotting a Polar Curve

On a Cartesian graph the points are of the form $(x, y)$ and equations are formed with $x$ and $y$ in them, these then being graphed. On a Polar graph the points are of the form $(r, \theta)$. Mirroring what is done with the Cartesian system, polar equations can be formed with $r$ and $\theta$ in them. And these can be graphed, but on polar graph paper, rather than Cartesian.

Here is a polar equation which is to be graphed.

$$r = 12\cos^2\theta - 4\sin\theta$$

To graph this polar equation, complete the table provided and then plot the polar coordinates obtained on the polar graph paper.
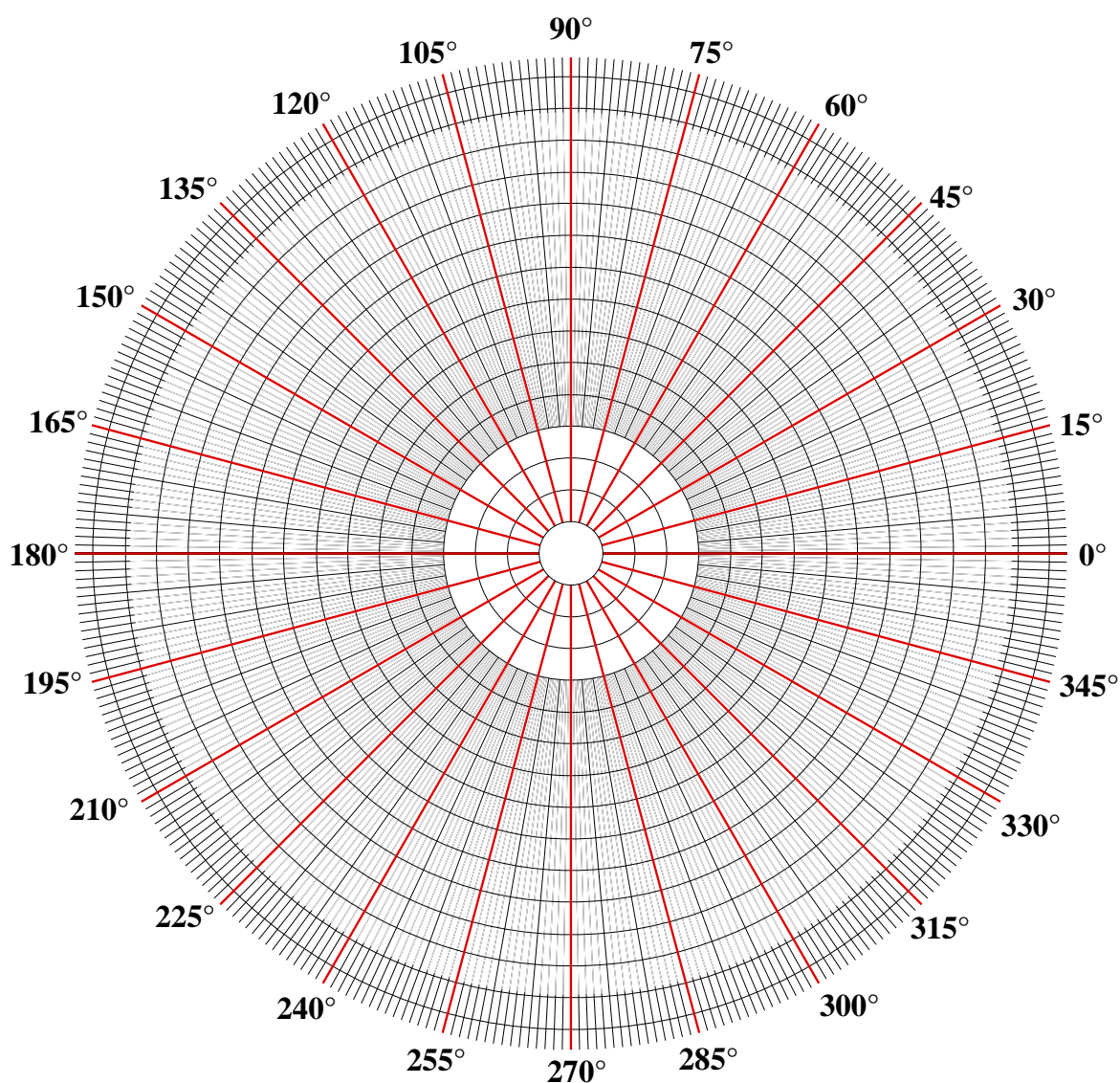
Work to 1 decimal place.

| $\theta$ (in degrees) | 0 | 15 | 30 | 45 | 60 | 75 | 90 |
|---|---|---|---|---|---|---|---|
| $r = 12\cos^2\theta - 8\sin\theta$ | | | | | | | |

| $\theta$ (in degrees) | 105 | 120 | 135 | 150 | 165 | 180 |
|---|---|---|---|---|---|---|
| $r = 12\cos^2\theta - 8\sin\theta$ | | | | | | |

| $\theta$ (in degrees) | 195 | 210 | 225 | 240 | 255 | 270 |
|---|---|---|---|---|---|---|
| $r = 12\cos^2\theta - 8\sin\theta$ | | | | | | |

| $\theta$ (in degrees) | 285 | 300 | 315 | 330 | 345 | 360 |
|---|---|---|---|---|---|---|
| $r = 12\cos^2\theta - 8\sin\theta$ | | | | | | |