Calculus II
Spring 2004
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Midterm 1: Formula Sheet

1. Some useful antiderivatives:

$$\int \sec^2 x \; dx = \tan x + C \qquad \int \csc^2 x \; dx = -\cot x + C$$

$$\int \sec x \; dx = \ln|\sec x + \tan x| + C \qquad \int \csc x \; dx = \ln|\csc x - \cot x| + C$$

$$\int \sec x \tan x \; dx = \sec x + C \qquad \int \csc x \cot x \; dx = -\csc x + C$$

2. Triogonometry:
   - $\sin^2\theta + \cos^2\theta = 1, \quad 1 + \tan^2\theta = \sec^2\theta, \quad 1 + \cot^2\theta = \csc^2\theta$
   - $\cos^2\theta = \dfrac{1+\cos 2\theta}{2}, \quad \sin^2\theta = \dfrac{1-\cos 2\theta}{2}$
   - $\cos(\pi/6) = \sin(\pi/3) = \dfrac{\sqrt{3}}{2}, \quad \cos(\pi/3) = \sin(\pi/6) = \dfrac{1}{2}, \quad \cos(\pi/4) = \sin(\pi/4) = \dfrac{\sqrt{2}}{2}$
3. Transforming polar to rectangular (Cartesian) coordinates: $x = r\cos\theta$, $y = r\sin\theta$
4. Area in polar coordinates: $dA = \dfrac{1}{2}r^2 d\theta$
5. Arc length:
   - For a parametric curve $(x(t), y(t))$: $d\ell = \sqrt{\left(\dfrac{dx}{dt}\right)^2 + \left(\dfrac{dy}{dt}\right)^2}\, dt$
   - For the graph of a function $y(x)$: $d\ell = \sqrt{1 + \left(\dfrac{dy}{dx}\right)^2}\, dx$
   - For a polar graph $r(\theta)$: $d\ell = \sqrt{r^2 + \left(\dfrac{dr}{d\theta}\right)^2}\, d\theta$
6. Complex exponentials: $e^{i\theta} = \cos\theta + i\sin\theta$