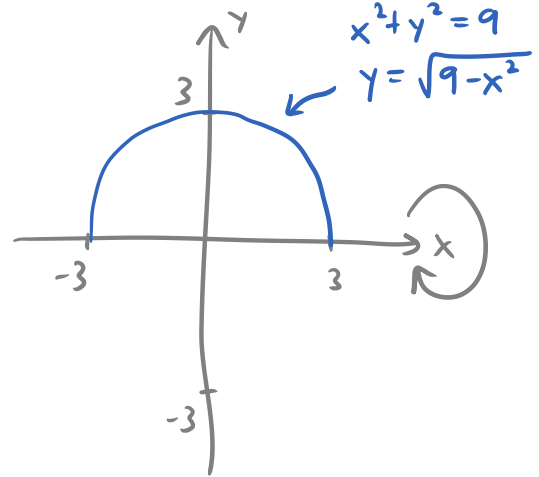


1. Find the surface area of a sphere with radius 3 using calculus. (Hint: Spin a semi-circle with radius 3 about the  $x$ -axis. Remember that the equation for the relevant circle here is  $x^2 + y^2 = 3^2$ .) You can check that you got the answer correct by using the formula for the surface area of a sphere,  $S = 4\pi r^2$ .

$$S = \int_{-3}^3 2\pi y \sqrt{1 + \left(\frac{dy}{dx}\right)^2} dx$$

$\int_{\text{Int. wrt } x}$   
 $\downarrow$  about  $x$ -axis

$$\frac{dy}{dx} = \frac{1}{2}(9-x^2)^{-\frac{1}{2}} \cdot (-2x) = \frac{-x}{\sqrt{9-x^2}}$$



$$= \int_{-3}^3 2\pi \sqrt{9-x^2} \sqrt{1 + \left(\frac{-x}{\sqrt{9-x^2}}\right)^2} dx$$

$$= \int_{-3}^3 2\pi \sqrt{9-x^2} \sqrt{1 + \frac{x^2}{9-x^2}} dx$$

$$= \int_{-3}^3 2\pi \sqrt{(9-x^2)\left(1 + \frac{x^2}{9-x^2}\right)} dx$$

$$= \int_{-3}^3 2\pi \sqrt{9 - \cancel{x^2} + \cancel{x^2}} dx$$

$$= \int_{-3}^3 6\pi dx$$

$$= 6\pi x \Big|_{-3}^3$$

$$= 18\pi - (-18\pi)$$

$$= \boxed{36\pi}$$

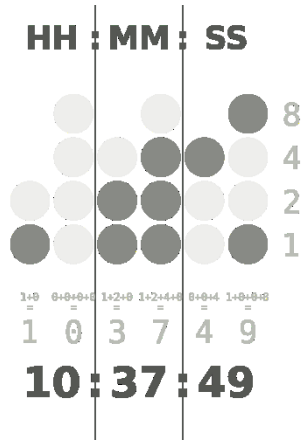
Check:

$$S = 4\pi r^2$$

$$= 4\pi(3)^2$$

$$= 36\pi \checkmark$$

There are 10 kinds of people in the world: those who understand binary, and those who don't.



Time Technology Samui Moom