SOME DIFFERENCE FORMULAS

for Numeric Differentiation

		Error
2–point forward	$f'(x_0) = \frac{-f_0 + f_1}{h}$	$O(h)$
2–point backward	$f'(x_0) = \frac{-f_{-1} + f_0}{h}$	$O(h)$
3–point forward	$f'(x_0) = \frac{-3f_0 + 4f_1 - f_2}{2h}$	$O(h^2)$
3–point central	$f'(x_0) = \frac{-f_{-1} + f_1}{2h}$	$O(h^2)$
3–point backward	$f'(x_0) = \frac{f_{-2} - 4f_{-1} + 3f_0}{2h}$	$O(h^2)$
5–point forward	$f'(x_0) = \frac{-25f_0 + 48f_1 - 36f_2 + 16f_3 - 3f_4}{12h}$	$O(h^4)$
5–point central	$f'(x_0) = \frac{f_{-2} - 8f_{-1} + 8f_1 - f_2}{12h}$	$O(h^4)$
5–point backward	$f'(x_0) = \frac{3f_{-4} - 16f_{-3} + 36f_{-2} - 48f_{-1} + 25f_0}{12h}$	$O(h^4)$
3–point forward	$f''(x_0) = \frac{f_0 - 2f_1 + f_2}{h^2}$	$O(h)$
3–point central	$f''(x_0) = \frac{f_{-1} - 2f_0 + f_1}{h^2}$	$O(h^2)$
3–point backward	$f''(x_0) = \frac{f_{-2} - 2f_{-1} + f_0}{h^2}$	$O(h)$
5–point forward	$f''(x_0) = \frac{35f_0 - 104f_1 + 114f_2 - 56f_3 + 11f_4}{12h^2}$	$O(h^3)$
5–point central	$f''(x_0) = \frac{-f_{-2} + 16f_{-1} - 30f_0 + 16f_1 - f_2}{12h^2}$	$O(h^4)$
5–point backward	$f''(x_0) = \frac{11f_{-4} - 56f_{-3} + 114f_{-2} - 104f_{-1} + 35f_0}{12h^2}$	$O(h^3)$
5–point forward	$f'''(x_0) = \frac{-5f_0 + 18f_1 - 24f_2 + 14f_3 - 3f_4}{2h^3}$	$O(h^2)$
5–point central	$f'''(x_0) = \frac{-f_{-2} + 2f_{-1} - 2f_1 + f_2}{2h^3}$	$O(h^2)$
5–point backward	$f'''(x_0) = \frac{3f_{-4} - 14f_{-3} + 24f_{-2} - 18f_{-1} + 5f_0}{2h^3}$	$O(h^2)$

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