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| **SESSION** | **NOVEMBER 2024** |
| **PROGRAM** | **MCA** |
| **SEMESTER** | **I** |
| **COURSE CODE & NAME** | **DCA6107 FUNDAMENTALS OF MATHEMATICS**  |
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**Set-I**

### **1. Find the derivative of** $f\left(x\right)=\sqrt{x}$ **using limits**

**Ans 1.**

The derivative using limits is defined as:

$$f^{'}\left(x\right)=\lim\_{h\to 0}\frac{f\left(x+h\right)-f\left(x\right)}{h}$$

For $f\left(x\right)=\sqrt{x}$:

$$f^{'}\left(x\right)=\lim\_{h\to 0}\frac{\sqrt{x+h}-\sqrt{x}}{h}$$

**Step 1: Rationalize the numerator**

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### **2. Evaluate** $∫f\left(x\right) dx$

#### (i) $f\left(x\right)=\frac{x^{5}+4x^{3}-2}{x^{2}}$

**Ans 2.**

**Step 1: Simplify the function**

$$f\left(x\right)=\frac{x^{5}}{x^{2}}+\frac{4x^{3}}{x^{2}}-\frac{2}{x^{2}}$$

$$f\left(x\right)=x^{3}+4x-2x^{-2}$$

**Step 2: Apply the integral**

The integral of $f\left(x\right)$ is:

$$∫f\left(x\right) dx=∫\left(x^{3}+4x-2x^{-2}\right) dx$$

#### (ii) $f\left(x\right)=\left(x+\frac{1}{x}\right)^{2}$

**Step 1: Expand the function**

$$f\left(x\right)=\left(x+\frac{1}{x}\right)^{2}=x^{2}+2x⋅\frac{1}{x}+\frac{1}{x^{2}}$$

### **3. Find** $\frac{∂f}{∂x}$ **and** $\frac{∂f}{∂y}$ **for** $f\left(x,y\right)=2x^{2}-xy+xy^{2}$**:**

#### Given function:

$$f\left(x,y\right)=2x^{2}-xy+xy^{2}$$

#### **Step 1: Partial derivative with respect to** $x$ **(**$\frac{∂f}{∂x}$**)**

Treat $y$ as a constant while differentiating with respect to $x$:

$$\frac{∂f}{∂x}=\frac{∂}{∂x}\left(2x^{2}\right)-\frac{∂}{∂x}\left(xy\right)+\frac{∂}{∂x}\left(xy^{2}\right)$$

**Calculation:**

1. For $2x^{2}$: $\frac{∂}{∂x}\left(2x^{2}\right)=4x$

### **SET-II**

### **4. Find** $\vec{A }+2\vec{B }$ **and** $\vec{A }+2\vec{B }-\vec{C }$ **where**$  \vec{A }=\hat{i }-\hat{j }+\hat{k }$**,** $\vec{B }=2\hat{i }+2\hat{j }+3\hat{k }$ **and** $\vec{C }=2\hat{i }+2\hat{j }$**.**

### **Ans 4. Find** $\vec{A}+2\vec{B}$ **and** $\vec{A}+2\vec{B}-\vec{C}$**:**

#### Given vectors:

$$\vec{A}=\hat{i}-\hat{j}+\hat{k}, \vec{B}=2\hat{i}+2\hat{j}+3\hat{k}, \vec{C}=2\hat{i}+2\hat{j}$$

#### **Step 1: Calculate** $\vec{A}+2\vec{B}$

First, calculate $2\vec{B}$:

### **5. Express 1 Radian into the degree measurement**

**Ans 5.**

To convert radians into degrees, use the formula:

$$1 radian=\frac{180^{∘}}{π}$$

**6. Find their modulus and amplitude of the following**

**(i)** $\sqrt{3}+i$ **(ii).** $-1+i\sqrt{3}$

**Ans 6.**

### **Find the modulus and amplitude of the following**

#### **(i)** $\sqrt{3}+i$

#### Step 1: Modulus

The modulus of a complex number $z=a+bi$ is given by:

$$∣z∣=\sqrt{a^{2}+b^{2}}$$

Here, $z=\sqrt{3}+i$, so $a=\sqrt{3}$ and $b=1$.

$$∣z∣=\sqrt{\left(\sqrt{3}\right)^{2}+1^{2}}=\sqrt{3+1}=\sqrt{4}=2$$

#### Step 2: Amplitude