Polar coordinates *

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Contents

1   Polar and rectangular coordinates

Problem 1.1. *Derive a conversion from polar to rectangular coordinates.*

Problem 1.2. *Derive a conversion from rectangular to polar coordinates.*

Problem 1.3. *Convert the point $P(2,3)$ in the plane to polar coordinates.*

Problem 1.4. *Convert the polar coordinate point in (1) to rectangular coordinates.*

$$P\left(-\sqrt{13}, \tan^{-1}\left(\frac{3}{2}\right) + \pi\right) \tag{1}$$

Problem 1.5. *Find the rectangular coordinates of the polar coordinate point in (2).*

$$P\left(2, \frac{\pi}{6}\right) \tag{2}$$

Problem 1.6. *Find the rectangular coordinates of the polar coordinate point in (3).*

$$P\left(-4, \frac{\pi}{3}\right) \tag{3}$$

Problem 1.7. *Find the rectangular coordinates of the polar coordinate point in (4).*

$$P\left(3, \frac{3\pi}{4}\right) \tag{4}$$

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*A course in vector calculus

2   Polar equation curves

Problem 2.1. *Describe the curve $r = 2$.*

Problem 2.2. *Describe the curve in (5).*

$$\theta = \frac{\pi}{4} \tag{5}$$

Problem 2.3. *Describe the curve $r = 2\sin\theta$.*

Problem 2.4. *Write a polar equation for the y-axis.*

Problem 2.5. *Describe the curve $r = 4\cos\theta$.*

Problem 2.6. *Describe the curve $r = \tan\theta\sec\theta$.*

Problem 2.7. *Describe the curve in (6).*

$$r = \frac{6}{\sqrt{9 - 5\sin^2\theta}} \tag{6}$$

Problem 2.8. *Describe the curve $r = -10\cos\theta$.*

Problem 2.9. *Describe the curve $r = 6\left(\sin\theta + \cos\theta\right)$.*

Problem 2.10. *Describe the curve $r = 10\sec\theta$.*

Problem 2.11. *Describe the curve $r = -3\csc\theta$.*

3   Polar and rectangular equations

Problem 3.1. *Convert the rectangular equation $x^2 + y^2 = 25$ to a polar equation.*

Problem 3.2. *Convert the rectangular equation $x^2 - y^2 = 1$ to a polar equation.*

Problem 3.3. *Convert the rectangular equation $xy = 4$ to a polar equation.*

Problem 3.4. *Convert the rectangular equation $x = 3$ to a polar equation.*

Problem 3.5. *Convert the rectangular equation $x + 2y = 3$ to a polar equation.*

Problem 3.6. *Convert the polar equation $\theta = 3$ to a rectangular equation.*

Problem 3.7. *Convert the polar equation $r = \tan\theta$ to a rectangular equation.*

Problem 3.8. *Show that the polar coordinate point $P\left(3, \frac{3\pi}{4}\right)$ lies on the curve of the polar equation $r = 3\sin 2\theta$.*

Problem 3.9. *Show that the polar coordinate point $P\left(3, \frac{3\pi}{2}\right)$ lies on the curve of the polar equation $r^2 = 9\sin\theta$.*

4 Sketching curves

Problem 4.1. *Sketch the polar equation $r = 1 + \cos\theta$*

Problem 4.2. *Sketch the polar equation $r = 1 + 2\cos\theta$*