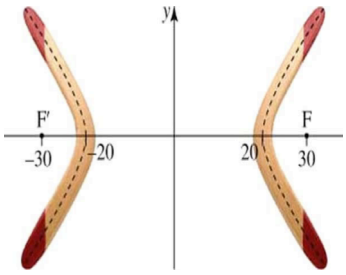
Wee 6
Term 3
2014

# Learning Brief

SME2 Geometry, Conics and Further Matrices

## Goals




Topic: Coordinate Geometry and Conics
Students should be able to:

- understand and use Coordinate Geometry techniques to investigate properties and features of the straight line
- investigate properties of the straight line and features of the conic sections

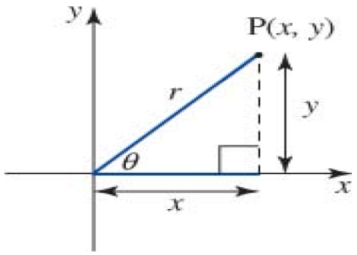
Key focus:

- Continue with: geometric and algebraic techniques and applications of geometric results ; exploration of sections of a right circular cone to obtain Circle, Parabola, Ellipse and Hyperbola; locus definitions, including terms focus, directrix and eccentricity; sketching conics showing directrices, foci, vertices, asymptotes and axes
- **Polar and parametric equations of conic sections**

## Theoretical Components

**Yellow ebook: Maths Quest 11 Advanced General Mathematics Chapter 10**
**Section 10E Polar coordinates**

"In the Cartesian coordinate system, a point, P, is located by using (*x*, *y*) coordinates. The same point can be located by stating the distance of the point from the origin, the radius, *r*, and the angle, *θ*, it makes with the positive *x* direction. These are known as *polar coordinates.* We write the polar coordinates of point P as [*r*, θ]. *Note: θ* may be given in degrees or radians."




**Read and take notes examples 10, 11 and view example 12**

**Section 10F Polar equations**

"A polar equation is an equation written in terms of *r* and/or *θ*. Using the conversions for *x* and *y* into polar coordinates, x = r cos (θ) and y = r sin (θ) we can change Cartesian equations into polar equations."
**Read and take notes examples 13 and 14**

**Videos:**
https://www.youtube.com/watch?v=zs0Nw0tb4y8
https://www.youtube.com/watch?v=IKbRiU7kL2w

## Practical Components

**Yellow ebook: Maths Quest 11 Advanced General Mathematics Chapter 10**
Exercise 10E Q1, 2, 3 do parts a, c
Q4, 5 do parts a, e, i
Exercise 10F Q1 and 2 do parts a, c, e, g, i, k, m
**REMEMBER:**
Cartesian coordinates (*x*, *y*)
Polar coordinates [*r*, *θ*]
where $x = r\cos(\theta)$ and $y = r\sin(\theta)$
also $r = \sqrt{x^2 + y^2}$ and $\tan(\theta) = \frac{x}{y}$

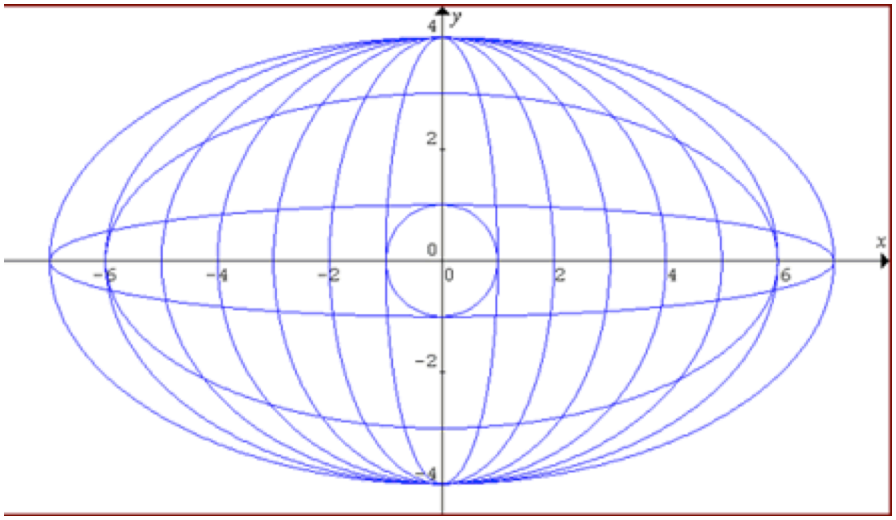
## O/F/O

None. Prepare for the Validation Task.

# Investigation

**'ART A:**

Here is a pattern for you to experiment with using graph drawing software.




'he equations of two of the graphs are:

$$x^2 + y^2 = 1 \ \ and \ \ \frac{x^2}{36} + \frac{y^2}{16} = 1$$

ind the equations of the other 8 graphs in this pattern.

łow do you know from their equations that all the graphs are symmetrical about both the y-axis and the x-axis?

)raw your own pattern of ellipses and circles.

**'ART B:**

or the equation $16x^2 - 9y^2 + 64x - 90y = 305$, find the vertices, foci, and asymptotes of the hyperbola and ketch its graph. HINT: first re-write the equation in the form $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$.

**'ART C:**

ind the Cartesian equation and sketch the graph of the smallest ellipse that passes through the point (6, 0) and encloses the circle /ith the polar equation $r = 4\cos\theta$ . Indicate the coordinates of the foci and the equations of the directrices. It may be helpful to se a CAS calculator to first plot the graph of the circle.