

Core Pure (A level/Year 2) Unit Test 4: Polar coordinates

- 1** Find the polar form of the following Cartesian coordinates, with angles measured in radians.
- a** $(7, 24)$ **(2 marks)**
- b** $(-2\sqrt{3}, -2)$ **(3 marks)**
- 2** Convert the following polar coordinates into Cartesian form. Angles are measured in radians.
- a** $(4, \frac{3\pi}{4})$ **(2 marks)**
- b** $(5\sqrt{3}, \frac{4\pi}{3})$ **(2 marks)**
- 3** Find polar equations for the following curves in Cartesian form, giving your answer in the form $r = f(\theta)$
- a** Find the polar equation for the Cartesian equation $y = 4x^2$, giving your answer in the form $r = f(\theta)$ **(3 marks)**
- b** Show that the curve with Cartesian equation $xy = 8$ has polar equation $r^2 = A \operatorname{cosec} 2\theta$, where A is a constant to be found. **(3 marks)**
- c** Show that the curve with Cartesian equation $y = \sqrt{3}x + 4a$ has the polar equation $r = 2a \operatorname{cosec}(\theta - B)$, where B is a constant to be found. **(4 marks)**
- 4** Sketch the following curves, where a is a positive constant.
- a** $r = 2a \sin 3\theta$, giving the coordinates of the point where the curve intersects the half line $\theta = \frac{3\pi}{2}$ **(2 marks)**
- b** $r = a(5 + 4 \cos \theta)$, giving the coordinates of the points where the curve intersects the initial line and the half line $\theta = \pi$ **(3 marks)**
- 5 a** Find the exact area of the finite region bounded by the curve with polar equation $r = 2 \sec \theta$ and the half-lines $\theta = 0$ and $\theta = \frac{\pi}{3}$ **(3 marks)**
- b** Find the exact area of the finite region bounded by the curve with polar equation $r = a(3 + 2 \cos \theta)$ and the half-lines $\theta = -\frac{\pi}{4}$ and $\theta = \frac{\pi}{4}$ **(4 marks)**

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- 6 a On the same diagram sketch for $0 \leq \theta < 2\pi$ the curves with polar equations

$$r = 3 \sin \theta \quad \text{and} \quad r = \sqrt{3} + \sin \theta \quad \text{(3 marks)}$$

- b Calculate the coordinates of the points of intersection of these two curves. (3 marks)

- c Find the exact value of the area of the finite region within both curves. (6 marks)

- 7 The curve C polar equation $r = 1 + \cos \theta$, where $0 \leq \theta < 2\pi$. Find the points of contact and the polar equations of the tangents to C that are parallel to the initial line. (7 marks)