Worksheet 21

28 March 2017

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1. **Warm up:** Convert the coordinates on the left to polar (r, θ) and the ones on the right to rectangular (x, y).

   (a) $(0, 0)$

   (b) $(1, 0)$

   (c) $(0, 1)$

   (d) $(1, 1)$

   (e) $(55, 78.2)$

   (f) $(0, 0)$

   (g) $(1, 0)$

   (h) $(0, \pi)$

   (i) $(1, \pi)$

   (j) $(41/7, 22\pi/3)$

2. Sketch the graph of $r = 1 + \sin 3\theta$ on the interval $0 \le \theta \le 2\pi$.

3. Express the following functions in the form $y = f(x)$ by eliminating the t parameter.

   (a) $x = t$
   $y = \tan^{-1}(t^3 + e^t)$

   (b) $x = t + 3$
   $y = 4t$

   (c) $x = e^{-2t}$
   $y = 6e^{4t}$

   (d) $x = t^2 - 4t + 5$
   $y = t - 2$

4. A particle is traveling around a circle of radius r whose shape is described by the parametric curve $c(t) = (x, y) = (r\cos(\omega t), r\sin(\omega t))$ for some constant ω, which indicates speed.

   (a) Find the value $\frac{dy}{dx}$ of the particle.

   (b) Find the value $\frac{d^2y}{dx^2}$ of the particle.

5. Consider the parametric curve $(x, y) = (\pi\sin(t + \pi), \sin(t))$.

   (a) What is the length of the curve from $t = 0$ to $t = \pi/2$?

   (b) Give the curve in rectangular coordinate form $y = f(x)$.

   (c) Give the curve $y = 5x$ as a parametric curve with $x = \sin(t)$.