Multiple-Choice Test

Chapter 03.04
Newton-Raphson Method

1. The Newton-Raphson method of finding roots of nonlinear equations falls under the category of _____________ methods.
   (A) bracketing
   (B) open
   (C) random
   (D) graphical

2. The Newton-Raphson method formula for finding the square root of a real number R from the equation $x^2 - R = 0$ is,
   (A) $x_{i+1} = \dfrac{x_i}{2}$
   (B) $x_{i+1} = \dfrac{3x_i}{2}$
   (C) $x_{i+1} = \dfrac{1}{2}\left(x_i + \dfrac{R}{x_i}\right)$
   (D) $x_{i+1} = \dfrac{1}{2}\left(3x_i - \dfrac{R}{x_i}\right)$

3. The next iterative value of the root of $x^2 - 4 = 0$ using the Newton-Raphson method, if the initial guess is 3, is
   (A) 1.5
   (B) 2.067
   (C) 2.167
   (D) 3.000

4. The root of the equation $f(x) = 0$ is found by using the Newton-Raphson method. The initial estimate of the root is $x_0 = 3$, $f(3) = 5$. The angle the line tangent to the function $f(x)$ makes at $x = 3$ is $57°$ with respect to the x-axis. The next estimate of the root, x_1 most nearly is
   (A) –3.2470
   (B) −0.2470
   (C) 3.2470
   (D) 6.2470

5. The root of $x^3 = 4$ is found by using the Newton-Raphson method. The successive iterative values of the root are given in the table below.

Iteration Number	Value of Root
0	2.0000
1	1.6667
2	1.5911
3	1.5874
4	1.5874

The iteration number at which I would first trust at least two significant digits in the answer is
(A) 1
(B) 2
(C) 3
(D) 4

6. The ideal gas law is given by

$$pv = RT$$

where p is the pressure, v is the specific volume, R is the universal gas constant, and T is the absolute temperature. This equation is only accurate for a limited range of pressure and temperature. Vander Waals came up with an equation that was accurate for larger ranges of pressure and temperature given by

$$\left(p + \frac{a}{v^2}\right)(v - b) = RT$$

where a and b are empirical constants dependent on a particular gas. Given the value of $R = 0.08$, $a = 3.592$, $b = 0.04267$, $p = 10$ and $T = 300$ (assume all units are consistent), one is going to find the specific volume, v, for the above values. Without finding the solution from the Vander Waals equation, what would be a good initial guess for v?
(A) 0
(B) 1.2
(C) 2.4
(D) 3.6

For a complete solution, refer to the links at the end of the book.