

Tangents with Parametric Curves

1. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for $x = 5t^2 - t$, $y = 8t^3 + 9t^2 - t$.

2. Find the equation of the tangent line to the given parametric curve at the point corresponding to the given value of the parameter.

$$x = t \cos\left(\frac{\pi}{2}t\right), \quad y = t^2 - 3 \quad \text{at } t = 4$$

3. Find the equation of the tangent(s) to the curve at the given point.

$$x = 3 - e^{t^2+2t}, \quad y = t^3 - 2t^2 - 8t + 4 \quad \text{at } (2, 4)$$

Arc Length with Parametric Curves

4. Find the distance traveled by a particle that travels along the path given by the parametric curve below and compare this to the length of the curve. All work for this problem must be done with parametric equations.

$$x = 4 - 2 \cos^2(4t), \quad y = 2 \sin(4t), \quad -3\pi \leq t \leq 20\pi$$

Surface Area with Parametric Equations

5. Set up, but do not evaluate, the integral that will give the surface area of the solid obtained by rotating the parametric curve below about the y -axis. You may assume that the curve makes one trace for the given range of t 's.

$$x = t \cos(4t), \quad y = t^2 + 6t \quad 0 \leq t \leq 4$$

Polar Coordinates

6. Convert $\cos^2\left(\frac{\theta}{2}\right) = r$ in an equation in Cartesian coordinates.

7. Sketch the graph of $r = 1 - 4 \cos \theta$.

8. Sketch the graph of $r = -15 \sin \theta$.

Area with Polar Coordinates

Note that for these problems you'll probably need a calculator to find the integration limits.

9. Find the area inside the inner loop of $r = 1 - 4 \cos \theta$.

10. Find the area of the region that lies inside $r = 4 \sin \theta$ and outside $r = 2 - \sin \theta$.

11. Find the area that lies inside both $r = 4 \sin \theta$ and $r = 2 - \sin \theta$.