

Chapter 13

Polar Graphs

Lesson 13-4 (pp. 804-810)

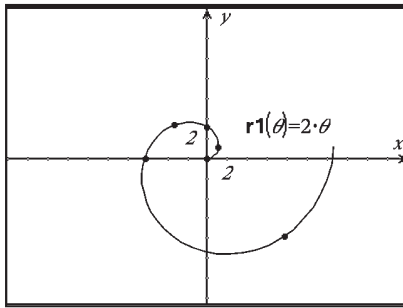
Mental Math

- a. (0, 1)
- b. (-2, 0)
- c. $(\frac{1}{2}, \frac{\sqrt{3}}{2})$
- d. $(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$

Activity 1

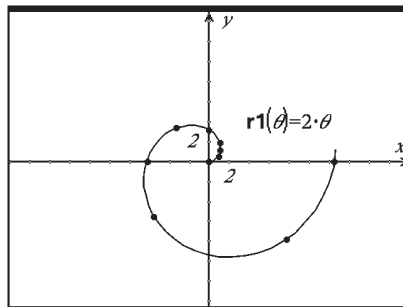
Step 1:

0; 3.14; 4.71; 6.28; 10.996



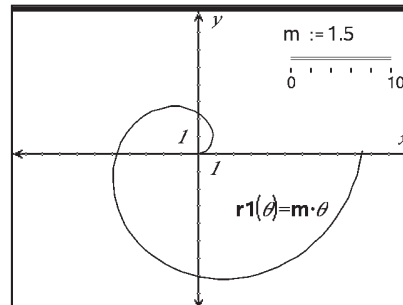
Step 2:

The graph of $r = 2\theta$ is a counterclockwise spiral. Sample additional points: $[-3.14, -1.57]$, $[1.047, 0.524]$, $[2.094, 1.047]$, $[7.854, 3.927]$, $[12.57, 6.28]$

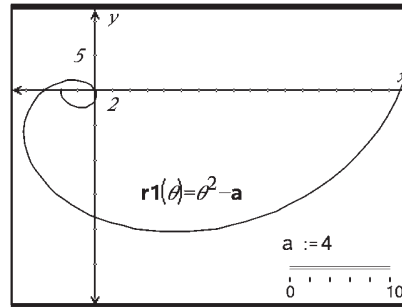


Step 3:

As m increases the spiral moves counterclockwise and outward.



Step 4



Activity 2

Step 1:

3; π

Step 2:

$[0, 0]$

Step 3:

$[3, 0.79]$

Step 4:

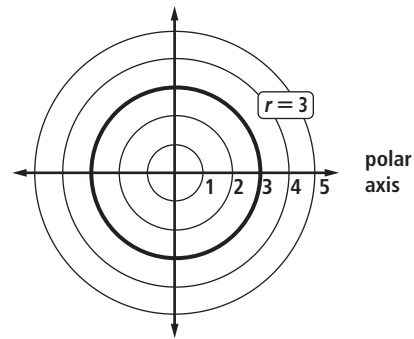
$[0, 1.57]$

Step 5:

minimum: $[-3, 2.36]$; x-intercepts: $[0, 3.14]$, $[0, 4.71]$, $[0, 6.28]$; maximum: $[3, 3.93]$

Questions

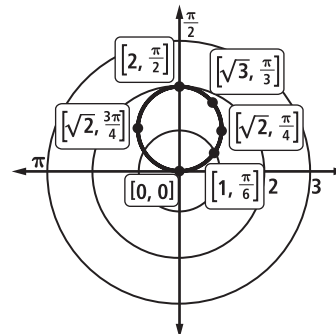
1. a.



b. $x^2 + y^2 = 9$

2. a circle with center (0, 0) and radius a

3. a.

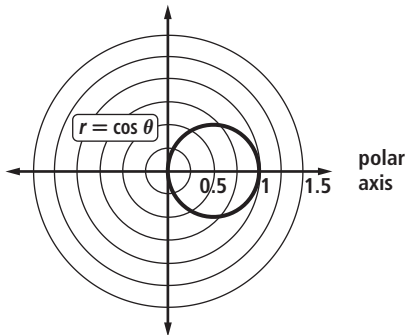


b. $r = \frac{y}{r} = 2 \sin \theta$

$$x^2 + y^2 = 2y$$

$$x^2 + (y - 1)^2 = 1$$

4. a.



b. $r = \cos \theta$

$$r = \frac{x}{r}$$

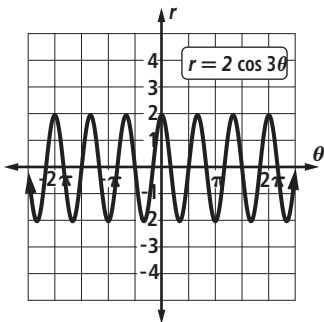
$$x^2 + y^2 = x$$

$$\left(x - \frac{1}{2}\right)^2 + y^2 = \frac{1}{4}$$

5. no; $\cos(4\pi) = 1 \neq 4$

6. no; $\cos(2 \cdot 0) = 1 \neq 0$

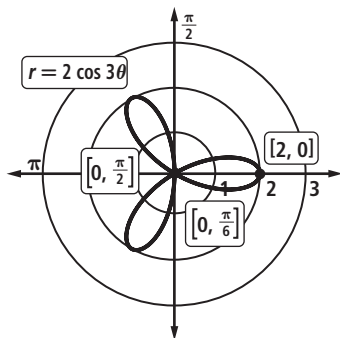
7. a.



b. max: 2; min: -2

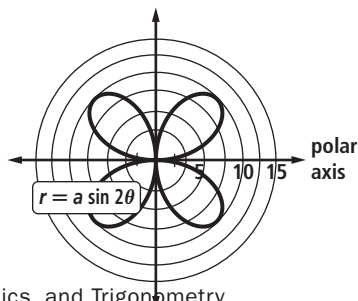
c. $r = 2, 0, 0$;

d.



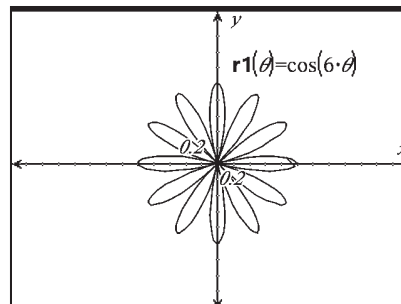
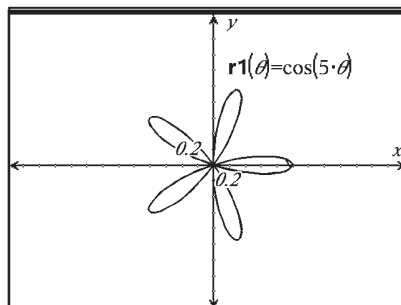
8. Answers vary. Sample: $[0, 0]$, $[1, \frac{\pi}{4}]$, $[\frac{\sqrt{3}}{2}, \frac{\pi}{3}]$, $[0, \frac{3\pi}{2}]$

9. Answers vary. Sample: $a = 10$

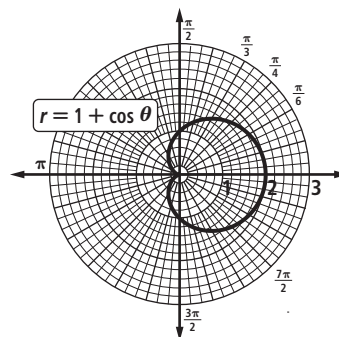


10. a. The graph of $r = \cos n\theta$ has n petals if n is odd and $2n$ petals if n is even.

b.

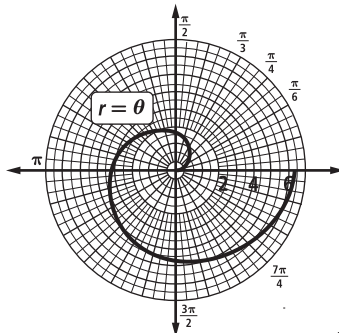


11. a.



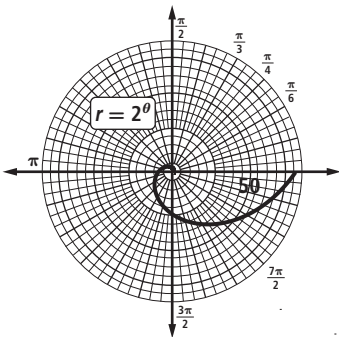
b. the curve is heart-shaped

12.



13. a. $[1, 0]$, $[1.724, \frac{\pi}{4}]$, $[2.971, \frac{\pi}{2}]$, $[5.12, \frac{3\pi}{4}]$, $[8.83, \pi]$, $[15.21, \frac{5\pi}{4}]$, $[26.22, \frac{3\pi}{2}]$, $[45.19, \frac{7\pi}{4}]$, $[77.88, 2\pi]$

b.

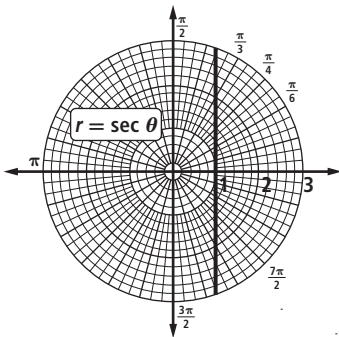


d. 0.9971

20. a. $r = 1 + 2 \sin \theta$

b. $b > a$

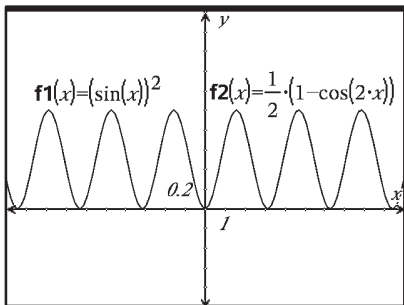
14. a.



b. $x = 1$

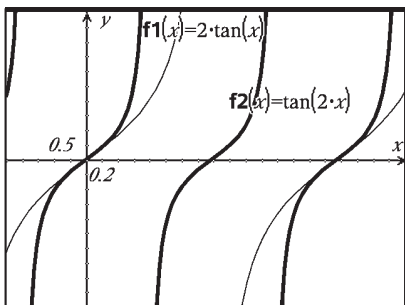
15. D

16. a. identity;



b. $\frac{1}{2}(1 - \cos 2x) = \frac{1}{2}(1 - (1 - 2 \sin^2 x)) = \sin^2 x$

17. a. not an identity;



b. Answers vary. Sample:
 $\tan\left(\frac{2\pi}{3}\right) = -\sqrt{3}$, but $2 \tan\left(\frac{\pi}{3}\right) = 2\sqrt{3}$

18. a. $\approx 1.7\%$

b. 0.58 ± 0.017

19. a. 0.9987

b. 0.84

c. 0.025