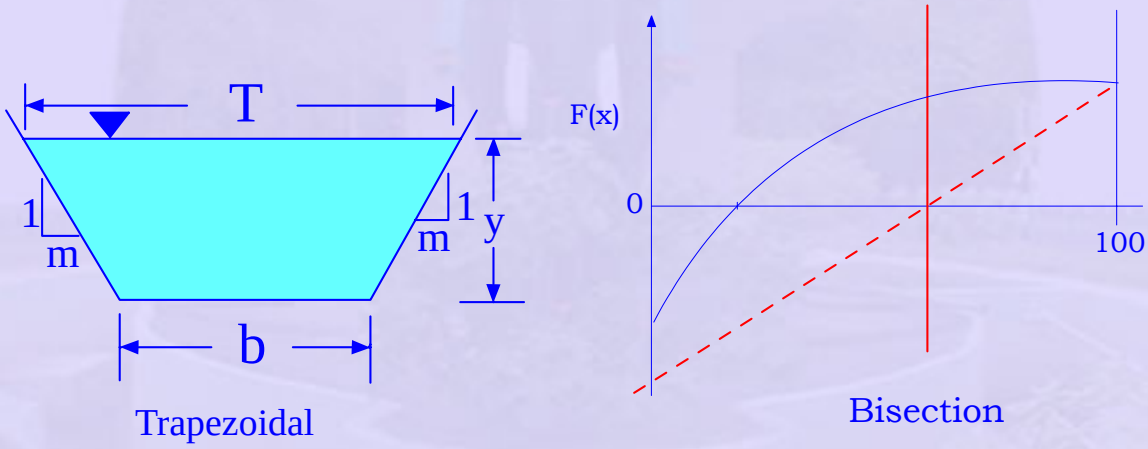
19.3 Solution of Algebraic or Transcendental Equation by the Bisection Method

In the algebraic expression F (x) = 0, when a range of values of x is known that contains only one root, the bisection method is a practical way to obtain it. It is best shown by an example.

The critical depth in a trapezoidal channel is to be computed for given discharge Q and the dimensions of the channel. The corresponding equation is $1-\frac{Q^2T}{gA^3}=0$ must be satisfied by some positive depth y_c greater than 0 and less than an upper bound say 100 m. T is the top width given by ($b + 2 my_c$). The interval is bisected and this value of y_c tried. If the value of F is positive, as with the solid line shown in figure, then the root is less than the midpoint and the upper limit is moved to the midpoint and the remaining half bisected and the procedure is repeated.



Similarly it could be used for obtaining uniform flow depth using the following equation.

$$Q = \frac{1}{n} AR^{\frac{2}{3}} \sqrt{S_0}$$

$$Q - \frac{1}{n} AR^{\frac{2}{3}} \sqrt{S_0} = 0$$

$$\frac{nQ}{\sqrt{S_0}} - AR^{\frac{2}{3}} = 0$$