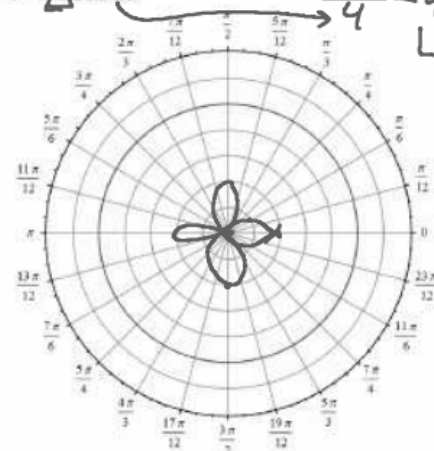


| θ | r |
|----------|-----|
| 0 | 2 |
| 45 | 0 |
| 90 | -2 |
| 30 | 1 |
| 60 | -1 |

Graph the following polar curve:

$$r = 2 \cos 2\theta$$

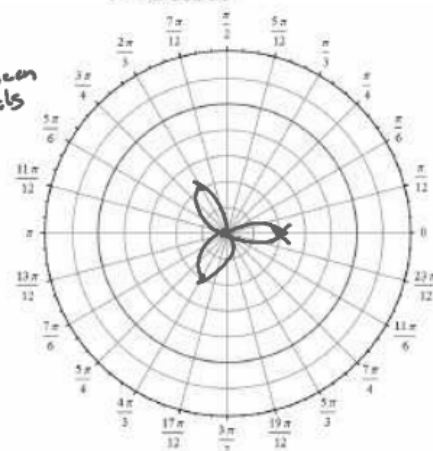
$\frac{360}{4} = 90^\circ$
Between Petals



1. What is the value of r when $\theta = 0$?
2. Divide 360 by the number of petals (first petal)
3. Add the number in part 2 until you get to 360 (tips of petals)

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

$$\frac{360}{3} = 120^\circ$$



1. What is the value of r when $\theta = 0$?
2. Divide 360 by the number of petals (first petal)
3. Add the number in part 2 until you get to 360 (tips of petals)

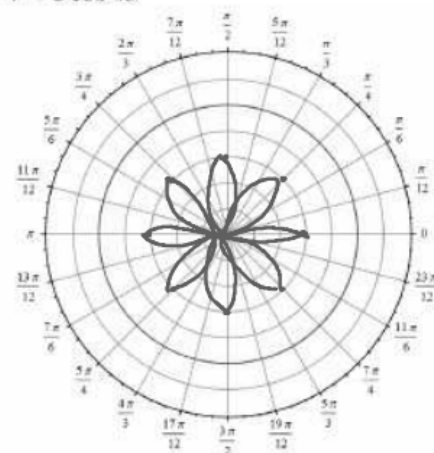
Graph the following polar curve:

$$r = 3 \cos 4\theta$$

$$r = 3$$

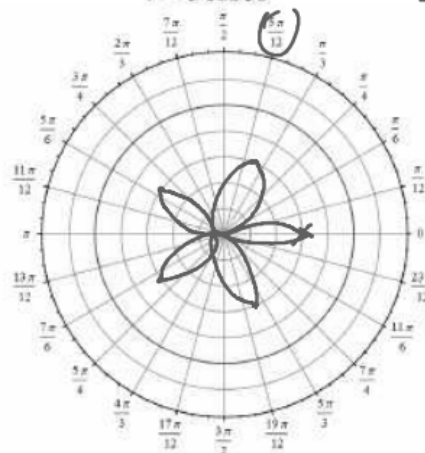
8-petals

$$\frac{360}{8} = 45^\circ$$



$$r = 3 \cos 5\theta$$

$$\frac{360}{5} = 72^\circ$$

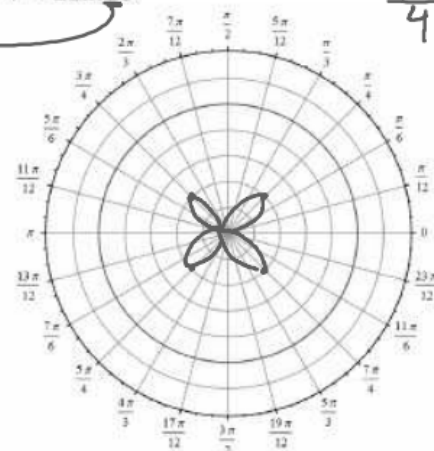


$\frac{90^\circ}{2} \rightarrow 45^\circ$
 We have 2 petals

Graph the following polar curve:

$$r = 2 \sin 2\theta$$

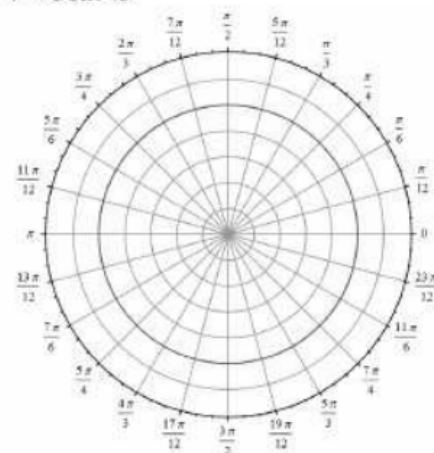
$$\frac{360}{4} = 90^\circ$$



1. What is the value of r when $\theta = 0$?
2. 90 divided by number in front of θ (First petal)
3. Divide 360 by the number of petals (distance between tips of petals)

Graph the following polar curve:

$$r = 3 \sin 4\theta$$

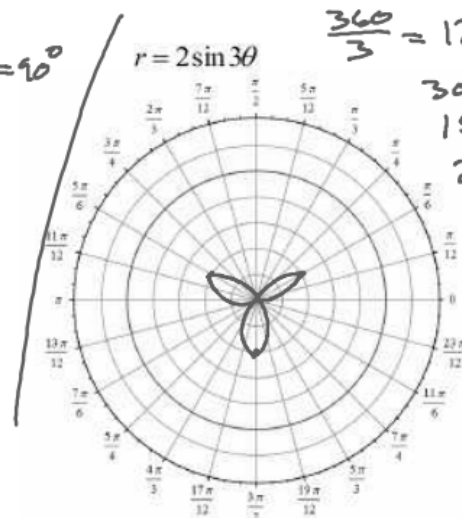


$$\frac{90}{3} = 30^\circ$$

$$\frac{360}{3} = 120^\circ$$

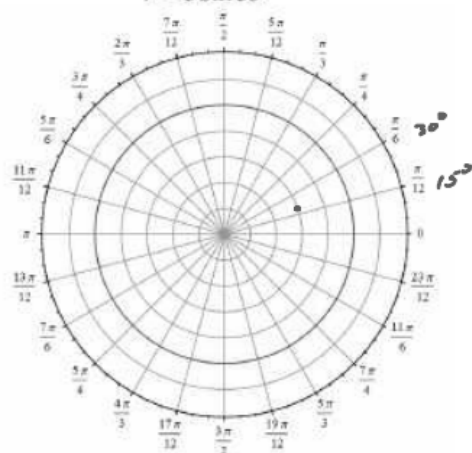
$$30^\circ, 150^\circ, 270^\circ$$

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



1. What is the value of r when $\theta = 0$?
2. 90 divided by number in front of θ (First petal)
3. Divide 360 by the number (distance between tips of petals)

$$r = 3 \sin 5\theta$$



Summary of the Rose: $r = \pm a \cos b\theta$

- For a polar equation to be considered a Rose, the value b must be greater than 1
- Plug in $\theta = 0$. This will give you the value of r and where you will start the the curve moving counterclockwise back to the pole.
- The value of a will tell you how far the furthest point away from the pole is (These occur at the tips of the rose petals)
- Divide 360 by the number of petals. Keep adding this number until you get back to 360. This will be where the tips of the petals are.
- If b is an odd number, that is the number of rose petals.
- If b is an even number, there are $2b$ number of rose petals.
- If b is negative the curve will be the same as if b is positive because cosine is an even function.
- If a is a negative number, the rose petal starts on the left side of the pole
- If a is a positive number, the rose petal starts on the right side of the pole

Summary of the Rose: $r = \pm a \sin b\theta$

- For a polar equation to be considered a Rose, the value b must be greater than 1
- Plug in $\theta = 0$. This will give you the value of r and where you will start the the curve moving counterclockwise out from the pole.
- The value of a will tell you how far the furthest point away from the pole is (These occur at the tips of the rose petals)
- Divide 90 by b . This will be where the end of the first petal is.
- Divide 360 by the number of petals. Keep adding this number to your first tip until you get back to 360. This will be the angles where the tips of the petals are.
- If b is an odd number, that is the number of rose petals.
- If b is an even number, there are $2b$ number of rose petals.
- If a and b are both positive or both negative the rose curve will open into the first quadrant.
- If a or b is negative the rose curve will open into the third quadrant, because sine is an odd function