**Math 128 : Calculus 2 for the Sciences** **Winter 2016**

Lecture 12: January 29, 2016

*Lecturer: Jen Nelson* *Notes By: Harsh Mistry*

## 12.1 Arc Length Example

**Example 12.1** *Determine the length of the of* $x = \frac{2}{3}(y^2+1)^{\frac{3}{2}}$ *from y = -2 to y = 1*

$$\begin{aligned} L = \int_{-2}^{1} \sqrt{1 + (2y(y^2+1)^{\frac{1}{2}})^2} dy &= \int_{-2}^{1} \sqrt{1 + 4y^2(y^2+1)} dy \\ &= \int_{-2}^{1} \sqrt{1 + 4y^4 + 4y^2} dy \\ &= \int_{-2}^{1} \sqrt{(2y^2+1)^2} dy \\ &= \int_{-2}^{1} (2y^2+1) dy \\ &= \left[\frac{2}{3}y^3 + y\right]_{-2}^{1} \\ &= 9 \end{aligned}$$

## 12.2 Area of Surface of Revolution

Formula :
about x - axis : SA $= \int 2\pi y ds$ where $ds = \sqrt{1 + (\frac{dy}{dx})^2} dx$ if $y = f(x), a \leq y \leq b$
about y - axis : SA $= \int 2\pi x ds$ where $ds = \sqrt{1 + (\frac{dx}{dy})^2} dy$ if $x = g(y), c \leq y \leq d$

**End of Lecture Notes**
**Notes By : Harsh Mistry**