

First derivative using the central differentiation method.

Calculates the first derivative of f using the backwards differentiation numerical method.

By using $f'(x) \approx \frac{-f(x+2h) + 8f(x+h) - 8f(x-h) + f(x-2h)}{12h}$, we calculate an approximation to the first derivative of f , where the error of said method is $O(h^4)$. The difference between this and the abbreviated method is the presence of more terms of the Taylor's series' expansion, which creates a smaller error.

Parameters

1. $f \rightarrow$ The symbolical function to calculate its derivative.
2. $h \rightarrow$ The absolute value of the difference between $f(x+2h)$ and $f(x+h)$ or $f(x-h)$ and $f(x-2h)$.
3. $x \rightarrow$ The point where the derivative will be calculated.
4. $df \rightarrow$ The symbolical derivative calculated.

Returns

1. $dfa \rightarrow$ The value of the derivative calculated using the numerical method in p .
2. $h \rightarrow$ The absolute value of the difference between $f(x+2h)$ and $f(x+h)$ or $f(x-h)$ and $f(x-2h)$.
3. $error \rightarrow$ The absolute error between the numerical method and the actual derivative.

```
function [dfa, h, error] = centralFirstDerivative(f, df, x, h)
    format longE
    dfa = (-f(x+2*h) + 8*f(x+h) - 8*f(x-h) + f(x-2*h))/(12*h);
    error = abs(df - dfa);
end
```