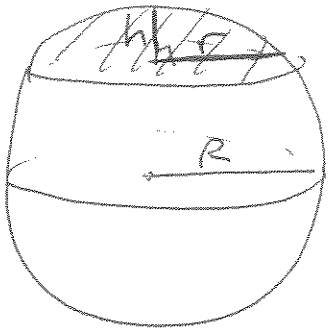
Surface Area of Spherical Cap, of depth h



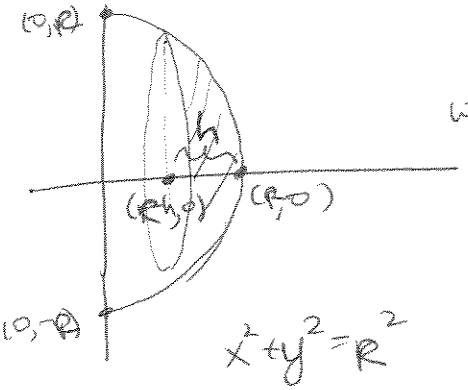
$$SA_{cap} = \frac{h}{2R}(4\pi R^2) = 2\pi Rh$$

(geometric argument)

Using Calculus!

$$SA = 2\pi \int_{R-h}^{R} y \, ds$$

w/ $$ds = \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$



$$x^2 + y^2 = R^2$$

in Quadrant 1, $y = \sqrt{R^2 - x^2}$

$$\frac{dy}{dx} = \frac{-2x}{2\sqrt{R^2-x^2}} = \frac{-x}{\sqrt{R^2-x^2}}$$

$$\sqrt{1 + \left(\frac{dy}{dx}\right)^2} = \sqrt{1 + \frac{x^2}{R^2-x^2}}$$

$$= \frac{R}{\sqrt{R^2-x^2}}$$

$$SA = 2\pi \int_{R-h}^{R} \sqrt{R^2-x^2}\left(\frac{R}{\sqrt{R^2-x^2}}\right) dx$$

$$= 2\pi R \int_{R-h}^{R} dx$$

$$= 2\pi R(R-(R-h))$$

$$= 2\pi R(h) = 2\pi Rh \;//$$