Q1 a $\frac{d}{dx}\left(\frac{3x^4 - 2x^3 + 5}{x^3 + 1}\right)$

Use the quotient rule

$$= \frac{d}{dx}\left(\frac{3x^4 - 2x^3 + 5}{x^3 + 1}\right)$$

$$= (x^3+1)\left(\frac{d}{dx}(3x^4 - 2x^3 + 5)\right) - (3x^4 - 2x^3 + 5)\left(\frac{d}{dx}(x^3+1)\right)$$

$$= \frac{(x^3+1)(12x^3 - 6x^2) - (3x^4 - 2x^3 + 5)(3x^2)}{(x^3+1)^2}$$

Simplify.

$$= \frac{(x^3+1)(12x^3 - 6x^2) - (3x^4 - 2x^3 + 5)(3x^2)}{(x^3+1)^2}$$

$$= \frac{3x^6 + 12x^3 - 21x^2}{(x^3+1)^2}$$

$$= \frac{3x^2(x^4 + 4x - 7)}{(x^3+1)^2}$$

$$\boxed{\frac{3x^2(x^4 + 4x - 7)}{(x^3+1)^2} \text{ Ans}}$$

B
Q1

$$\frac{d}{dx}\left(x^3+1\right)^2$$

use the quotient rule

$$=\frac{d}{dx}\left(\frac{(x^3+1)^2}{x^3-1}\right)$$

$$=\frac{(x^3-1)\left(\frac{d}{dx}((x^3+1)^2)\right)-(x^3+1)^2\left(\frac{d}{dx}(x^3-1)\right)}{(x^3-1)2}$$

$$=\frac{(x^3-1)(2(x^3+1)(3x2))-(x^3+1)^2(3x2)}{(x^3-1)2}$$

$$=\frac{3x8-6x5-9x2}{(x3-1)2}$$

$$=\frac{3x2(x6-2x^3-3)}{(x3-1)2}$$

$$\boxed{\frac{3x2(x6-2x^3-3}{(x3-1)^2}}$$

Ans

Q2

a Find the integration of

$$\int \frac{1}{\sqrt{x^5}} dx$$

Sol $\int \frac{1}{x^5 {}^{1/2}} dx$

$$= \int \frac{1}{x^{5/2}} dx$$

$$= \int x^{-5/2} dx$$

$$= \frac{x^{-5/2+1}}{-\frac{5}{2}+1} + c$$

$$= \frac{2 \cdot x^{-3/2}}{\cancel{2} \cdot 3/\cancel{2}} + c$$

$$\boxed{= \frac{2x^{-3/2}}{-3} + c}$$ Ans

Q2

B $\int \frac{1}{(8x+7)^8} dx$

Substitute $u = 8x+7 \rightarrow \frac{du}{dx} = 8$ steps.

$\rightarrow dx = \frac{1}{8} du$:

$= \frac{1}{8} \int \frac{1}{u^8} du$

Now solving

$\int \frac{1}{u^8} du$

Apply Power rule

$\int u^n du = \frac{u^{n+1}}{n+1}$ with $n = -8$:

$= -\frac{1}{7u^7}$

Plug in solved integrals.

$\frac{1}{8} \int \frac{1}{u^8} du$

$$\frac{1}{8}\int \frac{1}{u^8}\,du$$

$$= -\frac{1}{56u^7}$$

undo substitution $u = 8x+7$:

$$= -\frac{1}{56(8x+7)^7}$$

$$\int \frac{1}{(8x+7)^8}\,dx$$

$$= -\frac{1}{56\cdot(8x+7)^7} + C$$

Ans.

Q.3

(A) $\frac{-x+9}{2x^2-8x+6}$ dx by Partial fractions.

Sol:

$$2x^2-8x+6$$

$$2x^2-6x-2x+6$$

$$2x(x-3)-2(x-3)$$

$$(x-3)(2x-2)$$

let

$$\frac{-x+9}{(x-3)(2x-2)} = \frac{A}{(x-3)} + \frac{B}{(2x-2)}$$

$\times$ b/ $(x-3)(2x-2)$ on Both Sides

$$x+9 = A(2x-2) + B(x-3)$$

Putting

$$\boxed{x=3}$$

$$-3+9 = A(2(3)-2 + B(3-3)$$

$$6 = A(6-2) + B(0)$$

$$6 = A(4) + B(0)$$

$$\boxed{A = \frac{4}{6} = \frac{}{5}} \quad \boxed{A \Rightarrow \frac{2}{3}}$$

Now

Putting

$$2x-2=0$$

$$\boxed{x=1}$$

$$1+9 = A(2(1)-2 + B(1-3)$$

$$8 = A(2-2) + B(-2)$$

$$8 = A(0) + B(-2)$$

$$\boxed{B = -\frac{1}{4}}$$

$$\int \frac{-x+9}{(x-3)(2x-2)}\,dx = \int \left(\frac{A}{(x-3} + \frac{B}{(2x2} \right)$$

$$= \int \frac{-x+9}{(x-3)(2x-3}\,dx = \int \left(\frac{2/3}{(x-3} - \frac{\frac{1}{4}}{(2x-2} \right) dx$$

$$= \frac{2}{3}\int \frac{1}{(x-3}\,dx - \frac{1}{4}\int \frac{1}{(2x-2}\,dx$$

$$\boxed{= \frac{2}{3}\ln(x-3) - \frac{1}{4}\ln(2x-2) + C}$$

Ans.

Q4

$$x + \begin{bmatrix} 3 & -1 \\ 2 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 1 \\ -3 & 1 \end{bmatrix}$$

Sol:: $n = \begin{bmatrix} 5 & 1 \\ -3 & 1 \end{bmatrix} - \begin{bmatrix} 3 & -1 \\ 2 & 2 \end{bmatrix}$

$$\begin{bmatrix} 5-3 & 1-(-1) \\ -3-2 & 1-2 \end{bmatrix} \rightarrow n = \begin{bmatrix} 2 & 2 \\ -5 & -1 \end{bmatrix} \text{ Ans}$$

Part B: $n + \begin{bmatrix} -1 & 0 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} 2 & 6 \\ 1 & 5 \end{bmatrix} + \begin{bmatrix} -4 & 8 \\ -2 & 0 \end{bmatrix}$

Sol::

$$n + \begin{bmatrix} -1 & 0 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} 2+(-4 & 6+(-8 \\ 1+(-2) & 5+0 \end{bmatrix}$$

$$n + \begin{bmatrix} -1 & 0 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} -2 & -2 \\ -1 & 5 \end{bmatrix} = \begin{bmatrix} -2 & -2 \\ -1 & 5 \end{bmatrix} \begin{bmatrix} -1 \\ 0 & 2 \end{bmatrix}$$

$$n = \begin{bmatrix} -2+1) & -2-0 \\ -1-0 & 5\ 2 \end{bmatrix} = \begin{bmatrix} -1 & -2 \\ -1 & 3 \end{bmatrix}$$

Ans

Part C

$$X+2] \begin{bmatrix} 3 & \cdot 1 \\ 1 & 2 \end{bmatrix}$$

$$x = \begin{bmatrix} 3 & -1 \\ 1 & 2 \end{bmatrix} \cdot 2 \ I$$

$$x = \begin{bmatrix} 3 & -1 \\ 1 & 2 \end{bmatrix} - 2 \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$x \begin{bmatrix} 3 & -1 \\ 1 & 2 \end{bmatrix} - \begin{bmatrix} (2\times1) & (2\times0) \\ (2\times0 & (2\times1 \end{bmatrix}$$

$$x \begin{bmatrix} 3 & -1 \\ 1 & 2 \end{bmatrix} - \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$$

$$x = \begin{bmatrix} (3-2) & (-1-0 \\ (1-0 & (2-2 \end{bmatrix}$$

$$x = \begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix}$$ Ans.

Q5 A

$$A \begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix} \quad B \begin{bmatrix} -3 & 2 \\ 4 & 0 \end{bmatrix}$$

$$C \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$$ find n2 + BC

Sol:

$$A = \begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix}$$

$$A2 \begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix}$$

$$\begin{bmatrix} (1\times1) + (4\times2 & (1\times4) + (4\times1) \\ 2\times1) \times (1\times2 & (2\times4) + (1\times1) \end{bmatrix}$$

$$A2 = \begin{bmatrix} 1+8) & (4+4 \\ 2+2) & (8+1) \end{bmatrix}$$

$$A = \begin{bmatrix} 9 & 8 \\ 4 & 9 \end{bmatrix}$$

Now

$B \times C$

$$B = \begin{bmatrix} -3 & 2 \\ 4 & 0 \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$$

$$B \times C = \begin{bmatrix} (-3 \times 1) + (2 \times 0) & (-3 \times 0) + (2 \times 2) \\ (4 \times 1) + (0 \times 0) & (4 \times 0) + (0 \times 2) \end{bmatrix}$$

$$B \times C = \begin{bmatrix} (-3 + 0 & (4) \\ (4) & (0) \end{bmatrix}$$

$$B \times C \begin{bmatrix} -3 & 4 \\ 4 & 0 \end{bmatrix}$$

Now

$A2 + BC$

$$A2\begin{bmatrix} 9 & 8 \\ 4 & 9 \end{bmatrix} + \begin{bmatrix} -3 & 4 \\ 4 & 0 \end{bmatrix}$$

$$A2 + Bc = \begin{bmatrix} (9+(-3)) & (3+4) \\ (4+4) & (9+0 \end{bmatrix}$$

$$A^2 + BC = \begin{bmatrix} 6 & 12 \\ 8 & 9 \end{bmatrix}$$

Hence

$$A^2 + BC = \begin{bmatrix} 6 & 12 \\ 8 & 9 \end{bmatrix}$$

Ans

Q3

(B) $$\frac{4x^2+8x}{(x^2+1)(x^2+2x+3)}$$

Sol: $$\frac{4x^2+8x}{(x^2+1)(x^2+2x+3)} = \frac{4x^2+8x}{x^3(x^2+2x+3)}$$

2 Partial fraction for each ~~other~~ factor

$$\frac{4x^2+8x}{x^3(x^2+2x+3)} = \frac{A}{x} + \frac{B}{(x)^2} + \frac{C}{(x)^3} + \frac{Dx+B}{x^2+2x+3}$$

Multiply through by the common denominator of $x^3(x^2+2x+3)$

$4x^2+8x = Ax(x^2(x^2+2x+3)) + Bx(x(x^2+2x+3))$

$+ Cx(x^2+2x-3) + (Dx+B(x^3)$

$\therefore 4x^2+8x = Ax(x^4+2x^3-3x^2) - B(x^3+2x^2$

$+3x) + Cx(x^2+2x+3) + (Dx+E)x(x^3)$