Question 1:

a) Differentiate $\frac{3x^4-2x^3+5}{x^3+1}$ w.r.t x.

Solution:-

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

applying quotient rule

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

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

$$=\frac{(3\times 4x^3-2\times 3x^2+0)(x^3+1)-(3x^4-2x^3+5)(3x^2+0)}{(x^3+1)^2}$$

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

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

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

Question 1:

b) Differentiate $\frac{(x^3+1)^2}{x^3-1}$ with respect to x.

Solution:-

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

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

$$= \frac{2(x^3+1)\left(\frac{d}{dx}(x^3) + \frac{d}{dx}(1)\right)(x^3+1) - (x^3+1)^2(3x^2+0)}{(x^3-1)^2}$$

$$= \frac{2(x^3+1)(3x^2+0)(x^3-1) - 3x^2(x^3+1)^2}{(x^3-1)^2}$$

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

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

Question. 2:

a) Find the integration of $\int \frac{1}{\sqrt{x^5}} dx$

Solution:

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

applying power rule:

$$\int x^n dx = \frac{x^{n+1}}{n+1}, \quad \text{with } n = -\frac{5}{2}$$

$$= -\frac{2}{3x^{\frac{5}{2}}}$$

$$\int \frac{1}{\sqrt{x^5}} dx = -\frac{2}{3x^{\frac{3}{2}}} + C \quad \text{Answer}$$

Question 2 :

b) Find the integration of $\int \frac{1}{(8x+7)^8} dx$:

Solution: $\int \frac{1}{(8x+7)^4} dx$

Substitute $u = 8x+7 \rightarrow \frac{du}{dx} = 8 \rightarrow dx = \frac{1}{8} du$

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

applying power rule :

$= -\frac{1}{3u^3}$

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

$= -\frac{1}{24u^3}$

$= -\frac{1}{24(8x+7)^3}$

$\int \frac{1}{(8x+7)^8} = -\frac{1}{24(8x+7)^3} + C$ Answer:

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Question. 5:

If $A = \begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} -3 & 2 \\ 4 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$. Find $A^2 + BC$.

Solution:

$$A^2 = \begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 9 & 8 \\ 4 & 9 \end{bmatrix}$$

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

$$A^2 + BC = \begin{bmatrix} 9 & 8 \\ 4 & 9 \end{bmatrix} + \begin{bmatrix} -3 & 4 \\ 4 & 0 \end{bmatrix}$$

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