Parametric and Polar Curves
A Mathematica-Based Calculus Lab

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1. For each of the following parametric curves, first eliminate the parameter to find a Cartesian equation of the curve. Then sketch the curve and indicate with arrows the direction in which the curve is traced as the parameter increases. Check your work by using the Mathematica notebook `parametricanimation.nb`.

   (a) $x = \cos t$, $y = \sin t$, $0 \leq t \leq 2\pi$

   (b) $x = \cos 2t$, $y = \sin 2t$, $0 \leq t \leq 2\pi$

   (c) $x = \cos^2 t$, $y = \sin^2 t$, $0 \leq t \leq 2\pi$

   (d) $x = \cos t$, $y = \cos 2t$, $0 \leq t \leq 2\pi$

2. For each of the following polar curves, first try to sketch the curve by plotting points (r, θ) for several values of θ. Check your work by using the Mathematica notebook `polaranimation.nb`. (You should use t for θ in the Mathematica notebook.)

   (a) $r = \sin\theta$

   (b) $r = \sin 2\theta$

   (c) $r = 2\sin\theta$

   (d) $r = 4\sin 4\theta$

   (e) $r = \theta$

3. Use the Mathematica notebooks to find the craziest parametric and polar curves you can! Look at §11.1 #22 and §11.4 #56 for inspiration. The teams with the craziest curves in each category win 4 team contest points each!