Solutions :

1. a) (ii) Possible choices : $\left(2,\ \frac{\pi}{3}+2\pi\right) = \left(2,\ \frac{7\pi}{3}\right)$; $\left(-2,\ \frac{\pi}{3}+\pi\right) = \left(-2,\ \frac{4\pi}{3}\right)$

   (iii) $\left(1,\ \sqrt{3}\right)$

   b) (ii) Possible choices : $\left(-1,\ \frac{2\pi}{3}+2\pi\right) = \left(-1,\ \frac{8\pi}{3}\right)$; $\left(1,\ \frac{2\pi}{3}+\pi\right) = \left(1,\ \frac{5\pi}{3}\right)$

   (iii) $\left(\frac{1}{2},\ -\frac{\sqrt{3}}{2}\right)$

   c) (ii) Possible choices :

   $$\left(\sqrt{2},\ -\frac{5\pi}{4}+2\pi\right) = \left(\sqrt{2},\ \frac{3\pi}{4}\right) ;\ \left(-\sqrt{2},\ -\frac{5\pi}{4}+\pi\right) = \left(-\sqrt{2},\ -\frac{\pi}{4}\right)$$

   (iii) $(-1,\ 1)$

   d) (ii) Possible choices : $\left(-3,\ -\frac{\pi}{6}+2\pi\right) = \left(-3,\ \frac{11\pi}{6}\right)$; $\left(3,\ -\frac{\pi}{6}+\pi\right) = \left(3,\ \frac{5\pi}{6}\right)$

   (iii) $\left(-\frac{3\sqrt{3}}{2},\ \frac{3}{2}\right)$

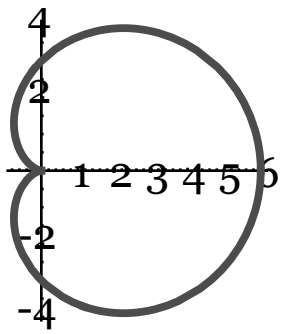
2. a) One choice : $\left(4,\ \frac{\pi}{4}\right)$

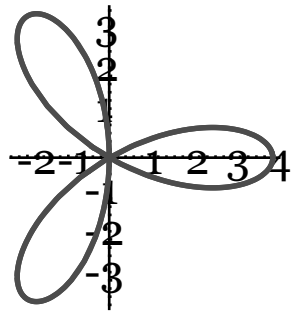
   b) One choice : $(3,\ \pi)$

   c) One choice : $\left(2,\ -\frac{\pi}{6}\right)$

   d) One choice : $\left(2,\ \frac{\pi}{2}\right)$

3. a) $r = 3 + 3\cos\theta$ b) $r = 4\cos 3\theta$



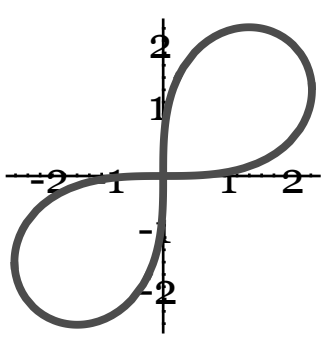


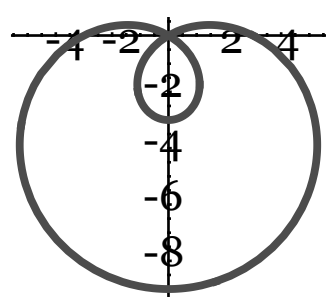
Area enclosed by the curve : $\frac{27\pi}{2}$

Area enclosed by one loop : $\frac{4\pi}{3}$

c $r^2 = 9 \sin 2\theta$

d $r = 3 - 6 \sin\theta$

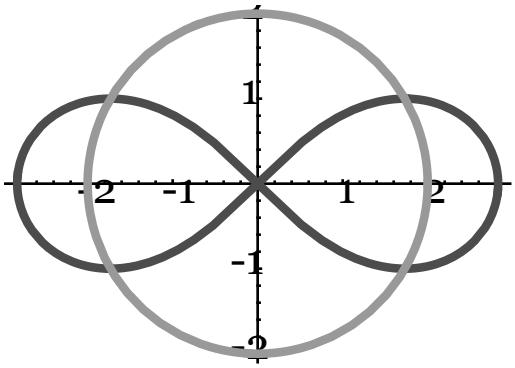




Area enclosed by one loop : $\frac{9}{2}$

Area enclosed by inner loop : $9\pi - \frac{27\sqrt{3}}{2}$

4.



Area inside the lemniscate and outside the circle : $4\sqrt{3} - \frac{4\pi}{3}$

5. $\sqrt{3}$