2nd Year
Mechanics of Materials (Material Strength)

T.D N° 1 (Area Calculus)

Differential Element.

- Select an appropriate coordinate system, specify the coordinate axes, and then choose a differential element for integration.
- For areas the differential element is generally a *rectangle* of area dA, having a finite length and differential width.
- Locate the element so that it touches the arbitrary point (x, y) on the curve that defines the boundary of the shape.

Size and Moment Arms.

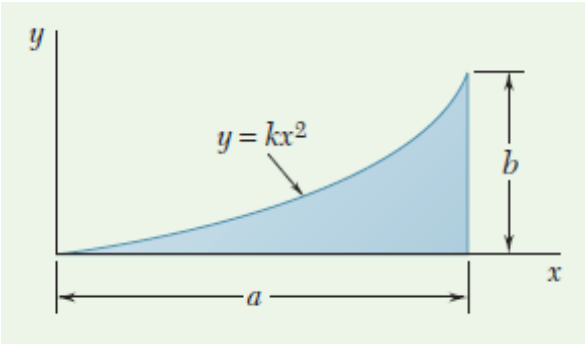
- Express the area dA or volume dV of the element in terms of the coordinates describing the curve.

Integrations.

- Express the function in the integrand in terms of the same variable as the differential thickness of the element.
- The limits of the integral are defined from the two extreme locations of the element's differential thickness, so that when the elements are "summed" or the integration performed, the entire region is covered.*

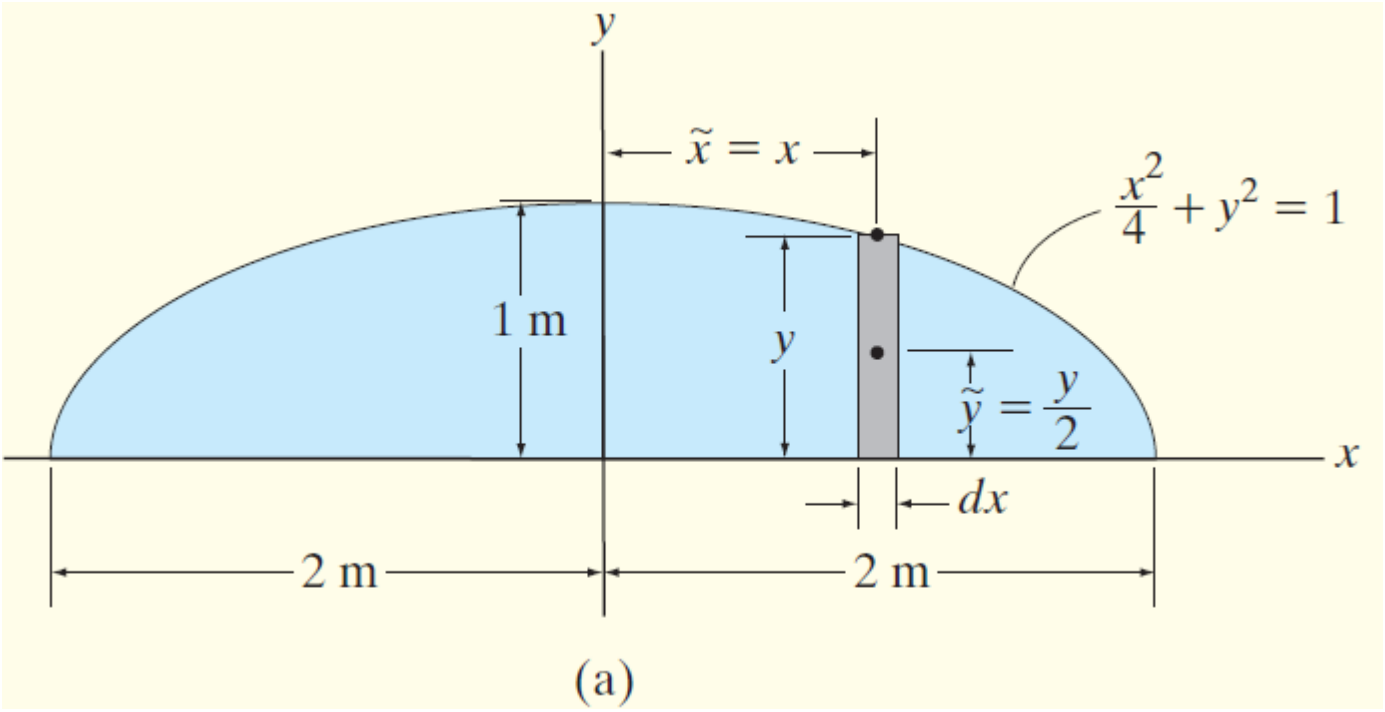
Exercise 1:

Determine the Area using both horizontal and vertical differential element. (k = 1, a = 1 m, b = 1 m)

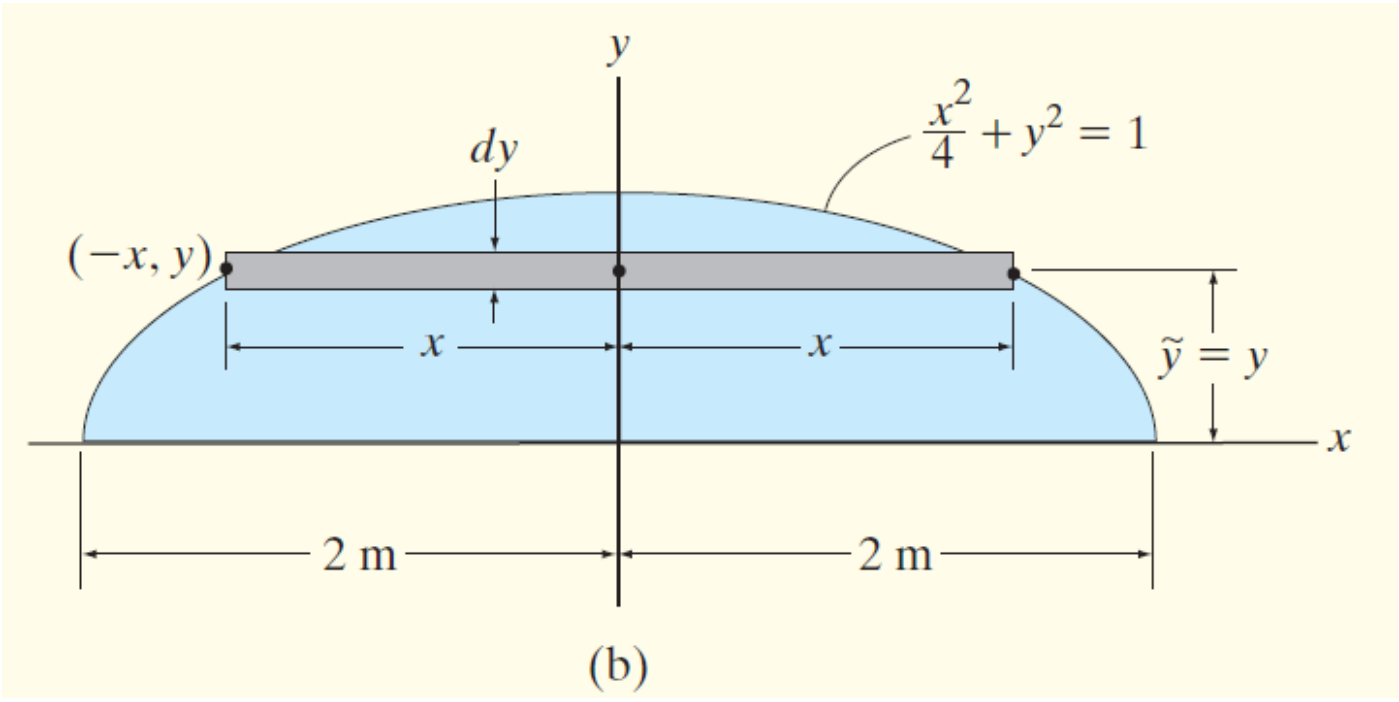


Exercice 2 :

Determine the Area using both horizontal and vertical differential element.



(a)



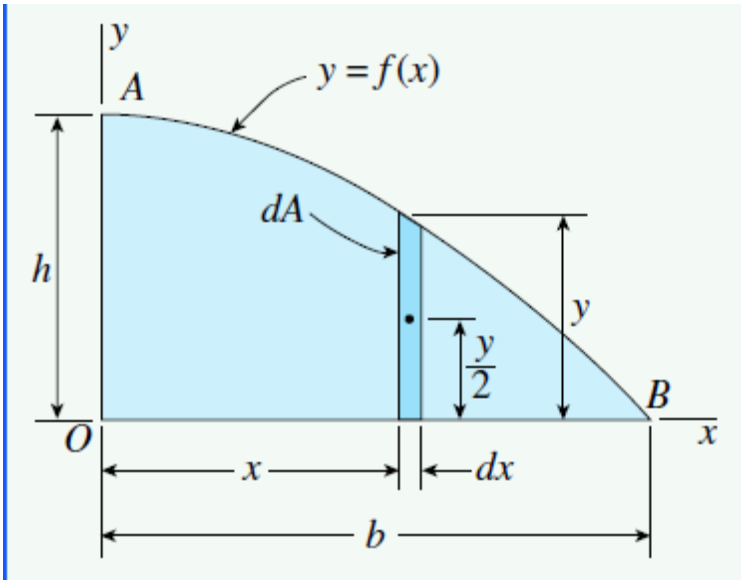
(b)

Exercice 3 :

A parabolic semi-segment *OAB* is bounded by the *x* axis, the *y* axis, and a parabolic curve having its vertex at *A*. The equation of the curve is :

$$y = f(x) = h\left(1 - \frac{x^2}{b^2}\right)$$

in which *b* is the base and *h* is the height of the semi-segment. Determine the Area using a vertical differential element.



Exercise 4 :

Determine the Area of the triangle using a horizontal differential element.