

BUID: 5818

Problem 5. Abril harm Cepeda Osegueda

Fundcion $f(x)$	Forward $\frac{f(x+\Delta x) - f(x)}{\Delta x}$	Backward $\frac{f(x) - f(x-\Delta x)}{\Delta x}$	Central $\frac{f(x+\Delta x) - f(x-\Delta x)}{2\Delta x}$	Exact
$f(x) = 1$	0%	0%	0%	0
$f(x) = x$	0%	0%	0%	1
$f(x) = x^2$	10%	-10%	0%	2
$f(x) = \sqrt{x}$	-59.24%	-72.75%	-66%	3
$f(x) = e^x$	10.7%	-9.37%	0.67%	2.7183
$f(x) = 2^x$	7.26%	-6.62%	0.32%	1.3863
$f(x) = \log(x)$	-8.84%	11.57%	1.37%	1
$f(x) = \sin(x)$	-16.19%	14.86%	-0.67%	0.5403
$f(x) = \cos(x)$	-5.73%	+7.07%	-0.67%	-0.8415

Discussion: The percentage is 0 when the slope is 0 as well (1,2). In case of a linear slope the absolute percentage of the forward and backward methods is equal. Therefore, the central is 0, since it cancels the difference between the other two (3). The percentage of the forward method tends to be higher when the slope is positive and lower when it is negative. The opposite happens for the backward method. The central method tends to be the closest to the exact value.

Problem 4. Abraham Cepeda Oseguera

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Function $f(x)$	Forward $\frac{f(x+\Delta x) - f(x)}{\Delta x}$	Backward $\frac{f(x) - f(x-\Delta x)}{\Delta x}$	Central $\frac{f(x+\Delta x) - f(x-\Delta x)}{2\Delta x}$	Exact $f'(x=1)$
$f(x) = 1$	0.0	0.0	0.0	0.0
$f(x) = x$	1.0	1.0	1.0	1.0
$f(x) = x^2$	2.2	1.8	2.0	2.0
$f(x) = \sum_{n=3}^{\infty} x^n$	1.2228	0.8174	1.0201	3.0
$f(x) = \sqrt{x}$	0.4772	0.5279	0.5025	0.5
$f(x) = e^x$	3.0092	2.4637	2.7364	2.7183
$f(x) = 2^x$	1.487	1.2945	1.3907	1.3863
$f(x) = \log(x)$	0.9116	1.1157	1.0137	0.10
$f(x) = \sin(x)$	0.4528	0.6206	0.5367	0.5403
$f(x) = \cos(x)$	-0.8897	-0.782	-0.8359	-0.8415

Discussion:

The numerical differentiation is exact when the slope is 0 (1,2). The forward method tends to be higher than the backward, ~~and the~~ while the central lies in between, when the slope is positive (3,4,5,6,7). On the other hand, the ~~less~~ opposite occurs when the slope is negative (8,9,10).