proprep™

Workbook

Table of Contents

Early Transcendentals – 14th Edition

Parametric Equations and Polar Coordinates

Polar Coordinates

Questions

1) Given the point with polar coordinates $(r,\theta)=\left(3,\frac{\pi}{5}\right)$, find three other sets of coordinates for the same point with different angles θ in the range $-2\pi\le\theta\le2\pi$.

Conversion between Polar and Cartesian Coordinates

2) Convert the following sets of Cartesian coordinates to polar coordinates:

a. $(1,\sqrt{3})$ b. $(-2,-2)$ c. $(0,-5)$ d. $(-3,4)$

3) Convert the following sets of polar coordinates to Cartesian coordinates:

a. $\left(\sqrt{8},\frac{3\pi}{4}\right)$ b. $\left(-4,\frac{2\pi}{3}\right)$ c. $\left(0,\frac{\pi}{2}\right)$ d. $\left(6,-\frac{\pi}{3}\right)$

Conversion between Polar and Cartesian Coordinates

4) Convert the following equations in x, y to polar form in r,θ:

a. $2x-5x^3=1+xy$ b. $x^2+y^2=6y$ c. $x=3$ d. $y=-4$.

5) Convert the following polar equations in r,θ to Cartesian form in x, y:

a. $r=-8\cos\theta$ b. $6r^3\sin\theta=4-\cos\theta$

c. $r=2$ d. $\theta=\frac{\pi}{4}$

6) Sketch the graph of $r = 2 + 4\sin\theta$.

Tangent Lines in Polar Coordinates

7) Find the equation(s) of the tangent line(s) to $r = \sin(4\theta)\cos(\theta)$ at $\theta = \frac{\pi}{6}$.

8) Find the equation(s) of the tangent line(s) to $r = 1 - 2\sin\theta$ at the origin.

Answer Key

1) $\left(3, -\frac{9\pi}{5}\right)$ $\left(-3, \frac{6\pi}{5}\right)$ $\left(-3, -\frac{4\pi}{5}\right)$

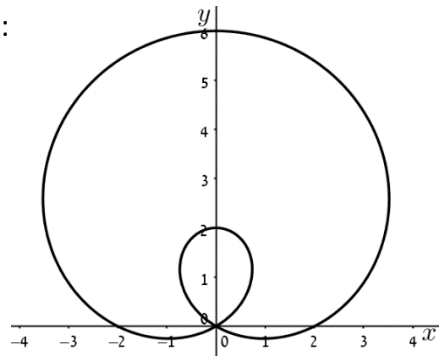
2) a. $\left(2, \frac{\pi}{3}\right)$ b. $\left(2\sqrt{2}, \frac{5\pi}{4}\right)$ c. $\left(5, \frac{3\pi}{2}\right)$ d. $(5, 2.214)$

3) a. $(-2, 2)$ b. $\left(2, -2\sqrt{3}\right)$ c. $(0, 0)$ d. $\left(3, -3\sqrt{3}\right)$

4) a. $1 + r^2\cos\theta\sin\theta$ b. $r = 6\sin\theta$ c. $r\cos\theta = 3$ d. $r\sin\theta = -4$

5) a. $(x+4)^2 + y^2 = 16$ b. $4\sqrt{x^2 + y^2} - x$ c. $x^2 + y^2 = 4$ d. $y = x$

6) see figure:



7) $y = \frac{1}{3\sqrt{3}}x + \frac{1}{4}$

8) $y\left(\theta = \frac{\pi}{6}\right) = \frac{\sqrt{3}}{3}x$, $y\left(\theta = \frac{5\pi}{6}\right) = -\frac{\sqrt{3}}{3}x$

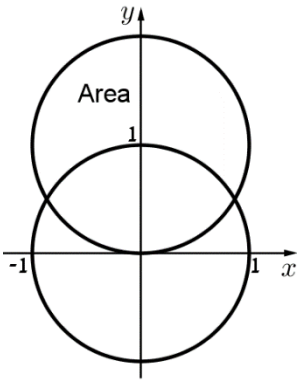
Areas and Lengths in Polar Coordinates

Questions

Area in Polar Coordinates

1) Find the area inside the graph of $r = 6 + 4\cos\theta$ and to the left of the y-axis.

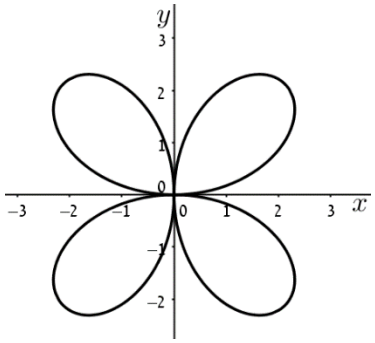
2) Find the area between the circles $r = 1$ and $r = 2\sin\theta$ as in the figure:



Arc Length in Polar Coordinates

3) Find the length of the circumference of the cardioid $r = 1 + \cos\theta$.

4) Find the arc length of one petal of the rose $r = 6 + 4\cos\theta$. [No need to evaluate the integral]



Surface Area in Polar Coordinates

5) Find the surface area obtained by revolving the curve $r = \cos\theta$, $0 \le \theta \le \frac{\pi}{2}$ about the x-axis.

6) Find the surface area obtained by revolving the curve $r = 4 + 4\sin\theta$, $-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$ about the y-axis.

Answer Key

1) $A = 22\pi - 48$

2) $A = \frac{\pi}{3} + \frac{\sqrt{3}}{2}$

3) $L = 8$

4) $L = 3\int_{0}^{\frac{\pi}{2}} \sqrt{\sin^2 2\theta + 4\cos^2 2\theta}\, d\theta$

5) $S = \pi$

6) $\frac{512\pi}{5}$