1. Bisection method
2. import math
3. def root\_bisection(f, a, b, tolerance=1.0e-6):
4. cnt = 0
5. dx = abs(b - a)
6. while dx > tolerance:
7. x = (a + b) / 2
8. if f(a) \* f(x) < 0:
9. b = x
10. else:
11. a = x
12. dx = abs(b - a)
13. cnt += 1
14. return (f'Found f(x) = 0 at x = {x:.8f} ± {tolerance:.8f}', "repeat time:", cnt)
15. def f(x):
16. return math.exp(x) \*\* 2 - 3 \* math.exp(x)
17. print(root\_bisection(f, 1, 10))
18. # output : ('Found f(x) = 0 at x = 9.99999946 ± 0.00000100', 'repeat time:', 24)
19. Newton’s method
20. import math
21. def root\_newton(f, df, guess, tolerance=1.0e-6):
22. x = guess
23. dx = 2 \* tolerance
25. while dx > tolerance:
26. x1 = x - f(x) / df(x)
27. dx = abs(x - x1)
28. x = x1
30. return (f'Found f(x) = 0 at x = {x:.8f} ± {tolerance:.8f}')
31. def f(x):
32. return math.exp(x) \*\* 2 - 3 \* math.exp(x)
33. def df(x):
34. return 2 \* x \* math.exp(x\*\*2) - 3 \* math.exp(x)
35. print(root\_newton(f, df, 1.0))
36. # output : Found f(x) = 0 at x = -3.14824975 ± 0.00000100