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```
% Ali Heydari
% Math 231, hw3
% Newton's Method
```

```
% Problem 3)part a) first root
```

```
% a = input('Please enter a value for the lower bound a: ');
% b = input('Please enter a value for the upper bound (b) : ');
```

```
x_k = ones(1,10);
error = zeros(1,10);
e_n = zeros(1,10);
```

Interactive Interface (with user input)

get initial conditions when we want it interactive :

```
% x_k(1) = input('Please enter the initial guess x_0: ');
% delta = input('Please enter the desired tolerance: ');
% f = input('Please enter f(x)?(type @(x) [then the function] ');
% f_prime = input('Please enter d/dx(f(x)) (derivative)?(type @(x) [then the function] ');
```

Non Interactive (without user input)

```
x_k(1) = -2.4;
f = @(x) x^3 - 3*x + 2;
delta = 10^(-6);
f_prime = @(x) 3*x^2 - 3;
```

```
xk = x_k(1);
fx = f(x_k(1)); % evaluate function at x_o: f(x_o)
```

```
counter = 1; % counter
```

Method

```
% keep finding the root until f(x_k)~~ 0
```

```

while abs(f(x_k(counter))) > 2 * delta

    % Neton's method formula
    x_k(counter+1) = x_k(counter) - (f(x_k(counter)) / f_prime(x_k(counter)));

    % display xk
    xk = x_k(counter+1);
    % Evaluating the function at new x_k
    fx = f(x_k(counter+1));

    % no real zero, so we keep this as an arbitrary bound
    e_n(counter) = abs(xk - (-2));
    if fx <= 1 * 10 ^-13

        root = xk;
    end

    % find the error

    error(counter) = abs(x_k(counter+1) - x_k(counter));

    counter = counter + 1;
    % Update the counter
end

```

Output Formatting

```

disp(" ");
disp(" ");
fprintf('The root of the function is at x = %i \n', root);
fprintf('Number of iterations: %i \n', counter);
disp(" ");
disp(" ");

disp("          pn          |p_{n+1} - p_n|          e_n = |pn - p| ")
for i= 1 : counter

    fprintf("%i    %i          %i          %i\n",i ,x_k(i),error(i),e_n(i));

end

```

Outputs

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The root of the function is at $x = -2.000000e+00$
Number of iterations: 5

	pn	$ p_{\{n+1\}} - p_n $	$e_n = pn - p $
1	-2.400000e+00	3.238095e-01	7.619048e-02
2	-2.076190e+00	7.259447e-02	3.596011e-03
3	-2.003596e+00	3.587421e-03	8.589972e-06
4	-2.000009e+00	8.589923e-06	4.919132e-11
5	-2.000000e+00	0	0