

ASSIGNMENT 1

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Reg #: Sp20-BCS-044

Course: Numerical Computing

/ Date

Question 1)

$\sin x - 5x + 2 = 0$, between 0.4 and 0.6 to 4 decimal places using Bisection Method.

$$f(x) = \sin x - 5x + 2$$

$$f(0.4) = \sin(0.4) - 5(0.4) + 2$$

$$= 0.3894$$

$$f(0.6) = \sin(0.6) - 5(0.6) + 2$$

$$= -0.4895$$

n	$a_n(-ve)$	$b_n(+ve)$	$x_{n+1} = \frac{a_n + b_n}{2}$	$f(x_{n+1})$
0	0.6	0.4	0.5	-0.0205
1	0.5	0.4	0.45	0.1849
2	0.5	0.45	0.475	0.0823
3	0.5	0.475	0.4875	0.0309
4	0.5	0.4875	0.49375	0.0051
5	0.5	0.4937	0.4968	-0.0073
6	0.4968	0.4937	0.4952	-0.0007
7	0.4952	0.4937	0.4944	0.0025
8	0.4952	0.4944	0.4948	0.0008
9	0.4952	0.4948	0.495	0.00003
10	0.4952	0.495	0.4951	-0.0003
11	0.4951	0.495	0.4950	0.00003

Hence the root is 0.495

Question 2)

$\sin x = 5x - 2$, between 0.4 and 0.6 to 4 decimal places using Regula Falsi

$$f(x) = \sin x - 5x + 2$$

$$c = \frac{af(b) - bf(a)}{f(b) - f(a)}$$

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

n	x_{n-1}	$f(x_{n-1})$	x_n	$f(x_n)$	x_{n+1}	$f(x_{n+1})$	Update
1	0.6	-0.4853	0.4	0.3894	0.4944	0.0025	$x_n = x_{n+1}$
2	0.6	-0.4853	0.4944	0.0025	0.4950	0.00003	$x_n = x_{n+1}$
3	0.6	-0.4853	0.4950	0.00003	0.4950	0.00003	$x_n = x_{n+1}$

Hence the root is 0.4950

Question 3)

$2 \cosh x (\sin x) = 1$, between 0.4 and 0.5 to 4 decimal places
using secant method

$$f(x) = 2 \cosh x (\sin x) - 1 = 0$$

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

n	x_{n-1}	$f(x_{n-1})$	x_n	$f(x_n)$	x_{n+1}	$f(x_{n+1})$
1	0.4	-0.1580211	0.5	0.0812253	0.466049	-0.00898
2	0.5	0.0812253	0.466049	-0.001898	0.466824	-0.00002360
3	0.466049	-0.001898	0.466824	-0.00002360	0.466833	-0.00000183

Hence the root is 0.4668

Question 4)

$f(x) = x^2 - 2x - 2$, to 3 decimal places using Newton Raphson

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

$$f(0) = 0^2 - 2(0) - 2 = -2$$

$$f'(x_n)$$

$$f(0.5) = (0.5)^2 - 2(0.5) - 2 = -2.75$$

$$f(-0.8) = (-0.8)^2 - 2(-0.8) - 2$$

$$= 0.24$$

$$f(-0.5) = (-0.5)^2 - 2(-0.5) - 2 = -0.75$$

$$f(-0.7) = (-0.7)^2 - 2(-0.7) - 2 = -0.11$$

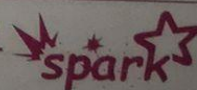
$f(x) = 0$ lies between -0.8 and -0.7

$$f'(x) = 2x - 2$$

$$f'(-0.7) = 2(-0.7) - 2 = -3.4$$

n	x_n	$f(x_n)$	$f'(x_n)$	x_{n+1}
0	-0.7	-0.11	-3.4	-0.732352
1	-0.732352	0.0010434	-3.464704	-0.732050
2	-0.732050	0.000002797	-3.4649	-0.732050

Hence the root is -0.732050



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Question 5)

$$f(x) = 2x - \cos x - 3 = 0$$

$x_0 = \frac{\pi}{2}$, to 3 decimal places
using iteration method.

$$x = g(x)$$

$$x = \frac{\cos x + 3}{2}$$

$$g'(x) = \left| \frac{-\sin x}{2} \right| = | -0.5 | = 0.5$$

$$x_{i+1} = g(x_i)$$

i	x_i	x_{i+1}
0	x_0	1.2759631
1	1.275963	1.645290
2	1.645290	1.462787
3	1.462787	1.553899
4	1.553899	1.508448
5	1.508448	1.531153
6	1.531153	1.519816
7	1.519816	1.525479
8	1.525479	1.522650
9	1.522650	1.524063
10	1.524063	1.523358
11	1.523358	1.523710
12	1.523710	1.523534

Hence the root of the equation
is 1.52359