resume_of_methods

Find a root in an interval using various methods (resume)
url https://github.com/dudung/py-jupyter-nb/blob/main/src/nummeth/root_finding/one/resume_of_methods.ipynb

function

$$f(x) = \sin(x - 0.26\pi) - 0.41 \tag{1}$$

newton-raphson method

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \tag{2}$$

secant method

$$x_{n+2} = x_{n+1} - \frac{(x_{n+1} - x_n) f(x_{n+1})}{f(x_{n+1}) - f(x_n)} \tag{3}$$

fixed point iteration method

$$x_{n+1} = 2 \sin^{-1} \left[\frac{0.205}{\cos(\frac{1}{2} x_n - 0.13\pi)} \right] + 0.26\pi = g(x_n). \tag{4}$$

Eqn (4) depends on Eqn (1), while Eqns (2)-(3) does not depend on it.

false position method

$$x_{n+2} = \frac{x_n f(x_{n+1}) - x_{n+1} f(x_n)}{f(x_{n+1}) - f(x_n)} \tag{5}$$

steffensen's method

$$x_{n+1} = x_n - \frac{f^2(x_n)}{f(x_n + f(x_n)) - f(x_n)} \tag{6}$$

comparison

Method	Steps	x_{root}	$f(x_{\text{root}})$	ipynb file
graphical	-	1.239375	+9.745206378231064e-05	graphical_method.ipynb
scanning	100000	1.239265	-2.875005146396603e-06	scanning_method.ipynb
bisection	20	1.239267349243164	-7.322925634212218e-07	bisection_method.ipynb
Newton-Raphson	4	1.2392681520841933	-3.275180127104704e-11	newton_raphson_method.ipynb
secant	7	1.239268151938497	-1.656393355808916e-10	secant_method.ipynb
fixed point iteration	8	1.2392674053631287	-6.811063382738958e-07	fixed_point_iteration_method.ipynb
false position	7	1.239268151938497	-1.656393355808916e-10	false_position_method.ipynb
steffensen	4	1.2392681512465442	-7.967593806945672e-10	steffensen_method.ipynb

In [ ]:
```
1.239375            +9.75e-05
1.23925             -2.87e-06
1.239267349243164   -7.32e-07
1.2392681520841933  +3.28e-11
1.239268151938497   -1.66e-10
1.2392674053631287  -6.81e-07
1.239268151938497   -1.66e-10
1.2392681512465442  -7.97e-10
```

In [ ]:
```
import math
def f(x):
    y = math.sin(x - 0.26 * math.pi) - 0.41
    return y

print(f(1.239265))
```

In [ ]: