Mathematics for Science

Assignment 2

Polar Equations and Graphs

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Instructions: Attempt all the Questions

1) Identify areas in real life where polar equations and/or graphs have been used.

2) Convert to rectangular equations the following polar equations

(i) $r = 1 - 2\cos\theta$ (ii) $r = 2\cos\theta$

(iii) $r = \tan\theta$ (iv) $r = 3\cos 2\theta$

(v) $2\cos\theta - 3\cos\theta = r$ (vi) $r = 6$

(vii) $r = 3\sin 2\theta$ (viii) $r = 2 + 2\cos\theta$

3) Convert the following polar coordinates to rectangular coordinates

(i) $(2, \pi)$ (ii) $(4, \frac{\pi}{4})$

(iii) $(-5, \frac{\pi}{6})$ (iv) $(3, \frac{2}{3}\pi)$

4) Convert the following rectangular coordinates to polar coordinates (let $r > 0$ and $0 \leq \theta \leq 2\pi$)

(i) $(2, \sqrt{3})$ (ii) $(-2,4)$

(iii) $(0, -3)$ (iii) $(-3, -3)$

5) Convert the following rectangular equations to polar equations

(i) $2x - 5y = 8$ (ii) $x^2 + y^2 = 25$

(iii) $y^2 + 2x = x^3$ (iv) $y = \frac{1}{3}x^2$

(v) $3x^2 + 2y - 4 = 0$ (vi) $x + y + 7x = 7\sqrt{(x^2 + y^2)}$

6) Plot the graphs of the following polar equations

(i) $r = 2\cos\theta$ for $0 \leq \theta \leq 2\pi$

(ii) $r = 2 + 2\cos\theta$ for $0 \leq \theta \leq 2\pi$

(iii) $r = 1 - 2\cos\theta$ for $0 \leq \theta \leq 2\pi$

(iv) $r = 4\cos(3\theta)$ for $0 \leq \theta \leq \pi$

(v) $r = \sin 3\theta$ for $0 \leq \theta \leq 2\pi$

(vi) $r = \frac{\theta}{\pi}$ for $\theta \geq 0$

7) Plot the graphs below using a graphing device

i) $r = \sin^2(2.4\theta) + \cos^4(2.4\theta)$

ii) $r = 1 + 2\sin\left(\frac{\theta}{2}\right)$ – Nephroid of Freeth

iii) $r = e^{\sin\theta} - 2\cos(4\theta)$ – butterfly curve

iv) $r = |\tan\theta|^{|\cot\theta|}$ - valentine curve

8) Find the distance between the following pairs of points ;

i) $P(1,4)$ and $Q(5,-3)$

ii) $X(-10,7)$ and $Y(17,2)$

iii) $A(9,-3)$ and $B(-2,9)$

9) Determine the distance and the midpoint of the following line segments given their endpoints;

(i) $(-2,10), (5,-1)$

(ii) $(-8,-7), (5,10)$

(iii) $(\frac{1}{2}, 1), (-1,4)$