$\textsc{mod}(v, d)\colon \mathbb{Z}, \mathbb{Z} \to \mathbb{Z}$

$res = (v + d) \mod d$

return (res)

$\textsc{simps}(f, h)\colon \mathbb{R}^1, \mathbb{R}^1 \to \mathbb{R}^1$

$r \in \mathbb{R}^2_{100,80}$

$n = \textsc{shape}(f)_0$

$undef = \mathfrak{G}^{\mathrm{DROP}([1], \mathrm{SHAPE}(f))}\, 0.0$

$$r_i \mid i \in [0, n-1] = \begin{cases} \dfrac{11.0 \cdot f_0 + 14.0 \cdot f_1 - f_2}{24.0} & i = 0 \\ \dfrac{f_{i-1} + 4.0 \cdot f_i + f_{i+1}}{3.0} & 1 \leq i \leq n-2 \\ undef & \textbf{otherwise} \end{cases}$$

$rs = r_2$

$r_2 = r_1$

$r_1 = r_0$

$r_0 = undef$

$r_i^{[i]} = r_{i-2}^{[i-2]} + rs^{[i-1]}$

$rs^{[i]} = r_{i-1}^{[i-1]}$

$\textbf{filter}(r^{[i]} \mid i = n-1)$

return $(r \cdot h)$

$\mathrm{N}(u, dx, dy)$: $\mathbb{R}^2, \mathbb{R}^1, \mathbb{R}^1 \to \mathbb{R}^2$

$$undef = \mathfrak{G}^{\text{DROP}([1],\text{SHAPE}(u))}\, 0.0$$

$$z_{i,j} \mid [i, j : 0 \leq i \leq s_0 \wedge 0 \leq j \leq s_1] = \begin{cases} \dfrac{u_{i,j+1} - 2.0 \cdot u_{i,j} + u_{i,s_1-1}}{dy \cdot dy} & [i, j : 0 \leq i \leq s_0 \wedge 0 \leq j \leq 1] \\ \dfrac{u_{i,j+1} - 2.0 \cdot u_{i,j} + u_{i,j-1}}{dy \cdot dy} & [i, j : 0 \leq i \leq s_0 - 1 \wedge 0 \leq j \leq s_0 \\ \dfrac{u_{i,0} - 2.0 \cdot ui, j + ui, j - 1}{dy \cdot dy} & [i, j : 0 \leq i \leq s_0 \wedge s_1 - 1 \leq j \leq s \\ 0.0 & \textbf{otherwise} \end{cases}$$

$$du_i \mid i \in [0, \text{TAKE}([1], s)] = \begin{cases} \dfrac{u_{i+1} - u_{i-1}}{2.0 \cdot dx} & 1 \leq i \leq s_0 - 2 \\ undef & \text{otherwise} \end{cases}$$

$$du_0 = \frac{u_1 - u_0}{dx}$$

$$du_{s_0-1} = \frac{u_{s_0-1} - u_{s_0} - 2}{dx}$$

return $(3.0 \cdot \text{SIMPS}(z, dx) - 6.0 \cdot u \cdot du)$

$\mathrm{L}(u, dx)$: $\mathbb{R}^1, \mathbb{R}^1 \to \mathbb{R}^1$

$$undef = \mathfrak{G}^{\text{DROP}([1],\text{SHAPE}(u))}\, 0.0$$

$$s = \text{SHAPE}(u)_0$$

$$z_i \mid i \in [0, \text{TAKE}([1], \text{SHAPE}(u))] = \begin{cases} -\dfrac{u_{i+2} - 2.0 \cdot u_{i+1} + 2.0 \cdot u_{i-1} - u_{i-2}}{2.0 \cdot dx \cdot dx \cdot dx} & 2 \leq i \leq s - 3 \\ undef & \textbf{otherwise} \end{cases}$$

$$z_0 = -\frac{u_0 - 2.0 \cdot u_1 + u_2}{dx \cdot dx \cdot dx}$$

$$z_1 = -\frac{-u_0 + 3.0 \cdot u_1 - 3.0 \cdot u_2 + u_3}{dx \cdot dx \cdot dx}$$

$$z_{s-2} = -\frac{-u_{s-4} + 3.0 \cdot u_{s-3} - 3.0 \cdot u_{s-2} + u_{s-1}}{dx \cdot dx \cdot dx}$$

$$z_{s-1} = \frac{u_{s-3} - 2.0 \cdot u_{s-2} + u_{s-1}}{dx \cdot dx \cdot dx}$$

return (x)

$\text{PREPENT}(a, b, c, d, e)$: $\mathbb{R}^1, \mathbb{R}^1, \mathbb{R}^1, \mathbb{R}^1, \mathbb{R}^1 \to \mathbb{R}^1, \mathbb{R}^1, \mathbb{R}^1, \mathbb{R}^1$

$n = \text{SHAPE}(a)_0$

$undef = \mathfrak{G}^{\text{DROP}([1], \text{SHAPE}(a))}\, 0.0$

$p = q = bet = den = \mathfrak{G}^n\, undef$

$bet_0 = \dfrac{1.0}{c_0}$

$p_0 = -d_0 \cdot bet_0$

$q_0 = -e_0 \cdot bet_0$

$bet_1 = -\dfrac{1.0}{c_1 + b_1 \cdot p_0}$

$p_1 = (d_1 + b_1 \cdot q_0) \cdot bet_1$

$q_1 = e_1 \cdot bet_1$

$den_1 = b_1$

$p_0^{[0]} = p_0, p_1^{[1]} = p_1, q_0^{[0]} = q_0, q_1^{[1]} = q_1$

$bet_i^{[i]} = b_i + a_i \cdot p_{i-2}^{[i-2]}$

$den_i^{[i]} = -\dfrac{1.0}{c_i + a_i \cdot q_{i-2}^{[i-2]} + bet_i^{[i]} \cdot p^{[i-1]}]_{i-1}}$

$p_i^{[i]} = (d_i + bet_i^{[i]} \cdot q^{[i-1]})_{i-1} \cdot den_i^{[i]}$

$q_i^{[i]} = e_i \cdot den_i^{[i]}$

filter$(p^{[i]}, q^{[i]}, bet^{[i]}, den^{[i]} \mid i = n-1)$

return (p, q, bet, den)

$\text{PENT}(p, q, bet, den, a, u)$: $\mathbb{R}^1_{100}, \mathbb{R}^1_{100}, \mathbb{R}^1_{100}, \mathbb{R}^1_{100}, \mathbb{R}^1_{100}, \mathbb{R}^2_{100,80} \to \mathbb{R}^2$

$n = \text{SHAPE}(a)_0$

$n_0 = u_0 \cdot bet_0$

$u_1 = (den_1 \cdot u_0 - u_1) \cdot bet_1$

$u_1^{[0]} = u_1$

$u_2^{[1]} = u_2$

$u_3^{[2]} = u_3$

$u_i^{[i]} = (a_i \cdot u_{i-2}^{[i-3]} + bet_i \cdot u_{i-1}^{[i-2]} - u_i^{[i-1]}) \cdot den_i$

filter$(u^{[i]} \mid i = n-1)$

$u^{[0]} = u$

$u_{n-2} = u_{n-2} + p_{n-2} \cdot u_{n-1}$

$u_{n-3-i}^{[i]} = u_{n-3-i}^{[i-1]} + p_i \cdot u_{n-4-i}^{[i-1]} + q_i \cdot u_{n-5-i}^{[i-1]}$

filter$(u^{[i]} \mid i = n-3)$

return (u)

$\textsc{soliton}(x, y)$: $\mathbb{R}^1, \mathbb{R}^1 \to \mathbb{R}^1$

$k = frac(\sqrt{6.0}, 4.0)$

$num = -4.0 \cdot x \cdot x + 15.0 \cdot k \cdot k \cdot y \cdot y + \frac{1.0}{k \cdot k}$

$denom = 4.0 \cdot x \cdot x + 16.0 \cdot k \cdot k \cdot y \cdot y + \frac{1.0}{k \cdot k}$

return $(\frac{16.0 \cdot num}{denom \cdot denom})$

MAIN$(a, b, c, d, e, p, q, bet, den, u, f)$: $\mathbb{R}^2_{100,3}, \mathbb{R}^2_{100,3}, \mathbb{R}^2_{100,3}, \mathbb{R}^2_{100,3}, \mathbb{R}^2_{100,3}, \mathbb{R}^2_{100,3}, \mathbb{R}^2_{100,3}, \mathbb{R}^2_{100,3}, \mathbb{R}^2_{100,3}, \mathbb{R}^2 100, 8$
$\mathbb{Z}$

$niter = \text{FIBRESCANINTARRAY}()$

$out = 0$

$undef = 0.0$

$dx = 0.1$

$dy = 0.1$

$dt = 0.0002$

$n = 100$

$m = 80$

$ymax = frac(\text{TOD}(n) \cdot dx, 2.0)$

$xmin = -xmax$

$ymax = frac(\text{TOD}(m) \cdot dy, 2.0)$

$ymin = -ymax$

$alpha = [\frac{8.0}{15.0}, \frac{2.0}{15.0}, \frac{1.0}{3.0}] \cdot dt$

$gamma = [\frac{8.0}{15.0}, \frac{5.0}{5.0}, \frac{3.0}{4.0}] \cdot dt$

$rho = [\frac{-17.0}{60.0}, \frac{-5.0}{12.0}] \cdot dt$

$eps = \frac{alpha}{4.0 \cdot dx \cdot dx \cdot dx}$

$mins = [\text{TOF}(xmin), \text{TOF}(ymin), -2f]$

$maxs = [\text{TOF}(xmax), \text{TOF}(ymax), 8f]$

$steps = [5f, 4f, 2f]$

$u_{i,j} \mid [i, j : 0 \leq i \leq n \wedge 0 \leq i \leq m] = \begin{cases} \text{SOLITON}(xmin + dx \cdot \text{TOD}(i)),\ ymin + dy \cdot \text{TOD}(j) & [i, j : 0 \leq \\ undef & \textbf{otherwi} \end{cases}$

$a = \mathfrak{G}^n - eps$

$a_0 = [0.0, 0.0, 0.0]$

$a_1 = [0.0, 0.0, 0.0]$

$a_{n-2} = 2.0 \cdot a_{n-3}$

$a_{n-1} = a_{n-2}$

$b = \mathfrak{G}^n(2.0 \cdot eps)$

$b_0 = [0.0, 0.0, 0.0]$

$b_1 = -b_2$

$b_{n-2} = 3.0 \cdot b_{n-3}$

$b_{n-1} = 2.0 \cdot b_{n-3}$

$c = \mathfrak{G}^{n \times 3}\, 1.0$

$c_0 = c_0 + 2.0 \cdot eps$

$c_1 = c_1 + 6.0 \cdot eps$

$c_{n-2} = c_{n-2} - 6.0 \cdot eps$

$c_{n-1} = c_{n-1} - 2.0 \cdot eps$

$d = \mathfrak{G}^n(-2.0 \cdot eps)$

$d_0 = 2.0 \cdot d_2$

$d_1 = 3.0 \cdot d_2$

$d_{n-2} = -dn - 3$