10.5 EXERCISES

PRACTICE

Match the polar equation with its corresponding graph. See Examples 2 and 3.

1. $r = \dfrac{3}{4 - \cos\theta}$

2. $r = \dfrac{9}{6 - 2\sin\theta}$

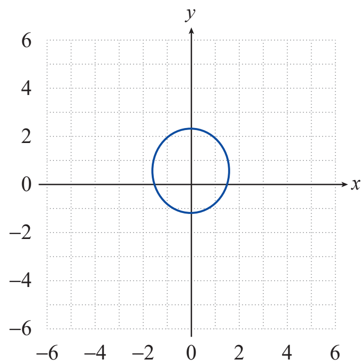
3. $r = \dfrac{3}{3 + 4\sin\theta}$

4. $r = \dfrac{1}{2 + 2\cos\theta}$

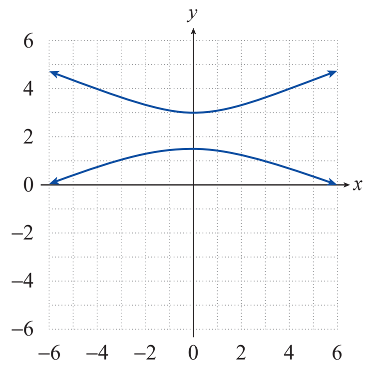
5. $r = \dfrac{6}{1 + 3\sin\theta}$

6. $r = \dfrac{6}{1 + 3\cos\theta}$

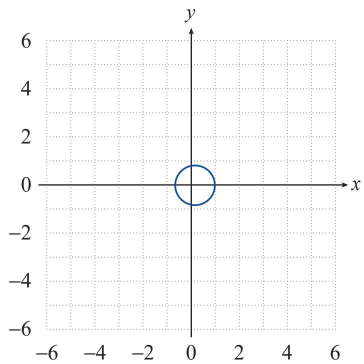
a.



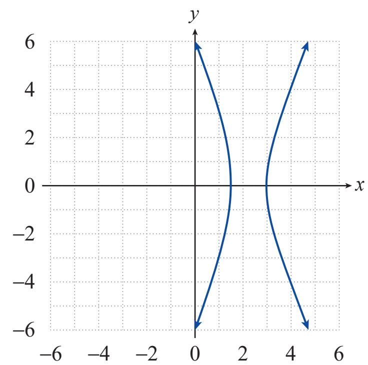
b.



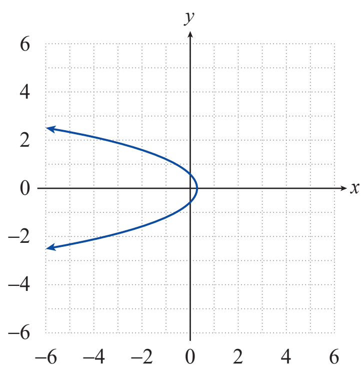
c.



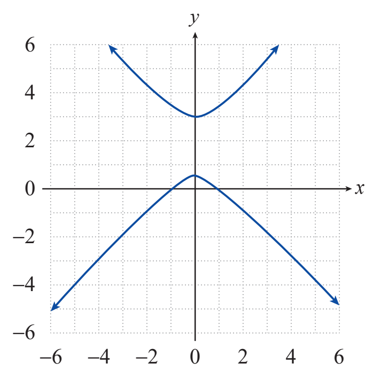
d.



e.



f.



Identify each conic section and find the equation for its directrix. See Example 1.

7. $r=\frac{7}{1+6\sin\theta}$

8. $r=\frac{2}{1-\sin\theta}$

9. $r=\frac{3}{4-\cos\theta}$

10. $r=\frac{4}{2-2\cos\theta}$

11. $r=\frac{1}{1+3\cos\theta}$

12. $r=\frac{7}{3+2\sin\theta}$

13. $r=\frac{5}{2+\cos\theta}$

14. $r=\frac{3}{4-3\sin\theta}$

15. $r=\frac{6}{3-5\cos\theta}$

16. $r=\frac{8}{5-6\sin\theta}$

17. $r=\frac{3}{2+2\sin\theta}$

18. $r=\frac{-1}{3+4\cos\theta}$

19. $r=\frac{4}{6-7\cos\theta}$

20. $r=\frac{9}{5-4\sin\theta}$

Construct a polar equation for each conic section with the focus at the origin and the given eccentricity and directrix. See Example 2.

	Conic	Eccentricity	Directrix
21.	Parabola	$e=1$	$x=-2$
22.	Hyperbola	$e=2$	$x=-3$
23.	Hyperbola	$e=4$	$y=-\frac{3}{4}$
24.	Parabola	$e=1$	$x=2$
25.	Ellipse	$e=\frac{1}{4}$	$x=12$
26.	Ellipse	$e=\frac{1}{2}$	$y=8$

Sketch the graphs of the following conic sections. See Examples 3, 4, and 5.

27. $r=\frac{5}{1+3\cos\theta}$

28. $r=\frac{3}{2+\sin\theta}$

29. $r=\frac{4}{1-2\sin\theta}$

30. $r=\frac{6}{2-4\cos\theta}$

31. $r=\frac{9}{3-2\cos\theta}$

32. $r=\frac{5}{3+\sin\theta}$

33. $r=\frac{4}{1+2\cos\theta}$

34. $r=\frac{4}{2+2\sin\theta}$

35. $r=\frac{-3}{4-9\cos\theta}$

36. $r=\frac{9}{-4+\frac{3}{2}\sin\theta}$

37. $r=\frac{-11}{3-\cos\theta}$

38. $r=\frac{2}{10+4\sin\theta}$

39. $r=\frac{3}{7+3\cos\theta}$

40. $r=\frac{2}{2+3\cos\left(\theta-\frac{\pi}{4}\right)}$

41. $r = \dfrac{-7}{5+3\sin\left(\theta - \frac{\pi}{6}\right)}$

42. $r = \dfrac{5}{-2-4\sin\left(\theta + \frac{2\pi}{3}\right)}$

43. $r = \dfrac{4}{-3-2\cos\left(\theta + \frac{\pi}{3}\right)}$

44. $r = \dfrac{1}{1+4\sin\left(\theta + \frac{\pi}{6}\right)}$

45. $r = \dfrac{2}{1+\cos\left(\theta - \frac{\pi}{4}\right)}$

46. $r = \dfrac{4}{2+2\sin\left(\theta - \frac{\pi}{3}\right)}$

APPLICATIONS

47. The planets of our solar system follow elliptical orbits with the sun located at one of the foci. If we assume the sun is located at the pole and the major axes of these elliptical orbits lie along the polar axis, the orbits of the planets can be expressed by the polar equation

$$r = \frac{\left(1-e^2\right)a}{1-e\cos\theta},$$

where e is the eccentricity. Verify the above equation.

48. Using the equation from Exercise 47, answer the following:

a. Show that the shortest distance from the sun to a planet, called the *perihelion*, is $r = a(1-e)$.

b. Show that the longest distance from the sun to a planet, called the *aphelion*, is $r = a(1+e)$.

c. Uranus is approximately 2.74×10^9 km away from the sun at perihelion and 3.00×10^9 km at aphelion. Find the eccentricity of Uranus' orbit.

d. The eccentricity of Neptune's path is 0.0113 and $a = 4.495 \times 10^9$ km. Determine the perihelion and aphelion distances for Neptune.