

Polar Coordinates¹

1. Enter the following sequence of commands:

```
syms t
```

```
r = cos(4*t) ..... Use t in place of  $\theta$ .
```

```
ezplot(r*cos(t), r*sin(t), [0,2*pi])
```

This plots the polar equation $r = \cos 4\theta$. Explain why.

2. Using the pattern above, plot the polar equation $r = \sin(n\theta)$ for several positive integers n . (Use the \uparrow key.) Find a formula for the number of loops.
3. Plot the polar equation $r = \sin(p\theta/q)$ for various integers p and q , satisfying $p > q > 0$. Write p/q in lowest terms and plot over the interval $[0, 2\pi q]$. Find a formula for the number of loops.
4. Plot the polar equation $r = \sin(\sqrt{2}\theta)$ on the interval $[0, 100\pi]$. Explain the resulting plot.
5. Plot the polar equation $r = e^{\cos\theta} - 2\cos 4\theta + \sin^5(\theta/12)$ for $0 \leq \theta \leq 24\pi$. (This curve was discovered by Temple H. Fay.) What does the graph resemble? (Type: `exp(cos(t))` for $e^{\cos\theta}$ and `(sin(t/12))^5` for $\sin^5(\theta/12)$.)
6. On a separate piece of paper, prepare a brief written report describing what happened and answering all the questions. Use complete sentences and use standard mathematical notation. Hand-in sketches of graphs or computer plots as directed by your instructor.

Polar equations can be plotted by transforming them into parametric equations.

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