Mathematics for Physical Sciences II 8 November 2012
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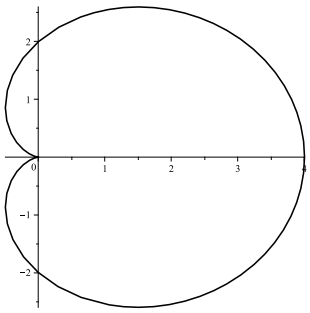
Problem Sheet 6: Curves in polar coordinates

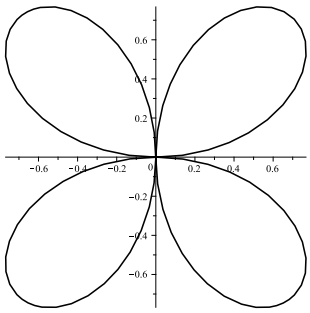
1. Plot the curve $r = 2(1 + \cos(\theta))$ from $\theta = 0$ to $\theta = 2\pi$ using $\frac{\pi}{6}$ intervals. (This curve is called a *cardioid*.)
2. Plot the following *rose curves* from $\theta = 0$ to $\theta = 2\pi$ using $\frac{\pi}{8}$ or $\frac{\pi}{6}$ intervals.

   $$(i)\ r = \sin(2\theta); \qquad (ii)\ r = \sin(3\theta); \qquad (iii)\ r = \sin(4\theta)$$

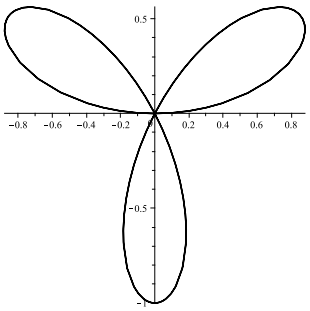
3. Plot the *snail curve* $r = 2 + 3\sin(\theta))$ from $\theta = 0$ to $\theta = 2\pi$ using $\frac{\pi}{6}$ intervals.
4. Plot the *double rose* curve $r = 1 - 2\sin(3\theta)$ from $\theta = 0$ to $\theta = 2\pi$ using $\frac{\pi}{6}$ intervals.
5. Using double integrals, calculate the area enclosed by each of the curves above.



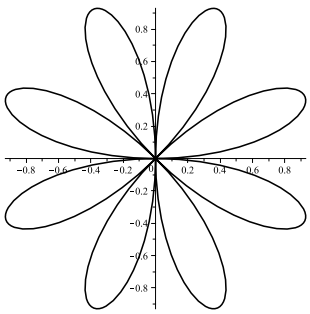
(a) $r = 2(1 + \cos\theta)$



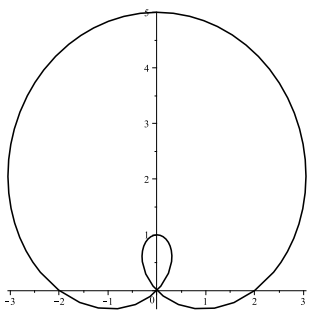
(b) $r = \sin(2\theta)$



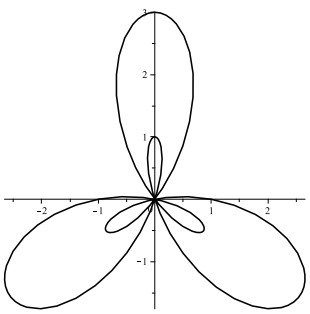
(c) $r = \sin(3\theta)$



(d) $r = \sin(4\theta)$



(e) $r = 2 + 3\sin\theta$



(f) $r = 1 - 2\sin(3\theta)$