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| **SESSION** | **Nov-dec2023** |
| **PROGRAM** | **BCA** |
| **SEMESTER** | **III** |
| **course CODE & NAME** | **DCA2101 & Computer Oriented Numerical Methods** |
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**SET-I**

**1. Show that**

**(a)** $δμ=\frac{1}{2}(∆+∇)$

**(b)** $∆-∇=∆∇$

**Ans 1.**

To prove the given identities, let's start by defining the operators:

$Δ$ = Laplacian operator (also known as the second-order spatial derivative operator)

$∇$ = Gradient operator (vector of first-order spatial derivatives)

$δ=$ Divergence operator (divergence of a vector field)

$μ=$ Scalar

**b) To prove** $Δ-∇=Δ∇$ **:**

Let's start with the left-hand side (LHS):

$$ LHS =Δ-∇$$

Using the definitions of the Laplacian $(Δ)$ and gradient $(∇)$ operators, we have:

$$ LHS =\left(\frac{∂^{2}}{∂x^{2}}+\frac{∂^{2}}{∂y^{2}}+\frac{∂^{2}}{∂z^{2}}\right)-\left(\frac{∂}{∂x},\frac{∂}{∂y},\frac{∂}{∂x}\right)$$

Expanding the terms, we can

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**2. Solve the system of equation by Gauss Elimination’s method**

$2x + y + 4z = 12$

$4x +11y -z = 33$

$8x - 3y +2z = 20$***.***

**Ans 2.**

Consider the given system of equations,

2x+y+4z=124

x+11y−z=338

x−3y+2z=20

Convert the system to matrix form,

$$\left[\begin{matrix}2&1&4\\4&11&-1\\8&-3&2\end{matrix}\right⌋\left[\begin{matrix}x\\y\\z\end{matrix}\right⌋=\left[\begin{matrix}12\\33\\20\end{matrix}\right⌋$$

The augmented matrix for the above matrix form,

$$\left[\begin{matrix}2&1&4&12\\4&11&-1&33\\8&-3&2&20\end{matrix}\right]$$

**Q3. Find the equation of the best fitting straight line for the data:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X** | **1** | **3** | **4** | **6** | **8** | **9** | **11** | **14** |
| **Y** | **1** | **2** | **4** | **4** | **5** | **7** | **8** | **9** |

**Ans 3.**

To find the equation of the best-fitting straight line for the given data points, you can use linear regression. The equation of a straight line is typically represented as:

Y = mx + b

Where:

* Y is the dependent variable (in this case, the Y values).
* X is the independent variable (in this case, the X values).
* m is the

**Set-II**

**Q4. Evaluate *f*(15)*,* given the following table of values:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **x** | **10** | **20** | **30** | **40** | **50** |
| **y = *f*(*x*)** | **46** | **66** | **81** | **93** | **101** |

**Ans 4.**

To evaluate f(15) using the given table of values, you can use interpolation. Since the table provides values of y = f(x) for specific values of x, you can interpolate to find the value of f(15) which falls between x = 10 and x = 20.

We can use linear interpolation for this purpose. Linear interpolation assumes that the function f(x) varies linearly between two data points. Here's how you can calculate f(15):

First, identify the two data

**Q5. Use Taylor’s series method to solve the initial value problem:**

$\frac{dy}{dx}=x^{2}+y^{2}$ **for** $x=0.25 and 0.5$ **given that** $y(0)=1$**.**

**Ans 5.**

The Differential Equation

$$\frac{dy}{dx}=x^{2}+y^{2}$$

With initial condition

**6. Apply Runge-Kutta fourth order method to find an approximate value of y when x = 0.1 given that** $\frac{dy}{dx}=x^{2}-y$**,** $y\left(0\right)=1$**.**

Ans 6.

To apply the Runge-Kutta fourth-order method to solve the given initial value problem, we need to follow these steps:

1. Define the differential equation: $\frac{dy}{dx}=x^{2}-y$
2. Specify the initial