Math Refresher

Sphere:

$$V = \frac{4\pi}{3} R^3 , \quad S = 4\pi R^2 \;\Rightarrow\; V(S) .$$

Calculator: Trivial.

Zeros of quadratic equation:

$$x^2 + p\,x + q = 0 \;\Rightarrow\; x = x_{1,2} = -\frac{p}{2} \pm \sqrt{\left(\frac{p}{2}\right)^2 - q} .$$

Extrema:

$$2\,x + p = 0 .$$

Right triangle Pythagoras, angles:

$$a^2 + b^2 = c^2 , \quad \alpha = \mathit{arccos}(a/c) , \quad \beta = \mathit{arccos}(b/c) .$$

Arc length from figure: Read of $x = 0.8,\ y = 7.5$. Pythagoras:

$$r = \sqrt{x^2 + y^2} \;\Rightarrow\; \cos\theta = \frac{x}{r} , \quad \theta = \mathit{arccos}(\cos\theta) , \quad s = \theta\, r .$$

Math Refresher

Derivative and integral for polynomials (Leibniz 1675):

$$\frac{dx^n}{dx} = n\,x^{n-1}\,, \qquad \int dx\,x^n = \frac{x^{n+1}}{n+1} + \mathit{constant}\,.$$

Swing height:

$$\cos\alpha = \frac{L - \triangle y}{L}\,.$$

Kinematics velocity, acceleration:

$$v = \dot{x} = \frac{dx}{dt}\,, \qquad a = \dot{v} = \frac{dv}{dt} = \ddot{x} = \frac{d^2x}{dt^2}\,.$$