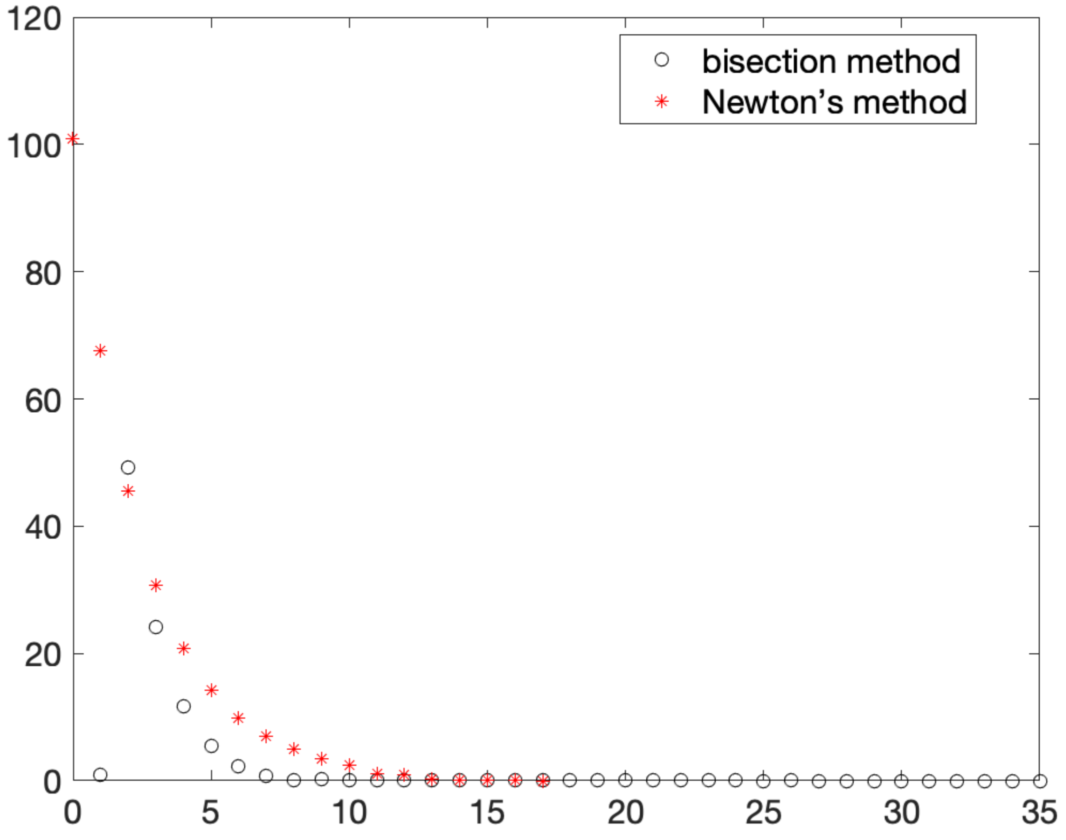
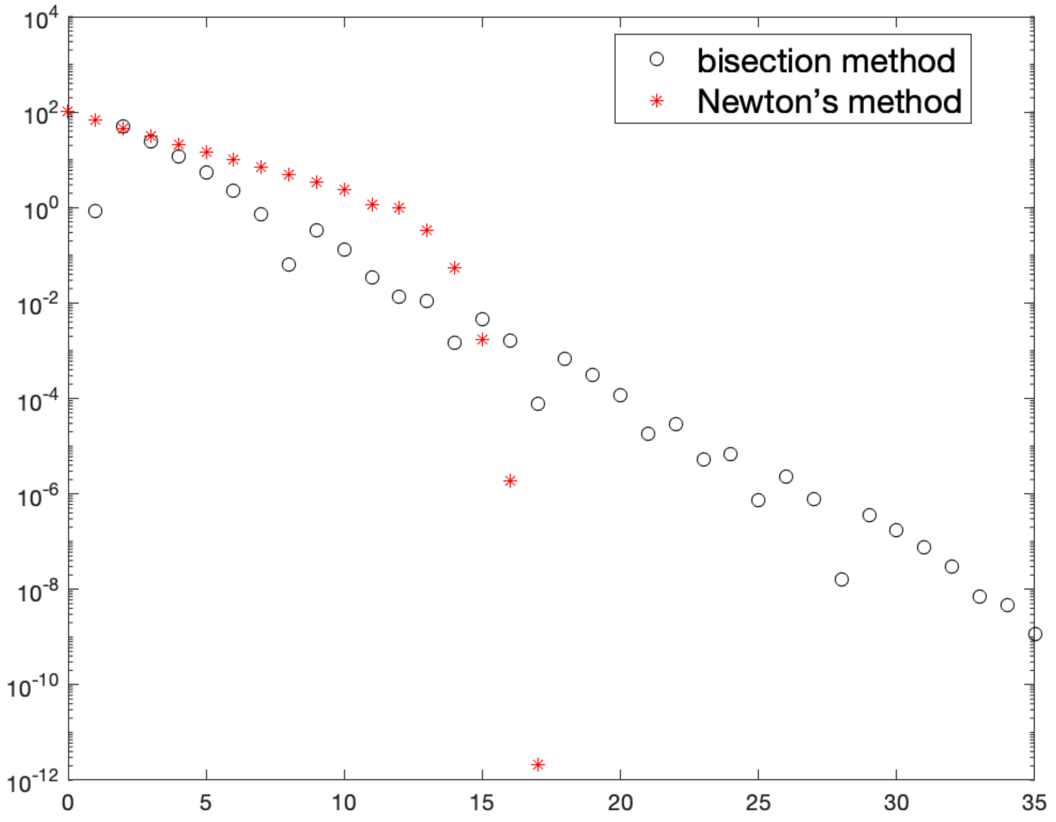
Siyue Zhu
AMATH 301 Spring 2020
HW2

Problem 4

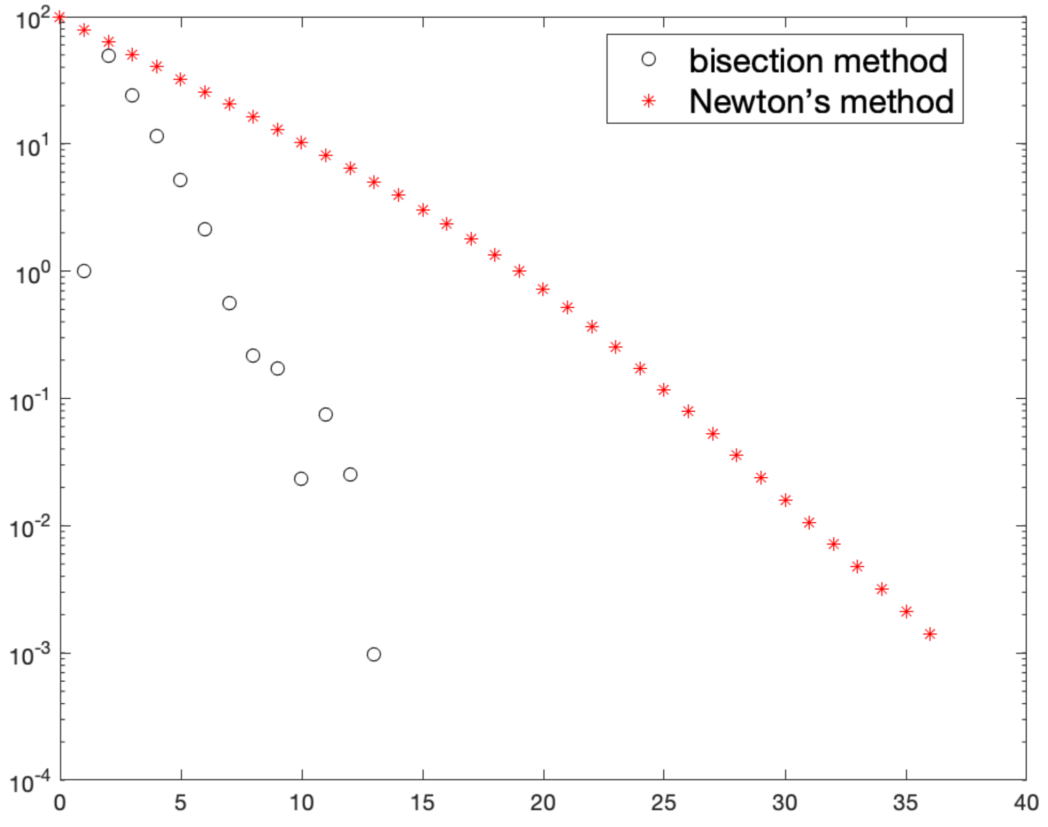


Problem 5



I think Newton's method is better in this case since it needs less iteration in this case.

Problem 6



I think bisection method is better for this function because it needs less iteration in this case.

Problem 7

(b)

Code

```
% Problem 4
f = @ (x) x^3-x^2+2*x+3;
f1 = @ (x) 3*x^2-2*x+2;
exact = fzero(f,0);

left = -100;
right = 100;
tolerance = 10 ^ (-8);

f_mid = 1;
iterations = 0;
errors1 = [];
n1 = [];
while abs(f_mid) > tolerance

    mid = (left+right)/2;
    f_mid = f(mid);

    if f_mid*f(left) < 0
        right = mid;
    elseif f_mid*f(right) < 0
        left = mid;
    else
        disp('No root found')
        break
    end
    errors1(iterations + 1) = abs(exact - mid);
    n1(iterations + 1) = iterations + 1;
    iterations = iterations + 1;
end

iterations = 0;
tolerance = 10 ^ (-8);
x = 100;
errors2 = [abs(exact - x)];
n2 = [0];
while iterations <100 && abs(f(x)) > tolerance
    x = x - f(x)/f1(x);

    errors2(iterations + 2) = abs(exact - x);
    n2(iterations + 2) = iterations + 1;
    iterations = iterations + 1;
end

plot(n1, errors1, 'ko'), hold on
plot(n2, errors2, 'r*')
set(gca, 'fontsize', [15])
legend('bisection method', 'Newton’s method', 'location', 'best', 'fontsize',
[15])
print('HW2_fig1.png','-dpng')

% Problem 5
semilogy(n1, errors1, 'ko'), hold on
semilogy(n2, errors2, 'r*')
```

```
legend('bisection method', 'Newton’s method', 'location', 'best', 'fontsize',
[15])
print('HW2_fig2.png','-dpng')

% Problem 6
f = @ (x) x^5-3*x^4+5*x^3-7*x^2+6*x-2;
f1 = @ (x) 5*x^4-12*x^3+15*x^2-14*x+6;
exact = fzero(f,0);

left = -100;
right = 100;
tolerance = 10 ^ (-8);

f_mid = 1;
iterations = 0;
errors1 = [];
n1 = [];
while abs(f_mid) > tolerance

    mid = (left+right)/2;
    f_mid = f(mid);

    if f_mid*f(left) < 0
        right = mid;
    elseif f_mid*f(right) < 0
        left = mid;
    else
        disp('No root found')
        break
    end
    errors1(iterations + 1) = abs(exact - mid);
    n1(iterations + 1) = iterations + 1;
    iterations = iterations + 1;
end

iterations = 0;
tolerance = 10 ^ (-8);
x = 100;
errors2 = [abs(exact - x)];
n2 = [0];
while iterations <100 && abs(f(x)) > tolerance
    x = x - f(x)/f1(x);

    errors2(iterations + 2) = abs(exact - x);
    n2(iterations + 2) = iterations + 1;
    iterations = iterations + 1;
end

semilogy(n1, errors1, 'ko'), hold on
semilogy(n2, errors2, 'r*')
legend('bisection method', 'Newton’s method', 'location', 'best', 'fontsize',
[15])
print('HW2_fig3.png','-dpng')
```