1.6 Polar Coordinates: 10-minute Pack

Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A curve C has polar equation $r = 8\sin(\theta)$, for $0 \leq \theta \leq \pi$.

(a) Show that the Cartesian equation of C can be written as $x^2 + (y - 4)^2 = 16$. **(3)**

(b) Hence state the centre and radius of C. **(2)**

(c) Using A = (1/2) x integral from θ=0 to θ=π of r^2 dtheta, show that the area enclosed by C is 16pi, and verify this agrees with your answer to part (b). **(4)**

(Total for Question 1 is 9 marks)

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Mark scheme · 1.6 Polar Coordinates: 10-minute Pack

Question 1

(a) multiply by r: $r^2 = 8r\sin(\theta)$ **M1**

(a) substitute $r^2 = x^2+y^2$ and $r\sin(\theta) = y$: $x^2 + y^2 = 8y$ **M1**

(a) complete the square: $x^2 + (y-4)^2 = 16$, cso (answer printed) **A1**

(a) Answer: $x^2 + (y-4)^2 = 16$

(b) centre (0, 4) **B1**

(b) radius 4 **B1**

(b) Answer: Centre (0,4), radius 4

(c) Area = (1/2) x integral from 0 to π of $(8\sin(\theta))^2$ dtheta = 32 x integral from 0 to π of $\sin^2(\theta)$ dtheta **M1**

(c) use $\sin^2(\theta) = (1 - \cos(2\text{theta}))/2$ to write the integrand as $16(1-\cos(2\text{theta}))$ **M1**

(c) integrate: $16[\theta - \sin(2\text{theta})/2]$ evaluated from 0 to π = 16pi, cso **A1**

(c) verification: this matches π x radius^2 = π x 4^2 = 16pi from part (b) **B1**

(c) Answer: Area = 16pi

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