Find the slope of the tangent line to the given polar curve at the point specified by the value of θ.

1) $r = 2\sin\theta, \quad \theta = \frac{\pi}{6}$

2) $r = 2 - \sin\theta, \quad \theta = \frac{\pi}{3}$

3) $r = 1 + \cos\theta, \quad \theta = \frac{\pi}{6}$

Find the points on the given curve where the tangent line is horizontal or vertical.

4) $r = 3\cos\theta$

5) $r = 1 + \cos\theta$

6) $r^2 = \sin 2\theta$

Find the area of the region that is bounded by the given curve and lies in the specified sector.

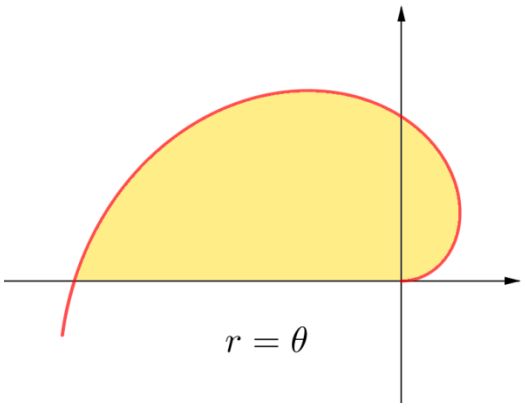
7) $r = \sqrt{\theta}, \quad 0 \le \theta \le \frac{\pi}{4}$

8) $r = \sin\theta, \quad \frac{\pi}{3} \le \theta \le \frac{2\pi}{3}$

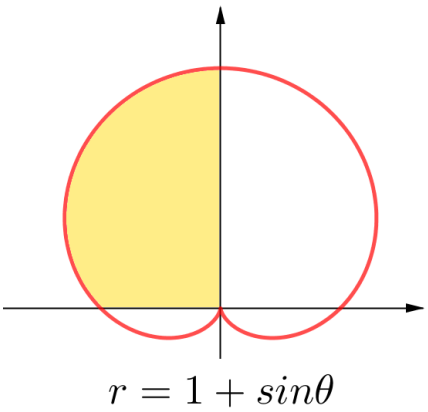
9) $r = \sqrt{\sin\theta}, \quad 0 \le \theta \le \pi$

Find the area of the shaded region.

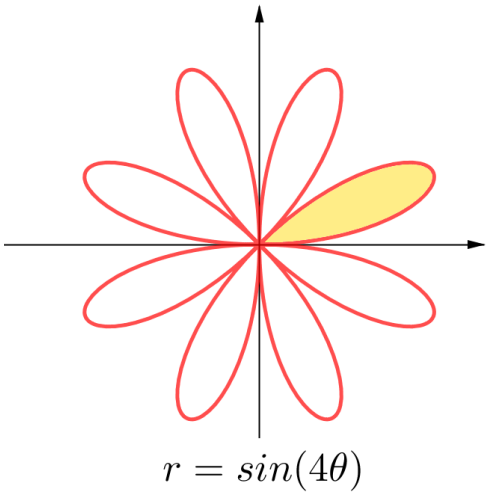
10)



11)

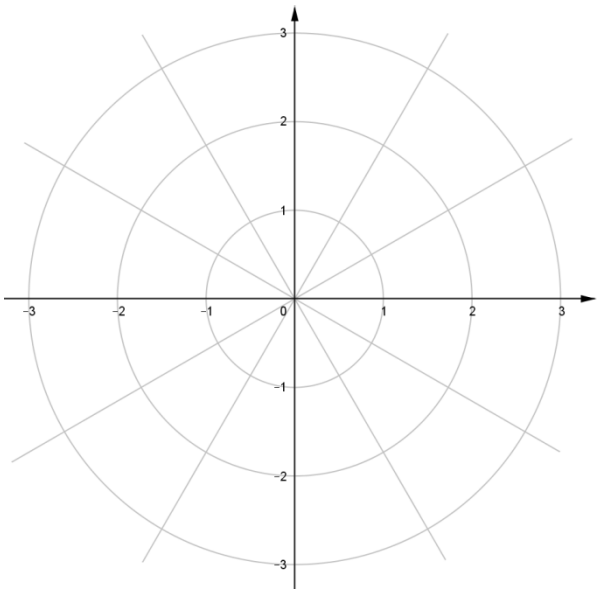


12)

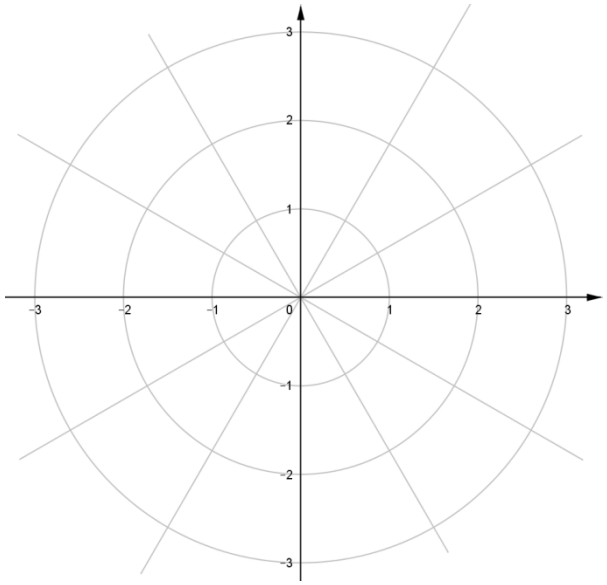


Sketch the curve and find the area that it encloses.

13) $r = 3\cos\theta$



14) $r = 2\cos 3\theta$



Find the area of the region enclosed by one loop of the curve.

15) $r = 1 + 2\sin\theta$ (inner loop)

16) Find the area enclosed by the loop of the **strophoid**: $r = 2\cos\theta - \sec\theta$

Find the area of the region that lies inside the first curve and outside the second curve.

17) $r = 4\sin\theta, \quad r = 2$

18) $r^2 = 8\cos 2\theta, \quad r = 2$

19) $r = 2 + \sin\theta, \quad r = 3\sin\theta$

20) $r = 3\cos\theta, \quad r = 1 + \cos\theta$

Find the area of the region that lies inside both curves.

21) $r = \sin\theta, \quad r = \cos\theta$

22) $r = \sin 2\theta, \quad r = \cos 2\theta$

23) $r^2 = 2\sin 2\theta, \quad r = 1$

Find all points of intersection of the given curves.

24) $r = \sin\theta, \quad r = \cos\theta$

25) $r = 2, \quad r = 2\cos 2\theta$

26) $r = \sin\theta, \quad r = \sin 2\theta$

27) Use a graphing device to estimate the values of θ for which the cures $r = 3 + \sin 5\theta$ and $r = 6\sin\theta$ intersect. Then estimate the area that lies inside both curves.

Find the exact length of the polar curve.

28) $r = 3\sin\theta, \quad 0 \le \theta \le \dfrac{\pi}{3}$

29) $r = e^{2\theta}, \quad 0 \le \theta \le 2\pi$

Use a calculator to find the length of the curve correct to four decimal places.

30) $r = 3\sin 2\theta$

31) $r = 1 + \cos(\theta/3)$