

Assignment #2

Question #1:

a) $0 = 1 - \frac{0.2}{9Ac^3}$
 $0 = 1 - \frac{0.2}{(9.81)(3y + \frac{y^3}{2})^3} (3+y)$
 $f(y) = 1 - \frac{40.7747}{(3y + \frac{y^3}{2})^3} (3+y) \quad f(y) = 0$

$f(y) \rightarrow 0 \quad @ y = 1.5$

$f(y) = 0 \text{ is } x_r = 1.5$

b) Bisection

$x_l = 0.5 \quad x_u = 2.5$

$f(x_l) = -32.26 \quad f(x_u) = 0.81$

$x_r = (x_l + x_u)/2 = 1.5 \rightarrow f(x_r) = -0.03$

1st $E_a = \left| \frac{x_u - x_l}{x_u + x_l} \right| \times 100\% = \left| \frac{2.5 - 0.5}{2.5 + 0.5} \right| \times 100\% = 66.67\%$

2nd $x_r = (1.5 + 2.5)/2 = 2 \quad E_a = \left| \frac{2.5 - 1.5}{2.5 + 1.5} \right| \times 100 = 25\%$

3rd $x_r = (2 + 1.5)/2 = 1.75 \quad E_a = \left| \frac{2 - 1.5}{2 + 1.5} \right| \times 100 = 14.28571\%$

Hence after 8 iterations \rightarrow root $x_r = 1.5078$

with an approx. error of 0.52%

which falls below 1%

False Position

c) $x_r = x_u - \frac{f(x_u)(x_l - x_u)}{f(x_l) - f(x_u)} = 2.5 - \frac{0.81(0.5 - 2.5)}{-32.26 - 0.81} = 2.4508$

1st $f(x_r) = 0.7999 \quad E_a = \frac{2.5 - 0.5}{2.5 + 0.5} \times 100\% = 66.67$

2nd $x_r = 2.403629114 \quad E_a = \frac{2.4508 - 0.5}{2.4508 + 0.5} \times 100 = 66.11125$

3rd $E_a = \frac{2.403629114 - 0.5}{2.403629114 + 0.5} \times 100 = 65.56034$

After 10 iterations, $x_r = 1.8743$ with approx error of 58.69% slow

Assignment 2

Question 3

$$V = \pi h^2 \cdot \left(\frac{3R-h}{3} \right) \quad R = 3m \quad V = 30m^3$$

$$f(h) = \pi h^2 \left[\frac{3R-h}{3} \right] - V$$

$$f(h) = \pi h^2 R - \frac{\pi h^3}{3} - V$$

$$f(h) = 3\pi h^2 - \frac{\pi h^3}{3} - 30$$

$$F(h) = 9.425h^2 - 1.047h^3 - 30$$

False position

$$x_r = x_u - \frac{f(x_u)(x_l - x_u)}{f(x_l) - f(x_u)}$$

First

$$x_l = 0, x_u = 3$$

$$x_r = x_u - \frac{f(x_u)(x_l - x_u)}{f(x_l) - f(x_u)}$$

$$= 3 - \frac{f(3)(0-3)}{f(0)-f(3)}$$

$$= 3 - \frac{(26.5487)(-3)}{-30-26.5487} = 1.59155$$

$$f(x_l)f(x_r) = f(0)f(1.59155)$$

$$= -30(-10.3485) = 310.4542$$

$$x_l = 1.59155, x_u = 3$$

$$x_r = 3 - \frac{f(3)(1.59155-3)}{f(1.59155)-f(3)}$$

$$= 3 - \frac{(26.5487)(-1.40845)}{-10.348-26.5487} = 1.98658$$

between
1.59155 - 3

$$\epsilon_a = \left| \frac{1.98658 - 1.59155}{1.98658} \right| \times 100 = 19.89\%$$

$$f(x_l)f(x_r) = f(1.59155)f(1.98658)$$

$$= -10.348(-1.01531)$$

$$= 10.50658$$

between
1.98658 - 3

Third

$$x_l = 1.98658, x_u = 3$$

$$x_r = 3 - \frac{f(3)(1.98658-3)}{f(1.98658)-f(3)}$$

$$\frac{26.5487(1-1.01342)}{-1.0153-26.5487}$$

$$= 3 - \frac{-1.0153-26.5487}{-1.0153-26.5487}$$

$$= 2.0239$$

$$\epsilon_a = \left| \frac{2.0239 - 1.98658}{2.0239} \right| \times 100$$

$$= 1.84\%$$

So depth
2.0239m

Assignment 2

Question 3

x_L	x_u	x_r	ϵ_a	$f(x_L) f(x_r)$
0	3	1.59155		310.4542
1.59155	3	1.98658	19.89%	10.50658
1.98658	3	2.0239	1.84%	

So the depth to which tank must be filled 2.0239m.