

CHE401 Exam 1 solution

Question 1

$$f(v) = V^3 - \left(b + \frac{RT}{P}\right)V^2 + \frac{a}{P}V - \frac{ab}{P}$$

$$df/dV = 3V^2 - 2\left(b + \frac{RT}{P}\right)V + \frac{a}{P}$$

$$V = V - f/(df/dV)$$

Start with $V=RT/P$

V	f	df/dV
3.4025889e+002	2.8871463e+006	1.1257253e+005
3.1461190e+002	4.0114030e+005	8.1948632e+004
3.0971688e+002	1.3266419e+004	7.6552221e+004

Question 2

$$f(x) = \frac{1}{10}(45 - 12x)$$

(a) Explicit Euler method:

$$x_{i+1} = x_i + hf(x_i) = x_i + h(45 - 12x_i)/10$$

Starting from $x = 200$ using $h = 0.1$ gives:

x	$f(x)$
2.0000000e+002	-2.3550000e+002
1.7645000e+002	-2.0724000e+002
1.5572600e+002	-1.8237120e+002

(b) Implicit Euler Method:

$$x_{i+1} = x_i + hf(x_{i+1}) = x_i + h(45 - 12x_{i+1})/10$$

$$x_{i+1}(1+1.2h) = x_i + 4.5h$$

$$x_{i+1} = (x_i + 4.5h) / (1+1.2h)$$

x	$f(x)$
200.0000	-235.5000
178.9732	-210.2679
160.1993	-187.7392