**Determine the type the following graphs of the following equations. Graph the equation and analyze the graph.**

16. $r = 2 - 3\cos\theta$

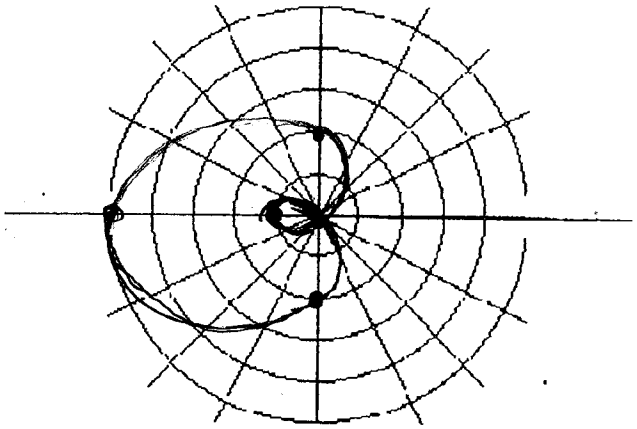
| $\theta$ | 0° | 90° | 180° | 270° | 360° |
|---|---|---|---|---|---|
| r | -1 | 2 | 5 | 2 | -1 |

Type: limaçon with a loop

Symmetry: x-axis

~~Max r-value:~~

Petals:



17. $r = -2 + 2\sin\theta$

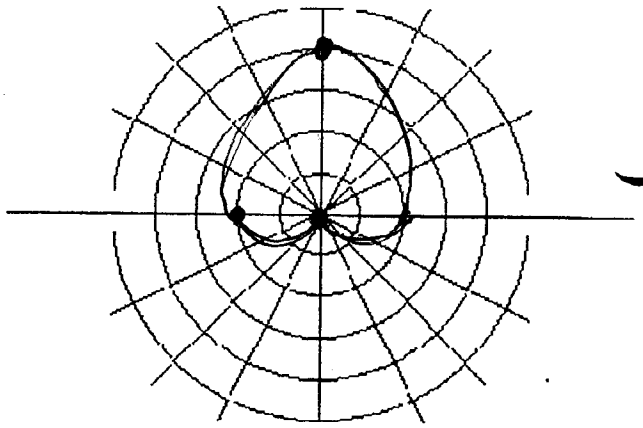
| $\theta$ | 0° | 90° | 180° | 270° | 360° |
|---|---|---|---|---|---|
| r | -2 | 0 | -2 | -4 | -2 |

Type: cardioid

Symmetry: y-axis

~~Max r-value:~~

~~Petals:~~



18. $r = -4\sin\theta$ $0 \to 2\pi$ graphs the circle twice

| $\theta$ | 0° | 45° | 90° | 135° | 180° | 225° | 270° | 315° | 360° |
|---|---|---|---|---|---|---|---|---|---|
| r | 0 | -2.8 | -4 | -2.8 | 0 | 2.8 | 4 | 2.8 | 0 |

Type: circle d=4

$-4\cdot\frac{\sqrt{2}}{2}$

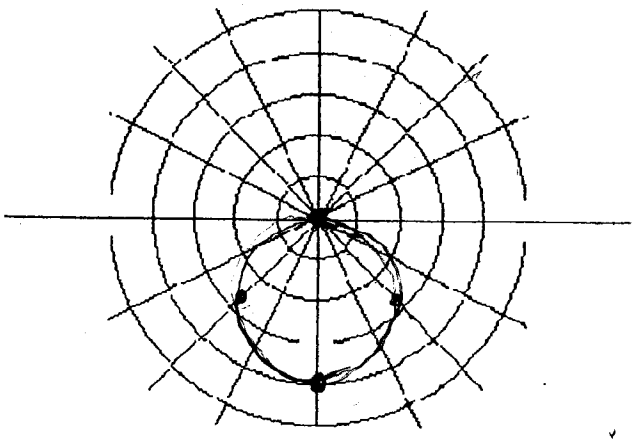
Symmetry: y-axis

$-2\sqrt{2}$

$-2.8$

~~Max r-value:~~

Petals:



19. $r = -4$

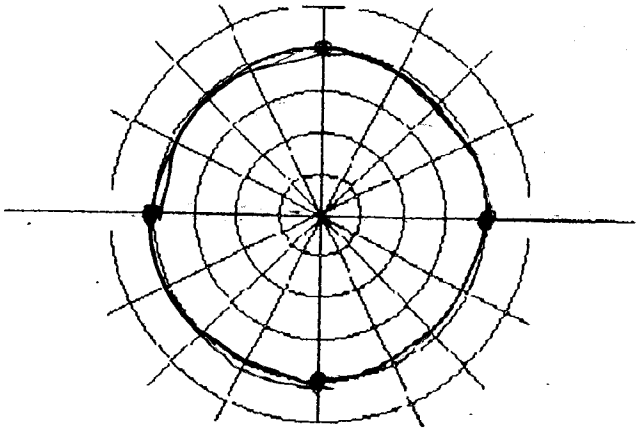
| $\theta$ | 0° | 90° | 180° | 270° | 360° |
|---|---|---|---|---|---|
| r | −4 | −4 | −4 | −4 | −4 |

Type: circle radius = 4

Symmetry: all types center (0,0)

Max r-value:

Petals:



20. $r = 3\sin\theta$

| $\theta$ | 0° | 45° | 90° | 135° | 180° | 270° | 360° |
|---|---|---|---|---|---|---|---|
| r | 0 | 2.1 | 3 | 2.1 | 0 | | |

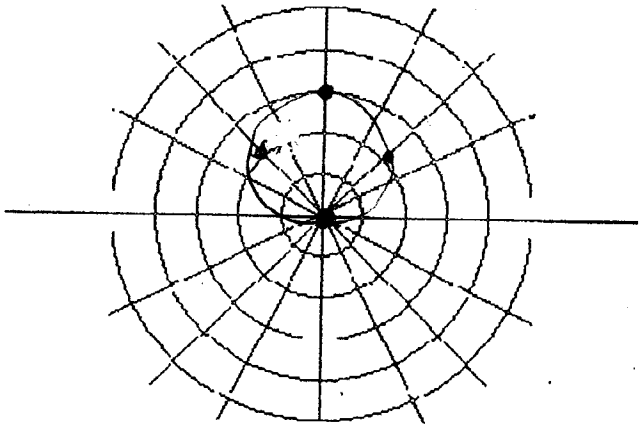
$3\cdot\frac{\sqrt{2}}{2}$

Type: circle $d = 3$

Symmetry: y-axis

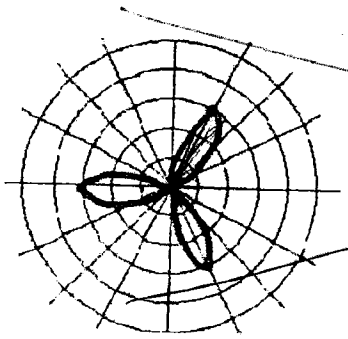
Max r-value:

Petals:

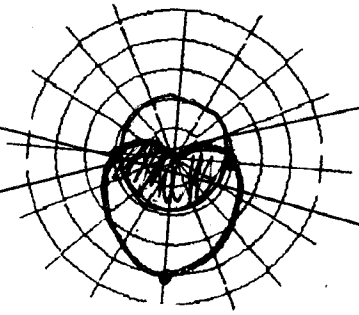


**Find an equation for r for the following graphs.**

21.



22.



23.