Assignment_0

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. **Due on 2018-07-30, 23:59 IST.**

Assignment_0

1) Consider the following function: \( f = \frac{kx_2}{x} \)

Where \( x = x_1 + kx_2 \), \( k \) is a constant and \( x_1, x_2 \) are independent variables. The value of the partial derivative \( \frac{\partial f}{\partial x_2} \) is

- \( kx \)
- \( kx_2/x^2 \)
- \( -kx_1/x^2 \)
- \( kx_1/x^2 \)

No, the answer is incorrect.

Score: 0

Accepted Answers:

\( kx_1/x^2 \)

2) The sum of the infinite series

\[
\sum_{i=1}^{\infty} \left( \frac{0.2^i}{i} \right) = 0.2 + \frac{(0.2)^2}{2} + \frac{(0.2)^3}{3} + \cdots
\]

is:

- \( \ln(1.2) \)
- \( \ln(0.8) \)
- \( \ln(1.25) \)
- \( e^{0.2} \)

No, the answer is incorrect.

Score: 0
Then, for \( n < N \), the product \( \prod_{i=1}^{n} [N - (i - 1)] \) is equal to

- \( N!/(N-n)! \)
- \( (N+n)!/N! \)
- \( (N+n)!/(N-n)! \)
- \( (N-n)!/N! \)

No, the answer is incorrect.  
Score: 0

Accepted Answers: 
- \( N!/(N-n)! \)

4) Consider the ordinary differential equation (ODE) 
\[
\left( \frac{d\epsilon}{dt} \right) + \left( \frac{\epsilon}{\tau_0} \right) = k_0
\]
where \( \tau_0 \) and \( k_0 \) are constants, and at \( t=0, \epsilon=0 \). The solution of this ODE is

- \( \epsilon(t) = k_0 \tau_0 [1 - \exp(-t/\tau_0)] \)
- \( \epsilon(t) = (k_0/\tau_0) [1 - \exp(-t/\tau_0)] \)
- \( \epsilon(t) = (k_0/\tau_0) \exp(-t/\tau_0) \)
- \( \epsilon(t) = k_0 \tau_0 \exp(-t/\tau_0) \)

No, the answer is incorrect.  
Score: 0

Accepted Answers: 
- \( \epsilon(t) = k_0 \tau_0 [1 - \exp(-t/\tau_0)] \)

5) The function \( f(x) = x^3 - 4x^2 + 2 \) has a point of inflection at

- \( x = 0 \)
- \( x = 3/4 \)
- \( x = 3/2 \)
- \( x = 4/3 \)

No, the answer is incorrect.  
Score: 0

Accepted Answers: 
- \( x = 4/3 \)

6) The function \( f(x) = x^4 - 8x^2 - 4 \) has

- a local minimum at \( x = 0 \), maxima at \( x = \pm 2 \), and points of inflection at \( x = \pm \sqrt{2} \)
- a local maximum at \( x = 0 \), minima at \( x = \pm 2 \), and points of inflection at \( x = \pm \sqrt{2} \)
- a local minimum at \( x = 0 \), maxima at \( x = \pm 2 \), and no points of inflection
a local maximum at x=0, minima at x=±2, and no points of inflection

No, the answer is incorrect.
Score: 0
Accepted Answers:
a local maximum at x=0, minima at x=±2, and points of inflection at x=±√2

7) Two points on the curve \( f(x)=x^4-8x^2-4x \) that have a common tangent line are

- (0,0) and (3,-3)
- (-1,-3) and (1,-11)
- (-2,-8) and (2,-24)
- (-3,21) and (3,-3)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(-2,-8) and (2,-24)

8) The specific volume of an ideal gas having molar mass 44 g/mol at 300 K and 1 bar is \( \ldots \) m\(^3\)/kg (provide answer up to two decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.56-0.58

9) For the formation of an ideal solution, which one of the following is necessarily true?

- Enthalpy change of mixing is zero, i.e., \( \Delta H_m=0 \)
- Entropy change of mixing is zero, i.e., \( \Delta S_m=0 \)
- Gibbs free energy change of mixing is zero, i.e., \( \Delta G_m=0 \)
- Activity coefficients are zero, i.e., \( y_i=0 \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
Enthalpy change of mixing is zero, i.e., \( \Delta H_m=0 \)

10) Problems 10 and 11 are based on the following statement:

The total enthalpy of a binary solution at constant \( T \) and \( P \) is given by

\[
H=n_1(a_1+b_1X_1)+n_2(a_2+b_2X_2)
\]
where \( a_1, a_2, b_1 \) and \( b_2 \) are constants (i.e., independent of composition), \( n_1 \) and \( n_2 \) are the number of moles of component 1 and 2 in the solution respectively, and \( X_1 \) and \( X_2 \) are the mole fractions of component 1 and 2 in the solution respectively.

The enthalpy change of mixing associated with the formation of 1 mole of this solution (i.e., the molar enthalpy change of mixing) is

\[
\Delta H_m = -(a_1 + a_2)X_1X_2 \\
\Delta H_m = -(b_1 + b_2)X_1X_2 \\
\Delta H_m = -(a_1 b_1 + a_2 b_2)X_1X_2 \\
\Delta H_m = -(a_1 b_2 + a_2 b_1)X_1X_2
\]

No, the answer is incorrect.
Score: 0

Accepted Answers:
\( \Delta H_m = -(b_1 + b_2)X_1X_2 \)

1. The partial molar enthalpy of component \( i \) is defined as 1 point

\[ H_i = (\frac{\partial H}{\partial n_i})_{T,P,n_{j\neq i}} \]

i.e., the partial derivative is evaluated keeping \( T, P \) and the number of moles of all components (except that of component \( i \)) constant. The expression for \( H_1 \) is

\[
H_1 = a_1 + b_1 X_1 \\
H_1 = a_1 + b_1 X_1 + X_1(b_1 X_1 - b_2 X_2) \\
H_1 = a_1 + b_1 X_1 + b_1 X_1^2 \\
H_1 = a_1 + b_1 X_1 + X_2(b_1 X_1 - b_2 X_2)
\]

No, the answer is incorrect.
Score: 0

Accepted Answers:
\( H_1 = a_1 + b_1 X_1 + X_2(b_1 X_1 - b_2 X_2) \)