Notecards Parametric & Polar		
1	How do you convert parametric equations to rectangular? $x(t) =$ $y(t) =$	Solve $x(t) =$ to be $t =$ Then plug $t =$ into $y(t)$
2	What is the slope of the tangent line in parametric?	$m = \frac{\Delta y}{\Delta x} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{y'(t)}{x'(t)}$
3	How do you find vertical tangent lines?	Set the bottom of the derivative equal to zero and solve for x
4	How do you find horizontal tangent line?	Set the top of the derivative equal to zero and solve for x
5	What is the formula for the 2nd derivative of a parametric? $\frac{d^2y}{dx^2} =$	$\frac{d^2y}{dx^2} = \frac{x'(t)y''(t) - y'(t)x''(t)}{[x'(t)]^3}$
6	How do you convert : A. Line through (a, b) with slope $= m$ B. Circle with radius $= r$ and center $(0,0)$ C. Circle with radius $= r$ and center (a, b) D. Ellipse $\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1$	A. $c(t) = (a + t, b + mt)$ B. $c(t) = (rcost, rsint)$ C. $c(t) = (a + rcost, b + rsint)$ D. . $c(t) = (acost, bsint)$
7	How do you convert rectangular functions to parametric function?	You can do one of two things: 1. You solve for $y =$ and you parametric is $(t, answer\ to\ y =)$ 2. You solve for $x =$ and your parametric is $(answer\ to\ x =, t)$ You pick the one that is the easiest to solve for.
8	What is the formula for the area of a parametric?	$Area = \int_{t_1}^{t_2} y(t) \cdot x'(t)dt$ $Area = \int_{lower\ limit}^{upper\ limit} [top - bottom] \cdot \frac{d}{dt}[right - left]dt$
9	What is the formula for arc length in rectangular of $f(x)$ over the interval from $[a, b]$	$\int_a^b \sqrt{1 + [f'(x)]^2}\ dx$

10	What is the formula for arc length in parametric of $(x(t), y(t))$ over the interval from $[a, b]$	$\int_a^b \sqrt{[x'(t)]^2 + [y'(t)]^2}\ dy$
11	How do you convert rectangular points into polar points? $(x, y) \rightarrow (r, \theta)$	Rectangular → Polar $(x, y) \rightarrow (r, \theta)$ $r = \sqrt{x^2 + y^2}$ $\theta = tan^{-1}\left(\frac{y}{x}\right)$ Make sure your θ is in the same quadrant as (x, y) If it is not add π to it.
12	How do you convert Polar points into Rectangular points? $(r, \theta) \rightarrow (x, y)$	Polar → Rectangular $(r, \theta) \rightarrow (x, y)$ $x = rcos\theta$ $y = rsin\theta$
13	How do you convert polar equations to rectangular equations?	Use the formulas $r = \sqrt{x^2 + y^2}$ $r^2 = x^2 + y^2$ $x = rcos\theta$ $y = rsin\theta$ Substitute these equations into the equations Solve for y if y is raised to the first power
14	How do you convert rectangular equations to polar equations?	Use the formulas $r = \sqrt{x^2 + y^2}$ $r^2 = x^2 + y^2$ $x = rcos\theta$ $y = rsin\theta$ Substitute these equations into the equations Solve for r
15	What is the formula for $\frac{dy}{dx}$ in polar?	$\frac{dy}{dx} = \frac{\frac{dr}{d\theta}sin\theta + rcos\theta}{\frac{dr}{d\theta}cos\theta - rsin\theta}$
16	What is the formula for Area of a Polar function?	$Area = \frac{1}{2}\int_{\theta_1}^{\theta_2} r^2\ d\theta$
17	What is the formula for the Area between two curves of polar functions?	$Area = \frac{1}{2}\int_{\theta_1}^{\theta_2} [f_2(\theta)]^2 - [f_1(\theta)]^2\ d\theta$ $Area = \frac{1}{2}\int_{\theta_1}^{\theta_2} [outside]^2 - [inside]^2\ d\theta$

18	What is the formula for the speed of a particle in parametric?	$$speed = \sqrt{[x'(t)]^2 + [y'(t)]^2}$$ Or $$speed = \sqrt{[v(x)]^2 + [v(y)]^2}$$ It is the magnitude of velocity
19	How do you know if a particle is speeding up or slowing down?	If the dot product of velocity and acceleration is positive then the particle is speeding up If the dot product of velocity and acceleration is negative then the particle is slowing down $v(t) = (x_1, y_1)$ $a(t) = (x_2, y_2)$ Dot product $= (x_1 \cdot x_2 + y_1 \cdot y_2)$
20	How do you find the total distance traveled over $a \leq t \leq b$	$$\int_a^b \sqrt{[v(x)]^2 + [v(y)]^2}$$