$$\mathcal{D}\left(x, y, y^{(1)}, \ldots, y^{(n)}\right) = 0, x \in \Omega = [0,1] \subset R B(y) = 0, x \in \partial\Omega = \{0,1\} \tag{1}$$

$\mathcal{D}(\ldots)$
$B(y)$
$\{ D\ (y) = 0, x \in \partial\Omega_D = \{0,1\}$
$N(y) = 0, x \in \partial\Omega_N = \{0,1\}$
$\partial\Omega_N \cup \partial\Omega_D = \partial\Omega$
$D(y)$
$\partial\Omega_D$
$\partial\Omega_N$
?
?
$^2 y(x) + 2y = sin(2x)\left(1 - 2sin(2x)\right), x \in [0,1]$
$y(0) = 0, ddxy\Big|_{x=0} = 1$
$y = 12sin(2x)$

$$y_h = \phi_0 + \sum_{i=1}^{N} a_i \phi_i(x) \tag{2}$$

$\phi_0$
$\phi_0 :$
$B(\phi_0) = 0 \phi_0(0) = 0, \phi_0(1) = 1$
$\phi_i$
$\phi_i(0) = \phi_i(1) = 0$
$\min_{a_1, \ldots, a_n} R(a_1, \ldots, a_n) = \int_\Omega \mathcal{D}(y_h) d\Omega + \int_{\partial\Omega_N} N(y_h) d\partial\Omega$
?
$R$
$\int_\Omega w R(a_1, \ldots, a_n) d\Omega = \int_\Omega w \mathcal{D}(y_h) d\Omega + \int_{\partial\Omega_N} w N(y_h) d\partial\Omega = 0$
$w = \psi_i$
$phi_0$
$\int_\Omega \psi_j R(a_1, \ldots, a_n) d\Omega = \int_\Omega \psi_i \mathcal{D}\left(\sum_{i=1}^N a_i \phi_i(x)\right) d\Omega + \int_{\partial\Omega} \psi_j B\left(\sum_{i=1}^N a_i \phi_i(x)\right) d\partial\Omega =$
$= \int_\Omega \psi_j \mathcal{D}\left(\sum_{i=1}^N a_i \phi_i(x)\right) d\Omega + \int_{\partial\Omega} \psi_j B\left(\sum_{i=1}^N a_i \phi_i(x)\right) d\partial\Omega = if$
$arelinearoperators =$
$= \int_\Omega \sum_{i=1}^N a_i \psi_j \mathcal{D}(\phi_i(x)) d\Omega + \int_{\partial\Omega} \sum_{i=1}^N a_i \psi_j B(\phi_i(x)) d\partial\Omega = 0$
$a_i$
$w$

$$w = \delta(x - x_k), x_k \in X \subset \Omega, and \|X\| = K, \int_\Omega \delta(x - x_k) R(a_1, \ldots, a_n) d\Omega = \int_\Omega \delta(x - x_k) \mathcal{D}\left(\sum_{i=1}^N a_i \phi_i(x)\right) d\Omega + + \int_{\partial\Omega} \delta(x - x_k) \tag{3}$$

$$dydx\Big|_{x=x_i} = y(x_i) - y(x_{i-1}) x_i - x_{i-1} \tag{4}$$