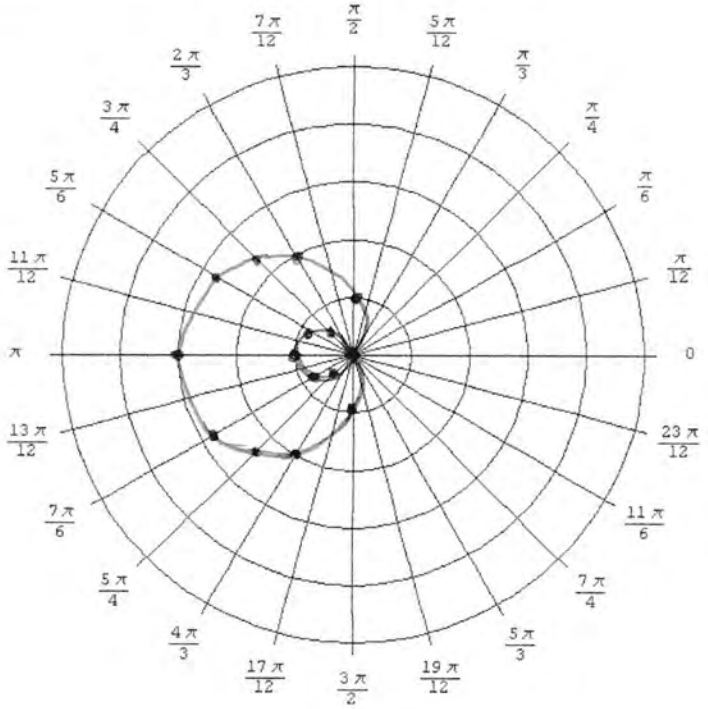
Sketch the polar graph $r = 1 - 2\cos\theta$ by first completing the table of $r-$values for the given list of $\theta-$values.
Give the exact value of $r$ in each case, as well as a decimal approximation to 1 decimal place. Use $\sqrt{2} \approx 1.4$ and $\sqrt{3} \approx 1.8$.
Then plot all 17 points, and connect with a **smooth curve** in increasing order of $\theta$.

| $\theta =$ | $r = 1 - 2\cos\theta$ **(exact value, may involve radicals)** | $r = 1 - 2\cos\theta$ (rounded to 1 decimal place) | $(r, \theta)$ |
|---|---|---|---|
| $0$ | $1 - 2\cos 0 = 1 - 2(1) = -1$ | $-1$ | $(-1, 0)$ |
| $\frac{\pi}{6}$ | $1 - 2\cos\frac{\pi}{6} = 1 - 2(\frac{\sqrt{3}}{2}) = 1 - \sqrt{3}$ | $-0.8$ | $(-0.8, \frac{\pi}{6})$ |
| $\frac{\pi}{4}$ | $1 - 2\cos\frac{\pi}{4} = 1 - 2(\frac{\sqrt{2}}{2}) = 1 - \sqrt{2}$ | $-0.4$ | $(-0.4, \frac{\pi}{4})$ |
| $\frac{\pi}{3}$ | $1 - 2\cos\frac{\pi}{3} = 1 - 2(\frac{1}{2}) = 0$ | $0$ | $(0, \frac{\pi}{3})$ |
| $\frac{\pi}{2}$ | $1 - 2\cos\frac{\pi}{2} = 1 - 2(0) = 1$ | $1$ | $(1, \frac{\pi}{2})$ |
| $\frac{2\pi}{3}$ | $1 - 2\cos\frac{2\pi}{3} = 1 - 2(-\frac{1}{2}) = 2$ | $2$ | $(2, \frac{2\pi}{3})$ |
| $\frac{3\pi}{4}$ | $1 - 2\cos\frac{3\pi}{4} = 1 - 2(-\frac{\sqrt{2}}{2}) = 1 + \sqrt{2}$ | $2.4$ | $(2.4, \frac{3\pi}{4})$ |
| $\frac{5\pi}{6}$ | $1 - 2\cos\frac{5\pi}{6} = 1 - 2(-\frac{\sqrt{3}}{2}) = 1 + \sqrt{3}$ | $2.8$ | $(2.8, \frac{5\pi}{6})$ |
| $\pi$ | $1 - 2\cos\pi = 1 - 2(-1) = 3$ | $3$ | $(3, \pi)$ |
| $\frac{7\pi}{6}$ | $1 - 2\cos\frac{7\pi}{6} = 1 - 2(-\frac{\sqrt{3}}{2}) = 1 + \sqrt{3}$ | $2.8$ | $(2.8, \frac{7\pi}{6})$ |
| $\frac{5\pi}{4}$ | $1 - 2\cos\frac{5\pi}{4} = 1 - 2(-\frac{\sqrt{2}}{2}) = 1 + \sqrt{2}$ | $2.4$ | $(2.4, \frac{5\pi}{4})$ |
| $\frac{4\pi}{3}$ | $1 - 2\cos\frac{4\pi}{3} = 1 - 2(-\frac{1}{2}) = 2$ | $2$ | $(2, \frac{4\pi}{3})$ |
| $\frac{3\pi}{2}$ | $1 - 2\cos\frac{3\pi}{2} = 1 - 2(0) = 1$ | $1$ | $(1, \frac{3\pi}{2})$ |
| $\frac{5\pi}{3}$ | $1 - 2\cos\frac{5\pi}{3} = 1 - 2(\frac{1}{2}) = 0$ | $0$ | $(0, \frac{5\pi}{3})$ |
| $\frac{7\pi}{4}$ | $1 - 2\cos\frac{7\pi}{4} = 1 - 2(\frac{\sqrt{2}}{2}) = 1 - \sqrt{2}$ | $-0.4$ | $(-0.4, \frac{7\pi}{4})$ |
| $\frac{11\pi}{6}$ | $1 - 2\cos\frac{11\pi}{6} = 1 - 2(\frac{\sqrt{3}}{2}) = 1 - \sqrt{3}$ | $-0.8$ | $(-0.8, \frac{11\pi}{6})$ |
| $2\pi$ | $1 - 2\cos 2\pi = 1 - 2(1) = -1$ | $-1$ | $(-1, 2\pi)$ |



Sketch the polar graph $r = 3 - 2\cos 2\theta$ by first completing the table of $r-$values for the given list of $\theta-$values.
Give the exact value of $r$ in each case, as well as a decimal approximation to 1 decimal place. Use $\sqrt{2} \approx 1.4$ and $\sqrt{3} \approx 1.8$.
Then plot all 17 points, and connect with a **smooth curve** in increasing order of $\theta$.

| $\theta =$ | $r = 3 - 2\cos 2\theta$ **(exact value, may involve radicals)** | $r = 3 - 2\cos 2\theta$ (rounded to 1 decimal place) | $(r, \theta)$ |
|---|---|---|---|
| $0$ | $3 - 2\cos 0 = 3 - 2(1) = 1$ | | $(1, 0)$ |
| $\frac{\pi}{6}$ | $3 - 2\cos\frac{\pi}{3} = 3 - 2(\frac{1}{2}) = 2$ | | $(2, \frac{\pi}{6})$ |
| $\frac{\pi}{4}$ | $3 - 2\cos\frac{\pi}{2} = 3 - 2(0) = 3$ | | $(3, \frac{\pi}{4})$ |
| $\frac{\pi}{3}$ | $3 - 2\cos\frac{2\pi}{3} = 3 - 2(-\frac{1}{2}) = 4$ | | $(4, \frac{\pi}{3})$ |
| $\frac{\pi}{2}$ | $3 - 2\cos\pi = 3 - 2(-1) = 5$ | | $(5, \frac{\pi}{2})$ |
| $\frac{2\pi}{3}$ | $3 - 2\cos\frac{4\pi}{3} = 3 - 2(-\frac{1}{2}) = 4$ | | $(4, \frac{2\pi}{3})$ |
| $\frac{3\pi}{4}$ | $3 - 2\cos\frac{3\pi}{2} = 3 - 2(0) = 3$ | | $(3, \frac{3\pi}{4})$ |
| $\frac{5\pi}{6}$ | $3 - 2\cos\frac{5\pi}{3} = 3 - 2(\frac{1}{2}) = 2$ | | $(2, \frac{5\pi}{6})$ |
| $\pi$ | $3 - 2\cos 2\pi = 3 - 2(1) = 1$ | | $(1, \pi)$ |
| $\frac{7\pi}{6}$ | $3 - 2\cos\frac{7\pi}{3} = 3 - 2(\frac{1}{2}) = 2$ | | $(2, \frac{7\pi}{6})$ |
| $\frac{5\pi}{4}$ | $3 - 2\cos\frac{5\pi}{2} = 3 - 2(0) = 3$ | | $(3, \frac{5\pi}{4})$ |
| $\frac{4\pi}{3}$ | $3 - 2\cos\frac{8\pi}{3} = 3 - 2(-\frac{1}{2}) = 4$ | | $(4, \frac{4\pi}{3})$ |
| $\frac{3\pi}{2}$ | $3 - 2\cos 3\pi = 3 - 2(-1) = 5$ | | $(5, \frac{3\pi}{2})$ |
| $\frac{5\pi}{3}$ | $3 - 2\cos\frac{10\pi}{3} = 3 - 2(-\frac{1}{2}) = 4$ | | $(4, \frac{5\pi}{3})$ |
| $\frac{7\pi}{4}$ | $3 - 2\cos\frac{7\pi}{2} = 3 - 2(0) = 3$ | | $(3, \frac{7\pi}{4})$ |
| $\frac{11\pi}{6}$ | $3 - 2\cos\frac{11\pi}{3} = 3 - 2(\frac{1}{2}) = 2$ | | $(2, \frac{11\pi}{6})$ |
| $2\pi$ | $3 - 2\cos 4\pi = 3 - 2(1) = 1$ | | $(1, 2\pi)$ |