

MA 114 Worksheet #25: Calculus with polar coordinates

- Find dy/dx for the following polar curves.
 - $r = 2 \cos \theta + 1$
 - $r = 1/\theta$
 - $r = 2e^{-\theta}$
- In each of the following, compute the slope of the tangent line at the given point. Then sketch the curve and the tangent line.
 - $r = \sin \theta$ at $\theta = \pi/3$.
 - $r = 1/\theta$ at $\theta = \pi/2$.
- Give the formula for the area of region bounded by the polar curve $r = f(\theta)$ from $\theta = a$ to $\theta = b$. Give a geometric explanation of this formula.
 - Give the formula for the length of the polar curve $r = f(\theta)$ from $\theta = a$ to $\theta = b$.
 - Use these formulas to establish the formulas for the area and circumference of a circle.
- Find the slope of the tangent line to the polar curve $r = \theta^2$ at $\theta = \pi$.
- Find the point(s) where the tangent line to the polar curve $r = 2 + \sin \theta$ is horizontal.
- Find the area enclosed by one leaf of the curve $r = \sin 2\theta$.
- Find the arc length of the curve $r = 5^\theta$ for $\theta = 0$ to $\theta = 2\pi$.
- Find the area of the region bounded by $r = \cos \theta$ for $\theta = 0$ to $\theta = \pi/4$.
- Find the area of the region that lies inside both the curves $r = \sqrt{3} \sin \theta$ and $r = \cos \theta$.
- Find the area in the first quadrant that lies inside the curve $r = 2 \cos \theta$ and outside the curve $r = 1$.
- Find the length of the curve $r = \theta^2$ for $0 \leq \theta \leq 2\pi$.
- Write down an integral expression for the length of the curve $r = \sin \theta + \theta$ for $0 \leq \theta \leq \pi$ but do not compute the integral.