$$= nh\left[y_0 + \frac{n}{2}\Delta y_0 + \frac{n(2n-3)}{12}\Delta^2 y_0 \ldots\ldots\right] \quad \ldots\ldots\ldots\ldots\ldots\ldots(4.1)$$

This is general formula is known as Newton-cote's Formula.

4.5.2 Trapezoidal Formula (composite)(n = 1)

Putting $n = 1$ in formula (4.1) and taking the curve through (x_o, y_o) and (x_1, y_1) as a polynomial of degree o
so that differences of order higher than one vanish, we get,

$$\int_{x_0}^{x0+h} f(x)dx = h\left[y_0 + \frac{1}{2}\Delta y_0\right]$$

$$= \frac{h}{2}[2y_0 + (y_1 - y_0)]$$

$$= \frac{h}{2}[y_0 + y_1]$$

Similarly, for the next interval (x_0-h, x_0+2h), we get,

$$\int_{x_0+h}^{x_0+2h} f(x)dx = \frac{h}{2}[y_1 + y_2]$$

… … … … … …

$$\int_{x_0+(n-1)h}^{x_0+nh} f(x)dx = \frac{h}{2}(y_{n-1} + y_n)$$

Adding the above integrals, we get;

$$\int_{x_0}^{x_0+nh} f(x)dx = \frac{h}{2}[(y_0 + y_n) + 2(y_1 + y_2 + \ldots\ldots\ldots + y_{n-1})]$$

$= \frac{h}{2}$ [(Sum of first and last terms) + 2 × (Sum of all intermediate ordinate)]

which is known as composite trapezoidal rule.

4.5.3 Geometrical Interpretation of Trapezoidal Formula

The area of shaded region bounded by the curve $y = f(x)$, x – axis, and the lines $x = a$ and $x = b$ represents th
trapezoidal formula for the integral given by $\int_a^b f(x)dx = \frac{h}{2}[y_0 + y_1]$ formula. This formula replaces the cu