Core Pure 2

Polar Coordinates

7 **Polar coordinates**	7.1	Understand and use polar coordinates and be able to convert between polar and Cartesian coordinates.	
	7.2	Sketch curves with r given as a function of θ, including use of trigonometric functions.	The sketching of curves such as $r = p \sec(\alpha - \theta)$, $r = a$, $r = 2a\cos\theta$, $r = k\theta$, $r = a(1 \pm \cos\theta)$, $r = a(3 + 2\cos\theta)$, $r = a\cos 2\theta$ and $r^2 = a^2\cos 2\theta$ may be set.
	7.3	Find the area enclosed by a polar curve.	Use of the formula $\frac{1}{2}\int_{\alpha}^{\beta} r^2 \mathrm{d}\theta$ for area. The ability to find tangents parallel to, or at right angles to, the initial line is expected.

Polar coordinates describe the location of a point in a 2D plane using the distance from the origin and anti-clockwise angle from the positive x-axis.

Recap: Converting to/ from polar coordinates

If: $x = r\cos\theta$ $y = r\sin\theta$

Then: $r^2 = x^2 + y^2$

And: $\theta = \tan^{-1}\left(\frac{y}{x}\right)$ (adjusted depending on quadrant)

Cartesian	Polar
$(0,2)$	
	$(3, \pi)$
$(1,1)$	
$(-5,12)$	
	$\left(6, -\frac{\pi}{6}\right)$

The Polar Equation of a Curve: $r = f(\theta)$

We can express equations of curves in polar form. Sometimes we can convert the polar form to cartesian form but often equations are simpler when left in polar form.

Find a cartesian equation for the following curves:

1. $\boldsymbol{r = 5}$
2. $\boldsymbol{r = 2 + \cos 2\theta}$

3. $r^2 = \sin 2\theta$

Converting to Polar Form:

Converting to polar is easier, but the harder part is often finding how to simplify the expression. Know your double angle formulae!

Find polar equations for the following:

1. $y^2 = 4x$

2. $x^2 - y^2 = 5$

3. $y\sqrt{3} = x + 4$

Test your understanding

Find the polar equation of a circle whose centre has polar coordinate (2, 0) with radius 2.

Ex 5A pg 104