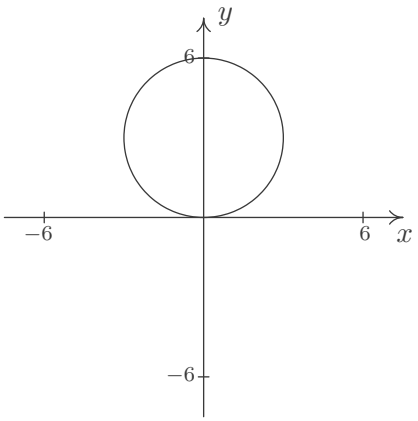
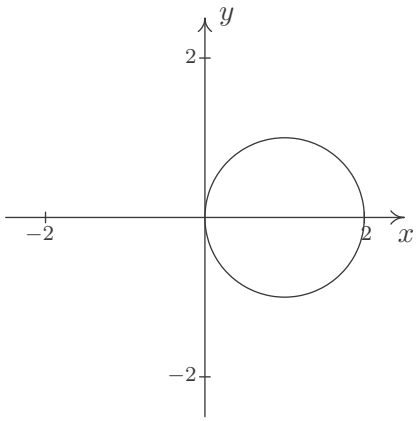
Worksheet 22 KEY - Polar Graphs (§10.6)

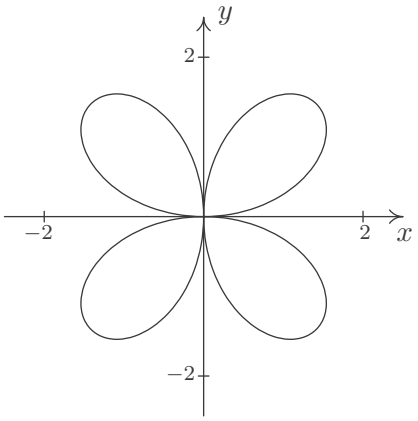
1. Circle: $r = 6\sin(\theta)$



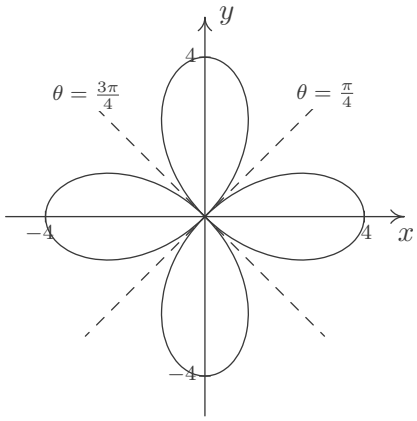
2. Circle: $r = 2\cos(\theta)$



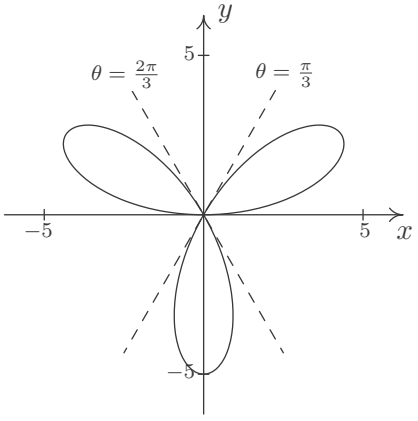
3. Rose: $r = 2\sin(2\theta)$



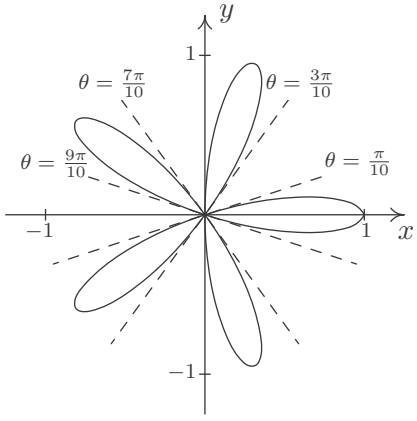
4. Rose: $r = 4\cos(2\theta)$



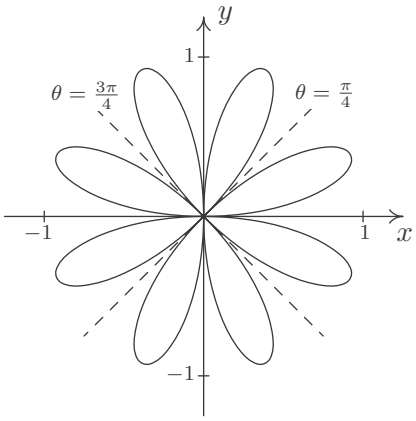
5. Rose: $r = 5\sin(3\theta)$



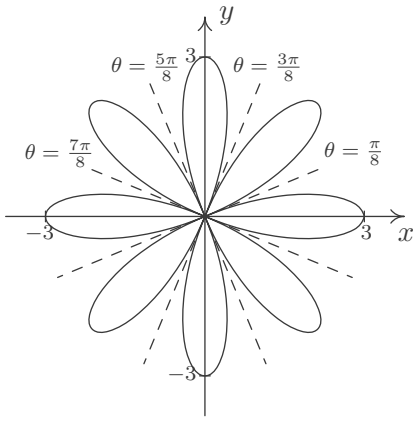
6. Rose: $r = \cos(5\theta)$



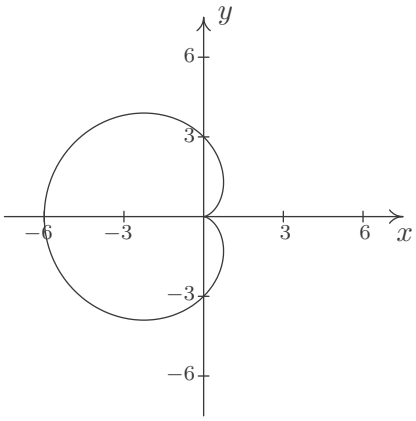
7. Rose: $r = \sin(4\theta)$



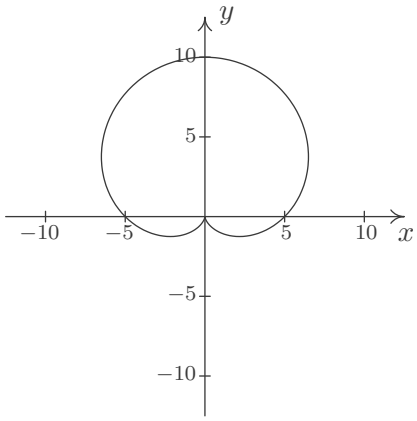
8. Rose: $r = 3\cos(4\theta)$



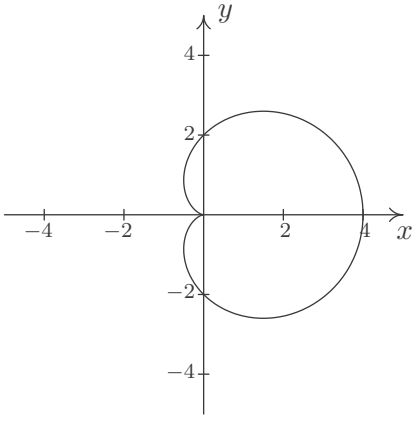
9. Cardioid: $r = 3 - 3\cos(\theta)$



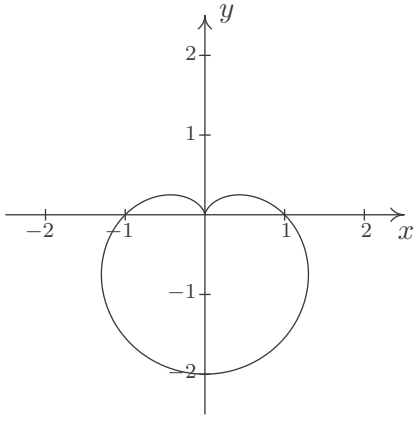
10. Cardioid: $r = 5 + 5\sin(\theta)$



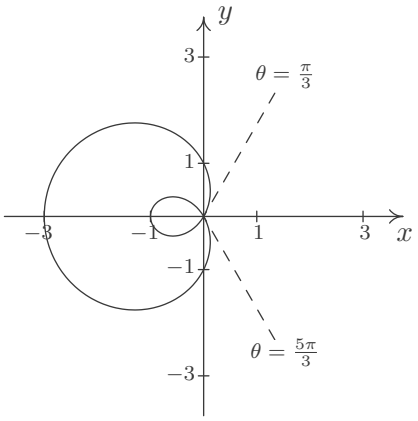
11. Cardioid: $r = 2 + 2\cos(\theta)$



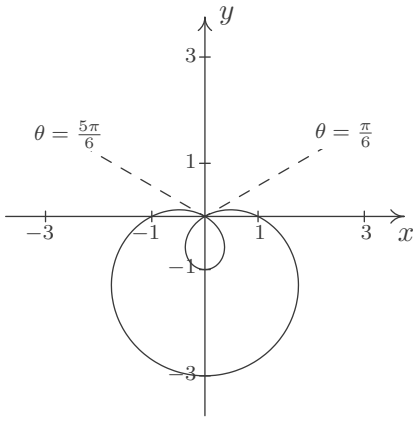
12. Cardioid: $r = 1 - \sin(\theta)$



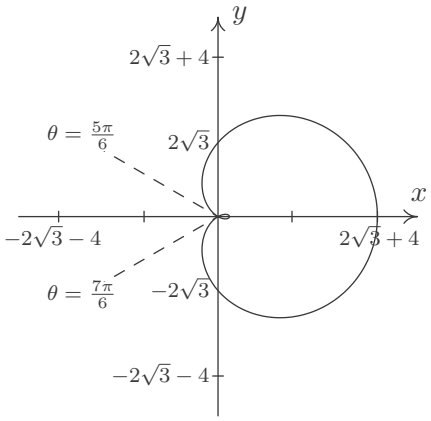
13. Limaçon: $r = 1 - 2\cos(\theta)$



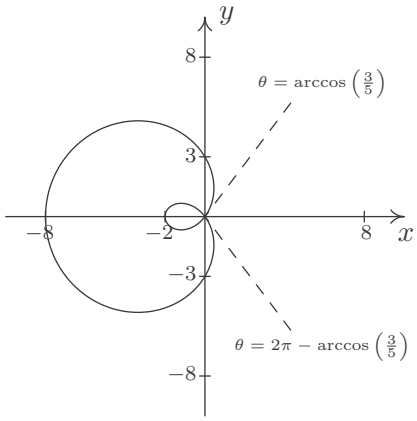
14. Limaçon: $r = 1 - 2\sin(\theta)$



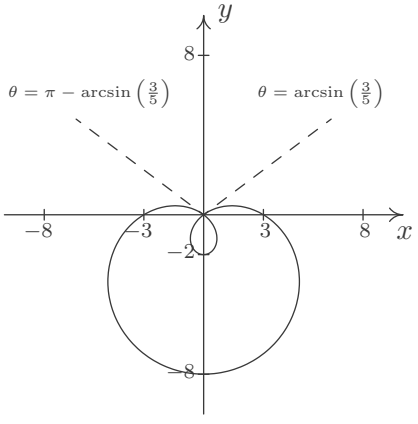
15. Limaçon: $r = 2\sqrt{3} + 4\cos(\theta)$



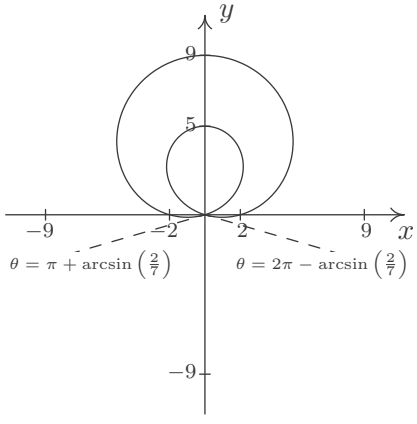
16. Limaçon: $r = 3 - 5\cos(\theta)$



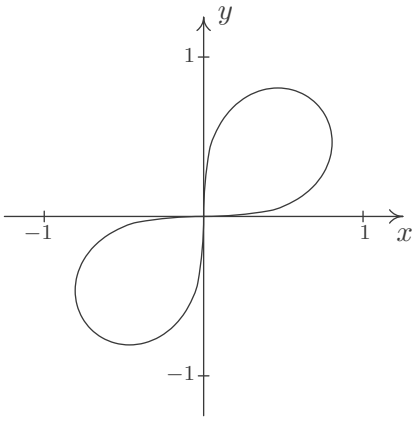
17. Limaçon: $r = 3 - 5\sin(\theta)$



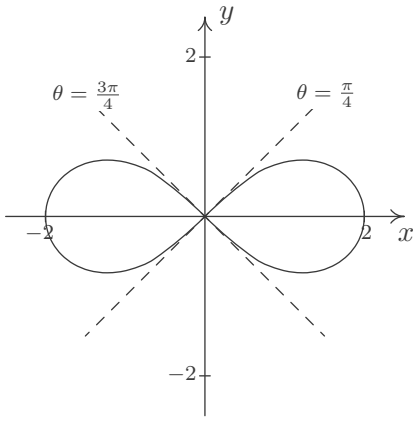
18. Limaçon: $r = 2 + 7\sin(\theta)$



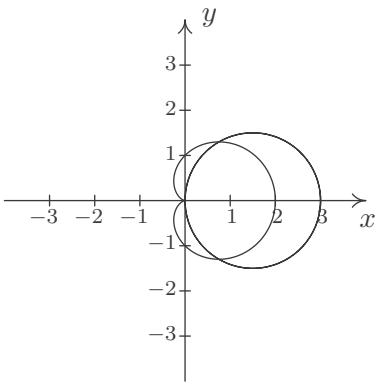
19. Lemniscate: $r^2 = \sin(2\theta)$



20. Lemniscate: $r^2 = 4\cos(2\theta)$

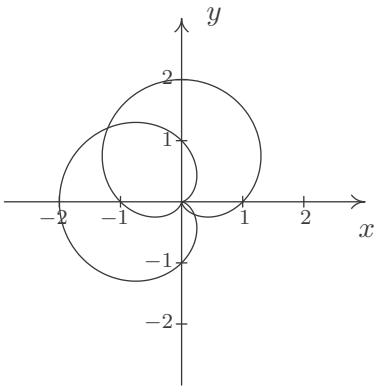


21. $r = 3\cos(\theta)$ and $r = 1 + \cos(\theta)$



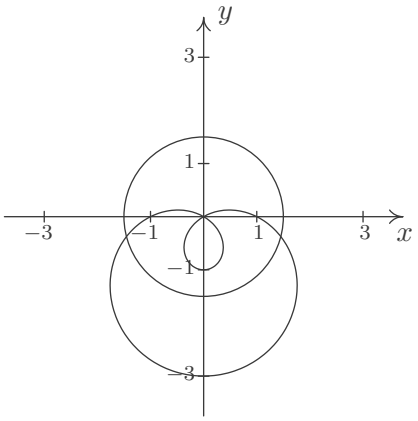
$\left(\frac{3}{2}, \frac{\pi}{3}\right)$, $\left(\frac{3}{2}, \frac{5\pi}{3}\right)$, pole

22. $r = 1 + \sin(\theta)$ and $r = 1 - \cos(\theta)$



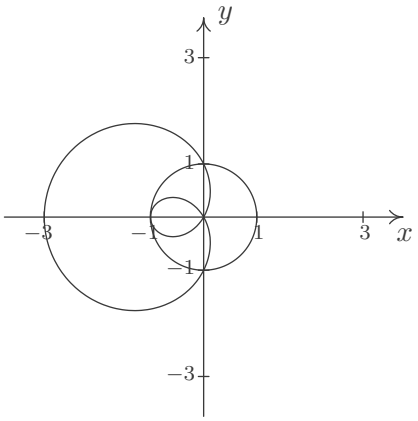
$\left(\frac{2+\sqrt{2}}{2}, \frac{3\pi}{4}\right)$, $\left(\frac{2-\sqrt{2}}{2}, \frac{7\pi}{4}\right)$, pole

23. $r = 1 - 2\sin(\theta)$ and $r = 2$



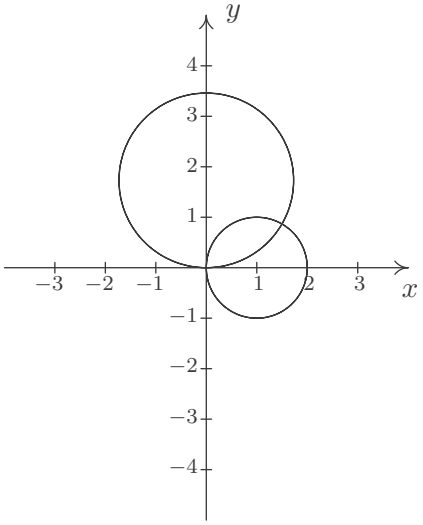
$\left(2, \frac{7\pi}{6}\right)$, $\left(2, \frac{11\pi}{6}\right)$

24. $r = 1 - 2\cos(\theta)$ and $r = 1$



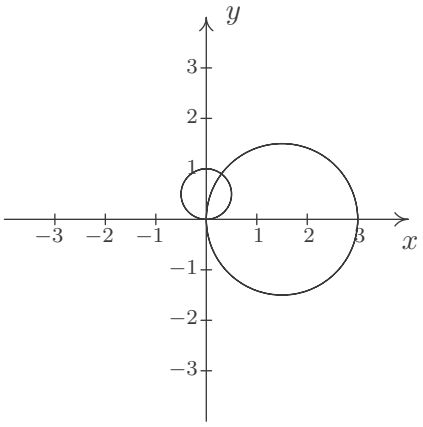
$\left(1, \frac{\pi}{2}\right)$, $\left(1, \frac{3\pi}{2}\right)$, $(-1, 0)$

25. $r = 2\cos(\theta)$ and $r = 2\sqrt{3}\sin(\theta)$



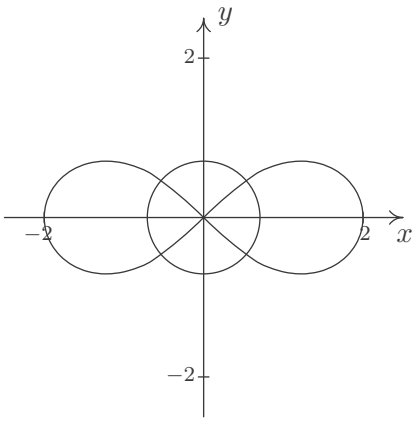
$\left(\sqrt{3}, \frac{\pi}{6}\right)$, pole

26. $r = 3\cos(\theta)$ and $r = \sin(\theta)$



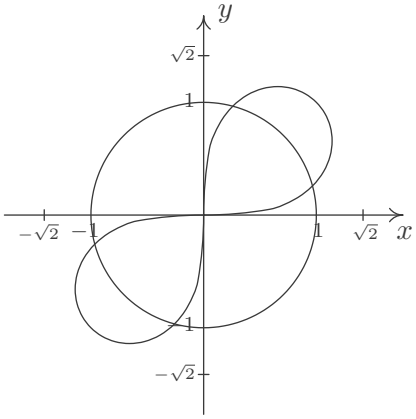
$\left(\frac{3\sqrt{10}}{10}, \arctan(3)\right)$, pole

27. $r^2 = 4\cos(2\theta)$ and $r = \sqrt{2}$



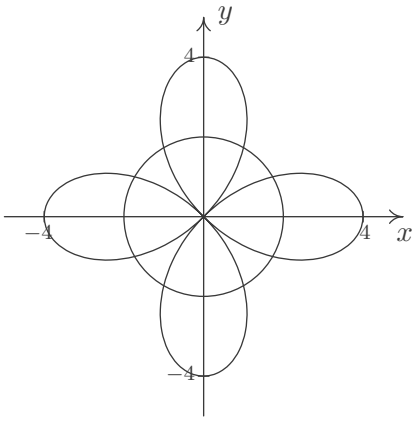
$\left(\sqrt{2}, \frac{\pi}{6}\right)$, $\left(\sqrt{2}, \frac{5\pi}{6}\right)$, $\left(\sqrt{2}, \frac{7\pi}{6}\right)$, $\left(\sqrt{2}, \frac{11\pi}{6}\right)$

28. $r^2 = 2\sin(2\theta)$ and $r = 1$



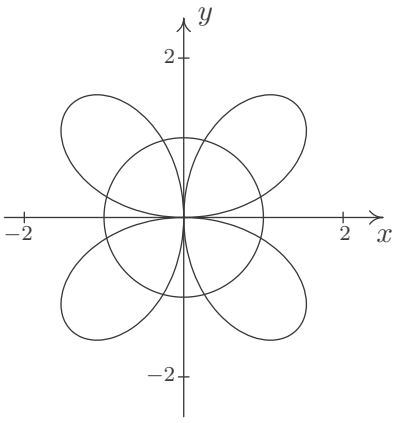
$\left(1, \frac{\pi}{12}\right)$, $\left(1, \frac{5\pi}{12}\right)$, $\left(1, \frac{13\pi}{12}\right)$, $\left(1, \frac{17\pi}{12}\right)$

29. $r = 4\cos(2\theta)$ and $r = 2$



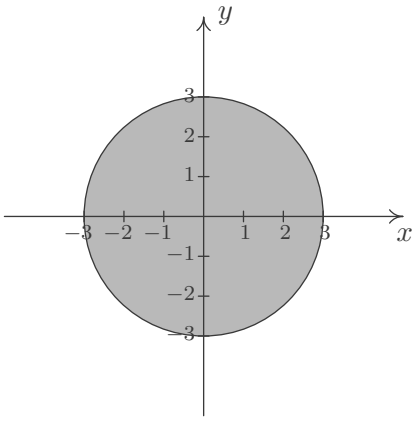
$\left(2, \frac{\pi}{6}\right)$, $\left(2, \frac{5\pi}{6}\right)$, $\left(2, \frac{7\pi}{6}\right)$,
$\left(2, \frac{11\pi}{6}\right)$, $\left(-2, \frac{\pi}{3}\right)$, $\left(-2, \frac{2\pi}{3}\right)$,
$\left(-2, \frac{4\pi}{3}\right)$, $\left(-2, \frac{5\pi}{3}\right)$

30. $r = 2\sin(2\theta)$ and $r = 1$

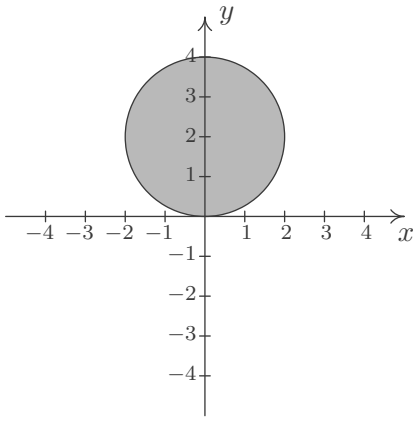


$\left(1, \frac{\pi}{12}\right)$, $\left(1, \frac{5\pi}{12}\right)$, $\left(1, \frac{13\pi}{12}\right)$,
$\left(1, \frac{17\pi}{12}\right)$, $\left(-1, \frac{7\pi}{12}\right)$, $\left(-1, \frac{11\pi}{12}\right)$,
$\left(-1, \frac{19\pi}{12}\right)$, $\left(-1, \frac{23\pi}{12}\right)$

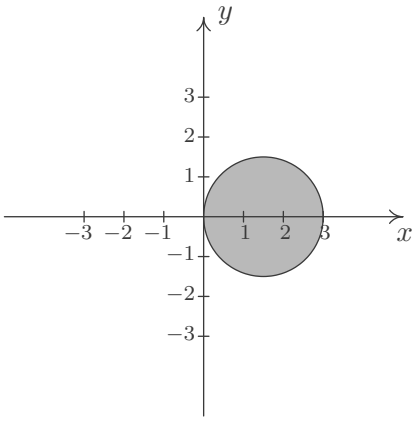
31. $\{(r,\theta)\,|\,0 \le r \le 3,\ 0 \le \theta \le 2\pi\}$



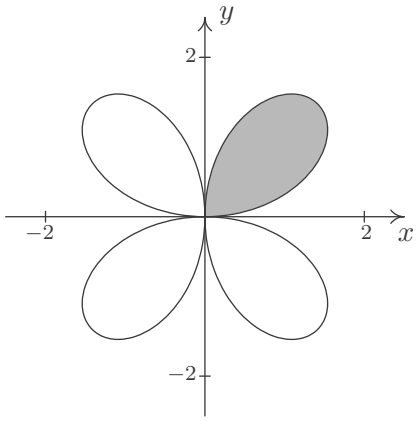
32. $\{(r,\theta)\,|\,0 \le r \le 4\sin(\theta),\ 0 \le \theta \le \pi\}$



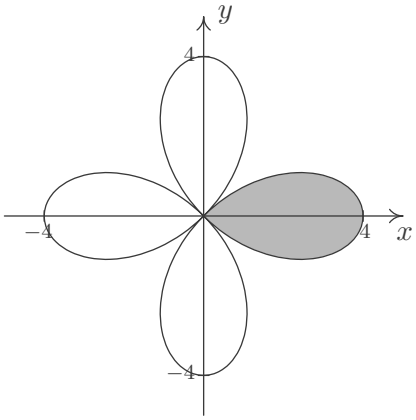
33. $\left\{(r,\theta)\,|\,0 \le r \le 3\cos(\theta),\ -\frac{\pi}{2} \le \theta \le \frac{\pi}{2}\right\}$



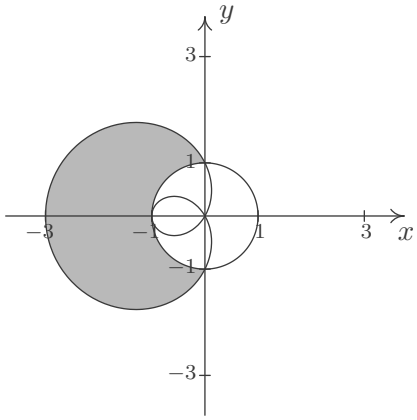
34. $\left\{(r,\theta)\,|\,0 \le r \le 2\sin(2\theta),\ 0 \le \theta \le \frac{\pi}{2}\right\}$



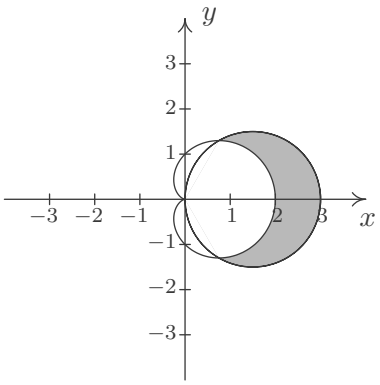
35. $\left\{(r,\theta)\,|\,0 \le r \le 4\cos(2\theta),\ -\frac{\pi}{4} \le \theta \le \frac{\pi}{4}\right\}$



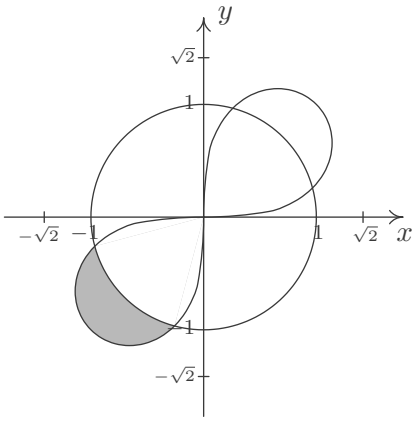
36. $\left\{(r,\theta)\,|\,1 \le r \le 1-2\cos(\theta),\ \frac{\pi}{2} \le \theta \le \frac{3\pi}{2}\right\}$



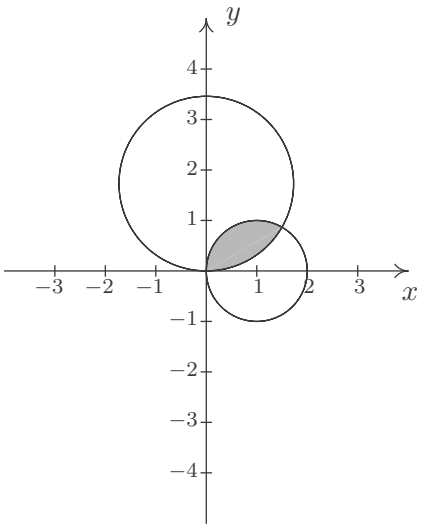
37. $\left\{(r,\theta)\,|\,1+\cos(\theta)\le r\le 3\cos(\theta),\ -\frac{\pi}{3}\le\theta\le\frac{\pi}{3}\right\}$



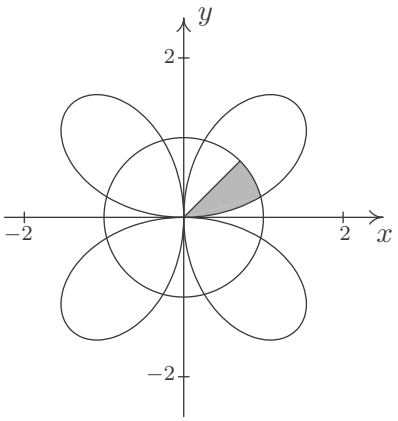
38. $\left\{(r,\theta)\,|\,1\le r\le\sqrt{2\sin(2\theta)},\ \frac{13\pi}{12}\le\theta\le\frac{17\pi}{12}\right\}$



39. $\left\{(r,\theta)\,|\,0\le r\le 2\sqrt{3}\sin(\theta),\ 0\le\theta\le\frac{\pi}{6}\right\}\cup\left\{(r,\theta)\,|\,0\le r\le 2\cos(\theta),\ \frac{\pi}{6}\le\theta\le\frac{\pi}{2}\right\}$



40. $\left\{(r,\theta)\,|\,0 \le r \le 2\sin(2\theta),\ 0 \le \theta \le \frac{\pi}{12}\right\} \cup \left\{(r,\theta)\,|\,0 \le r \le 1,\ \frac{\pi}{12} \le \theta \le \frac{\pi}{4}\right\}$



41. $\{(r,\theta)\,|\,0 \le r \le 5,\ 0 \le \theta \le 2\pi\}$

42. $\left\{(r,\theta)\,|\,0 \le r \le 5,\ \pi \le \theta \le \frac{3\pi}{2}\right\}$

43. $\left\{(r,\theta)\,|\,0 \le r \le 6\sin(\theta),\ \frac{\pi}{2} \le \theta \le \pi\right\}$

44. $\left\{(r,\theta)\,|\,4\cos(\theta) \le r \le 0,\ \frac{\pi}{2} \le \theta \le \pi\right\}$

45. $\{(r,\theta)\,|\,0 \le r \le 3 - 3\cos(\theta),\ 0 \le \theta \le \pi\}$

46. $\left\{(r,\theta)\,|\,0 \le r \le 2 - 2\sin(\theta),\ 0 \le \theta \le \frac{\pi}{2}\right\} \cup \left\{(r,\theta)\,|\,0 \le r \le 2 - 2\sin(\theta),\ \frac{3\pi}{2} \le \theta \le 2\pi\right\}$
or $\left\{(r,\theta)\,|\,0 \le r \le 2 - 2\sin(\theta),\ \frac{3\pi}{2} \le \theta \le \frac{5\pi}{2}\right\}$

47. $\left\{(r,\theta)\,|\,0 \le r \le 3\cos(4\theta),\ 0 \le \theta \le \frac{\pi}{8}\right\} \cup \left\{(r,\theta)\,|\,0 \le r \le 3\cos(4\theta),\ \frac{15\pi}{8} \le \theta \le 2\pi\right\}$
or $\left\{(r,\theta)\,|\,0 \le r \le 3\cos(4\theta),\ -\frac{\pi}{8} \le \theta \le \frac{\pi}{8}\right\}$

48. $\{(r,\theta)\,|\,3 \le r \le 5,\ 0 \le \theta \le 2\pi\}$

49. $\left\{(r,\theta)\,|\,0 \le r \le 3\cos(\theta),\ -\frac{\pi}{2} \le \theta \le 0\right\} \cup \{(r,\theta)\,|\,\sin(\theta) \le r \le 3\cos(\theta),\ 0 \le \theta \le \arctan(3)\}$

50. $\left\{(r,\theta)\,|\,0 \le r \le 6\sin(2\theta),\ 0 \le \theta \le \frac{\pi}{12}\right\} \cup \left\{(r,\theta)\,|\,0 \le r \le 3,\ \frac{\pi}{12} \le \theta \le \frac{5\pi}{12}\right\} \cup$
$\left\{(r,\theta)\,|\,0 \le r \le 6\sin(2\theta),\ \frac{5\pi}{12} \le \theta \le \frac{\pi}{2}\right\}$