

Will's Guide To Life, Volume 3

Math 230, Fall 2005

1 Section 6.4

Arc length of a smooth curve in the plane. $s = \int \sqrt{(dx)^2 + (dy)^2}$ How to change this into something you can integrate in terms of x or y . Surface area of revolution, noting that revolving around the x -axis gives you an integral in terms of y and revolving around the y -axis gives you an integral in terms of x . $A = \int t ds$ where t is either x or y depending on which axis you are revolving around.

2 Section 8.1

The idea of how to solve a “nice” differential equation by putting all the x terms together on one side, the y terms together on the other side and integrating. Using initial values to solve exactly, not having to settle for some function $+C$. The Natural Growth Equation, and its many applications. Torricelli's law, $\frac{dy}{dt}$ is proportional to \sqrt{y} .

3 Section 9.1

The basic ideas behind conic sections. What you can tell from the general equation for any conic section, $Ax^2 + By^2 + Cx + Dy + E = 0$. The distance formula and the general equation for a circle centered at (h, k) with radius r .

4 Section 9.2

Polar Coordinates. How to switch back and forth from Polar to Rectangular Coordinates. $x = r \cos \theta$, $y = r \sin \theta$, $r^2 = x^2 + y^2$, $\theta = \tan^{-1}(\frac{y}{x})$. Sketching the “nicer” polar graphs, a circle centered at $(a, 0)$ or $(0, a)$, a cardioid, a line through the origin, a limaçon.

5 Section 9.3

Area in Polar Coordinates. $A = \frac{1}{2} \int r^2 d\theta$. The real challenge is figuring out what your limits of integration are. Area between two curves in polar.

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6 Section 9.4

Parametric Curves. How to eliminate the parameter, and get an equation in terms of x 's and y 's. Sketching a parametric curve. Finding tangent lines to a parametric curve. $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$. $\frac{d^2y}{dx^2} = \frac{1}{\frac{dx}{dt}} \frac{d}{dt} \left(\frac{dy}{dx} \right)$.

7 Section 9.5

Integrals with Parametric Equations. Put formulas for area, surface area, arc length, volume etc. in terms of t rather than x and y . The only real trick is $ds = \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2} dt$.

8 Section 9.6

Basic Ideas of the Conic Sections. The idea of focus, directrix, and eccentricity.

For more detailed information on these topics, please go to:
<https://netfiles.uiuc.edu/wgreen4/www>