# Graphing Polar Curves

$r \cos\theta = a \rightarrow x = a \rightarrow$ vertical line $\qquad r \sin\theta = b \rightarrow y = b \rightarrow$ horizontal line

$r = a$, is a circle centered at the origin. $\qquad \theta = a$, is an angled line.

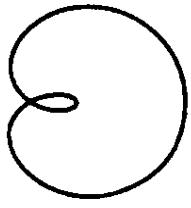
$r = \pm 2a \cos\theta$, is a circle of radius "a" right or left of the origin.

$r = \pm 2a \sin\theta$, is a circle of radius "a" above or below the origin.

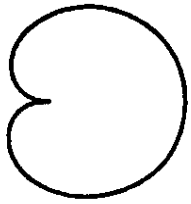
## Limacons

$r = a \pm b \sin\theta$ $\qquad$ or $\qquad$ $r = a \pm b \cos\theta$

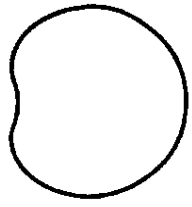
$a/b < 1$ $\qquad$ $a/b = 1$ $\qquad$ $1 < a/b < 2$ $\qquad$ $a/b \geq 2$



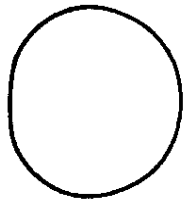
Limacon with Inner Loop



Cardioid



Dimpled Limacon

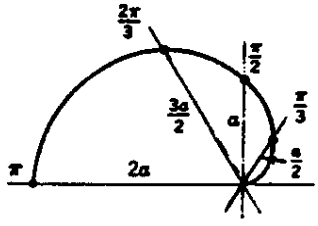


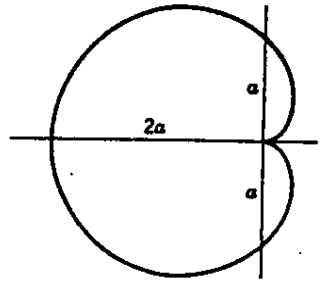
Convex Limacon

Consider:

$a = b \rightarrow$ Cardioid

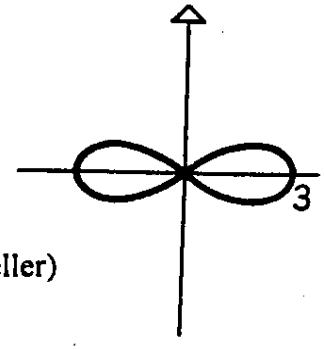
$r = a(1 - \cos\theta)$




$r^2 = a^2 \cos 2\theta$ $\quad$ or $\quad$ $r^2 = -a^2 \cos 2\theta$

$r^2 = a^2 \sin 2\theta$ $\quad$ or $\quad$ $r^2 = -a^2 \sin 2\theta$

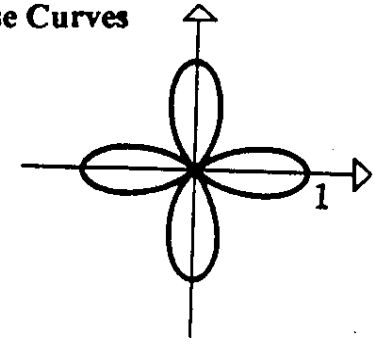



Lemniscate (propeller)

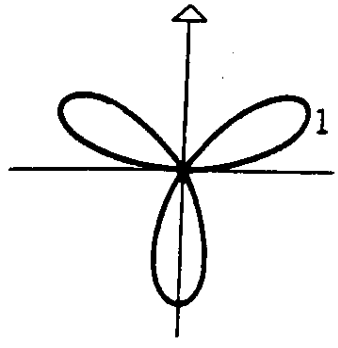
## Rose Curves

$r = a \sin(n\theta)$ $\quad$ or $\quad$ $r = a \cos(n\theta)$

If n is odd, then the curve has "n" equally spaced petals.
If n is even, then the curve has "2n" equally spaced petals.




Four-petal rose

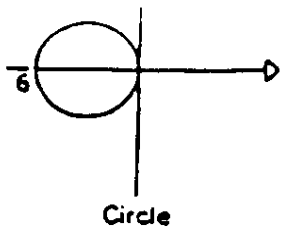



Three-petal rose

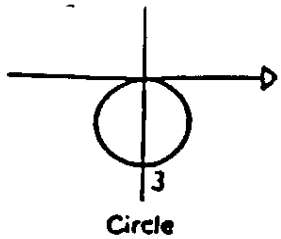
# Polar Curves -- Match the Graph with the Equation

| Polar Equations | | Answers |
|---|---|---|
| A) | $r = -6\cos\alpha$ | 1. A |
| B) | $r = 3(1 - \sin\alpha)$ | 2. O |
| C) | $r = 1 + 2\sin\alpha$ | 3. H |
| D) | $r = 3 - \cos\alpha$ | 4. V |
| E) | $r = -3 - 4\sin\alpha$ | 5. B |
| F) | $r^2 = \sin 2\alpha$ | 6. P |
| G) | $r = \sin 3\alpha$ | 7. I |
| H) | $2r = \cos\alpha$ | 8. W |
| I) | $r = 4 - 4\cos\alpha$ | 9. C |
| J) | $r = 4 + 3\cos\alpha$ | 10. Q |
| K) | $r = 5 + 3\sin\alpha$ | 11. J |
| L) | $r^2 = 9\cos 2\alpha$ | 12. X |
| M) | $r = \cos 2\alpha$ | 13. D |
| N) | $r = 9\sin 4\alpha$ | 14. R |
| O) | $r = -3\sin\alpha$ | 15. K |
| P) | $r = 2 + 2\cos\alpha$ | 16 Y |
| Q) | $r = 1 - 2\cos\alpha$ | 17. E |
| R) | $r = 2 + \sin\alpha$ | 18. S |
| S) | $r = 5 - 2\cos\alpha$ | 19. L |
| T) | $r^2 = -16\sin 2\alpha$ | 20. Z |
| U) | $r = 2\cos 3\alpha$ | 21. F |
| V) | $r = 1 + \sin\alpha$ | 22. T |
| W) | $r = -5 + 5\sin\alpha$ | 23. M |
| X) | $r = 3 + 2\sin\alpha$ | 24. AA |
| Y) | $r = 3 + 4\cos\alpha$ | 25. G |
| Z) | $r^2 = -9\cos 2\alpha$ | 26. U |
| AA) | $r = 3\sin 2\alpha$ | 27. N |
| BB) | $r = \cos 5\alpha$ | 28. BB |

1.




Circle

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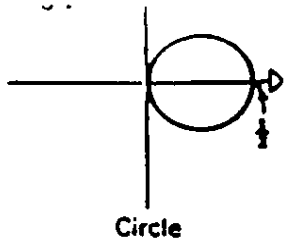


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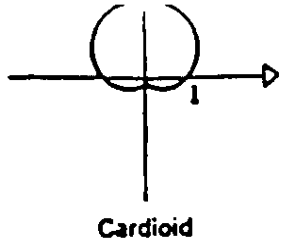


Cardioid

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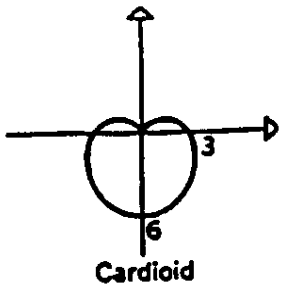


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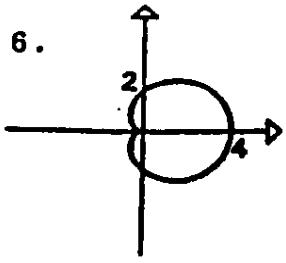


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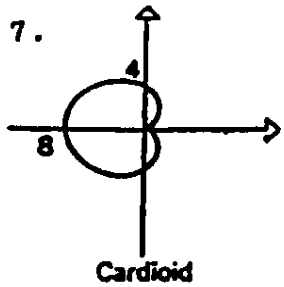


Cardioid

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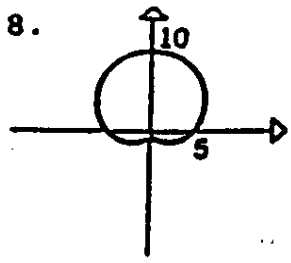


Cardioid

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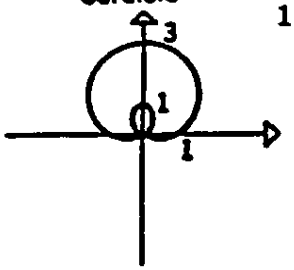


Limaçon

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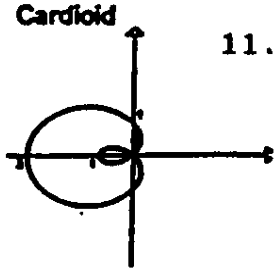

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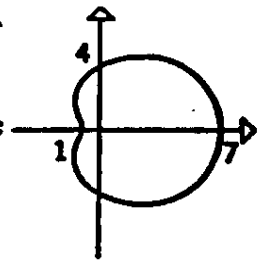


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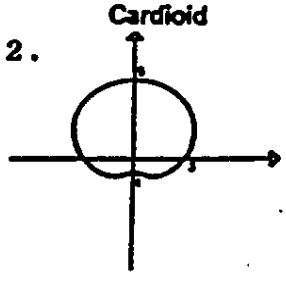

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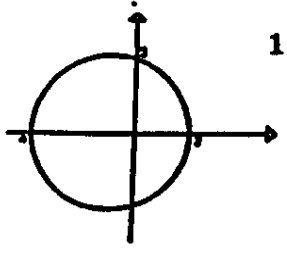

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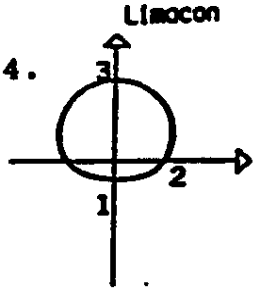


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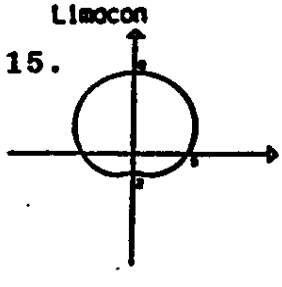

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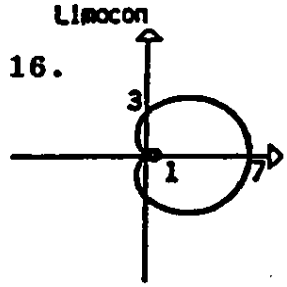


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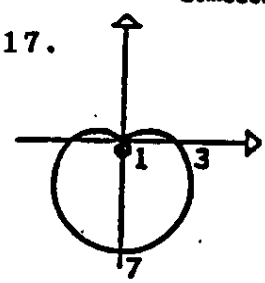


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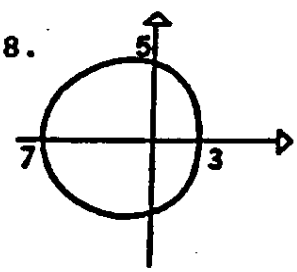


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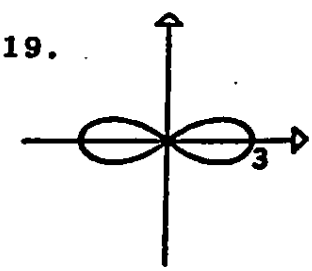
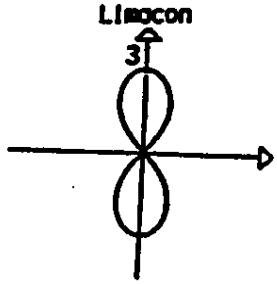



Lemniscate

20.

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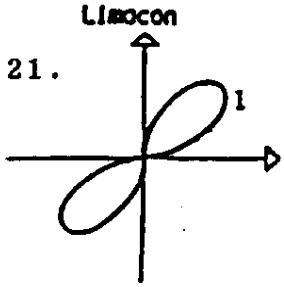


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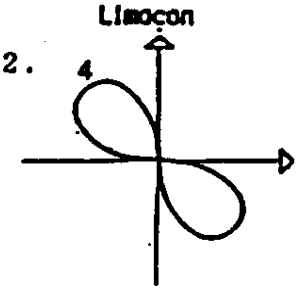


Lemniscate

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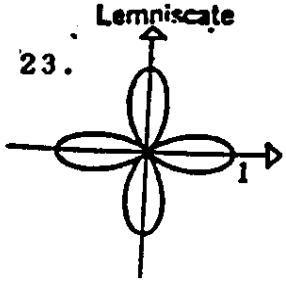
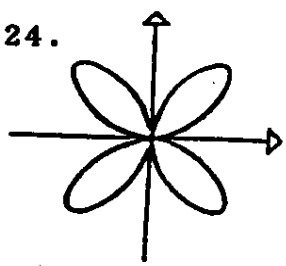



Four-petal rose

24.



Four-petal rose

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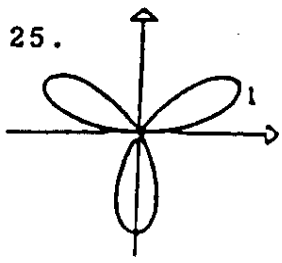
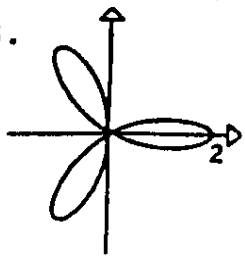



Three-petal rose

26.




Three-petal rose

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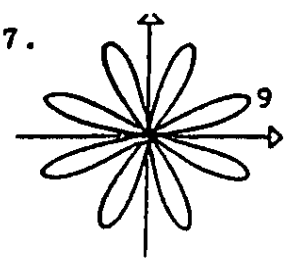


Eight-petal rose

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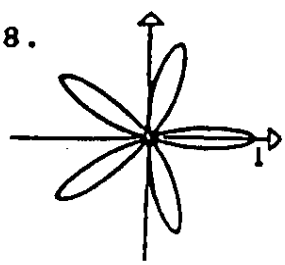


Five-petal rose