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PAPER : APPLIED MATHS II
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Q1

(a) $\int x^2 e^x dx$

SOL:-

Using integration by parts:

$\Rightarrow x^2 \int e^x dx - \int [\int e^x dx \cdot \frac{d}{dx} x^2] dx$

$\Rightarrow x^2 e^x - \int e^x \cdot (2x) dx$

$\Rightarrow x^2 e^x - 2 \int e^x x dx$

again using I.B.P

$\Rightarrow x^2 e^x - 2 \{x \int e^x dx - \int [e^x dx \frac{d}{dx} \cdot x] dx\}$

$\Rightarrow x^2 e^x - 2 \{x e^x - \int e^x (1) dx\}$

$\Rightarrow x^2 e^x - 2 \{x e^x - e^x\} + C$

$\Rightarrow x^2 e^x - 2xe^x + 2e^x + C$

$\Rightarrow \boxed{e^x [x^2 - 2x + 2] + C}$ Ans:-

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Q1 Part B

(b) $\int (1+3t) t^3 \, dt$

Sol:-

$\Rightarrow \int (t^3 + 3.t.t^3) \, dt$

$\Rightarrow \int t^3 dt + 3\int t^4 dt$

$\Rightarrow \frac{t^{3+1}}{3+1} + 3 \frac{t^{4+1}}{4+1} + C$

$\Rightarrow \frac{t^4}{4} + 3 \frac{t^5}{5} + C$

$\Rightarrow \boxed{\frac{1}{4} t^4 + \frac{3}{5} t^5 + C}$ Ans:

Q1 Part C

c $\int (e^x - e^3) \, dx$

$\Rightarrow \int e^x dx - \int e^3 dx$

$\Rightarrow e^x - \frac{e^3}{3} + C$

$\Rightarrow \boxed{e^x - \frac{1}{3} e^3 + C}$ Ans:

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Question- 2-

$$f(x) = e^{-6x} \quad at \quad x = -4$$

Solution:-

$$f(x) = f(x_0) + (x-x_0)f'(x_0) + \frac{(x-x_0)^2}{2!}f''(x_0)$$

$$+ \cdots\cdots + \frac{(x-x_0)^n}{n!}f^n(x_0) \rightarrow (1)$$

$$f(x) = e^{-6x}$$

$$f(-x) = e^{-6x-4} = e^{24}$$

$$f'(x) = e^{-6x}(-6) = -6e^{-6x}$$

$$= -6e^{-6x-4} = -6e^{24}$$

$$f''(x) = -6e^{-6x} - 6 = 36e^{-6x}$$

$$f''(-4) = 36e^{-6x(-4)} = 36e^{24}$$

put these values in eq (1).

$$e^{-6x} = e^{24} + (x+4)(-6e^{24}) + \frac{(x-4)^2}{2!}(36)e^{24}$$

$$+ \cdots\cdots$$

$$e^{-6x} = e^{24} - 6xe^{24} - 24e^{24} + \frac{(x+4)^2}{2}$$

$$36e^{24} + \cdots\cdots$$ Answer.

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Q③ $f(x) = e^{-6x}$ at $x = -4$

We know that

$$f(x) = f(x_0) + (x - x_0) f'(x_0) + \frac{(x - x_0)^2}{2!} f''(x_0) + \cdots +$$

$$\frac{(x - x_0)^n}{n!} f^n(x_0) . \longrightarrow ①$$

$$f(x) = e^{-6x}$$

$$f(-4) = e^{-6 \times -4} = e^{24}$$

$$f'(x) = e^{-6x}(-6) = -6e^{-6x} = -6e^{-6x-4} = -6e^{24}$$

$$f''(x) = -6e^{-6x} \times -6 = 36e^{-6x}$$

$$f''(-4) = 36e^{-6 \times (-4)} = 36e^{24}$$

Put these values in equation ①

$$e^{-6x} = e^{24} + (x+4)(-6e^{24}) + \frac{(x+4)^2}{2!}(36)e^{24} + \cdots$$

$$e^{-6x} = e^{24} - 6xe^{24} - 24e^{24} + \frac{(x+4)^2}{2} 36e^{24} + \cdots$$

Ans

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Q3 PART "A".

SOL:- $F(y) = x \sin x$

$\frac{d}{dx}(x \sin x)$

Using products rule

$\Rightarrow x \frac{d}{dx} \sin x + \sin x \frac{d}{dx} x$

$\Rightarrow x \cos x + \sin x \, (1)$

$\Rightarrow \boxed{x \cos x + \sin x}$ Ans

PART "B"

$F(y) = x^2 \cos x$

SOL:-

$\frac{d}{dx}(x^2 \cos x)$

Using product rule.

$\Rightarrow x^2 \frac{d}{dx} \cos x + \cos x \frac{d}{dx} x^2$

$\Rightarrow x^2(-\sin x) + \cos x \, (2x)$

$\Rightarrow -x^2 \sin x + 2 \cos x \, (x)$

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$\Rightarrow -x^2 \sin x + 2x \cos x$

$\Rightarrow \boxed{-x(x \sin x - 2\cos)}$ Ans.

Part "C"

$F(t) = z.(2z-2)^2$

Sol:. $\frac{d}{dz}[z.(2z-2)^2]$

Using product rule

$\Rightarrow z \frac{d}{dz}(2z-2)^2 + (2z-2)^2 . \frac{d}{dz}(z)$

$\Rightarrow z\{2(2z-2)(2)\} + (2z-2)^2 . (1)$

$\Rightarrow z\{4(2z-2)\} + (2z-2)^2$

$\Rightarrow 4z(2z-2) + (2z-2)^2$

$\Rightarrow (2z-2)\{4z + 2z - 2\}$

$\Rightarrow \boxed{(2z-2)\{6z-2\}}$ Ans: