Homework 2

Menyoung Lee

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P1

1 $3x + 2x^3 = 1 + x^5 \rightarrow x = 1 + x^5 - 2x - 2x^3$

2 $3x + 2x^3 = 1 + x^5 \rightarrow 3x = 1 + x^5 - 2x^3 \rightarrow x = \frac{1+x^5-2x^3}{3}$

3 Newton's Method.

$$g(x) = x - \frac{f(x)}{f'(x)}$$

$$3x + 2x^3 = 1 + x^5 \rightarrow 0 = 1 + x^5 - 3x - 2x^3 = f(x)$$

$$g(x) = x = x - 0 = x - \frac{0}{5x^4 - 3 - 6x^2} = x - \frac{1 + x^5 - 3x - 2x^3}{5x^4 - 3 - 6x^2}$$

P2

Here we use the third function from the above.

$$r_1 = 0.31375559, r_2 = 1.68696945, r_3 = -1.77101764.$$

P3

$$f(x) = 1 + x^5 - 3x - 2x^3 \rightarrow f'(x) = 5x^4 - 3 - 6x^2 \rightarrow f''(x) = 20x^3 - 12x$$

$$g(x) = x - \frac{f(x)}{f'(x)}$$

Applying the quotient rule,

$$g'(r) = 1 - \frac{f'(r)f'(r) - f(r)f''(r)}{f'(r)^2} = -\frac{f(r)f''(r)}{f'(r)^2} = 0$$

by definition that $f(r) = 0$.

P4

Indeed the error ratio does converge to zero, save pathological weirdness of small numbers at the end.