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Paper	maths

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Q1) part(a) $\frac{3x^3-5x^2+5}{x^2+1}$

Let

Sol:- $y = \frac{3x^3-5x^2+5}{x^2+1}$

diff w,r,t x

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

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

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

$$= \frac{(x^2+1)(9x^2-10x)-(6x^4-5x^3+10x)}{(x^2+1)^2}$$

$$= \frac{9x^4-10x^3+9x^2-10x-6x^4+5x^3-10x}{(x^2+1)^2}$$

$$\frac{dy}{dx} = \frac{3x^4-5x^3+9x^2-20x}{(x^2+1)^2}$$

Q1 part B)

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

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

diff w.r.t. x

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

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

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

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

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

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

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

$$\frac{dy}{dx} = \frac{2x^5 - 4x^3 - 6x}{(x^2-1)}$$ Ans

pag #3 $\quad\quad f g \int dx + g$

Q#2

part(a)

if $y = (1+2\sqrt{x})^3 \cdot x^{\frac{2}{3}}$

diff w, r, to, x

$y = [(1)^3 + (2\sqrt{x})^3 + 3(1)(2\sqrt{x})(1+2\sqrt{x})] \, x^{3/2}$

$y = [1 + 8x^{3/2} + 6\sqrt{x}(1+2\sqrt{x})] \cdot x^{3/2}$

$y = [1 + 8x^{3/2} + 6\sqrt{x} + 12x] \cdot x^{3/2}$

$y = [1 + 8x^{3/2} + 6x^{1/2} + 12x] \cdot x^{3/2}$

$y = x^{3/2} + 8x^{\frac{3}{2}+\frac{3}{2}} + 6x^{\frac{1}{2}+\frac{3}{2}} + 12x^{1+\frac{3}{2}}]$

$y = x^{3/2} + 8x^3 + 6x^2 + 12x^{5/2}$

diff w, r, to, x

$\frac{dy}{dx} = \frac{d}{dx}\left(x^{3/2} + 8x^3 + 6x^2 + 12x^{5/2}\right)$

$dy/dx = \left(\frac{3}{2}x^{\frac{3}{2}-1} + 8 \times 3x^2 + 6 \times 2x + \cancel{12}^{6} \times \frac{5}{\cancel{2}} x^{\frac{5}{2}-1}\right)$

$dy/dx = \frac{3}{2}x^{1/2} + 24x^2 + 12x + 30x^{3/2}$ Ans

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Q 2 part B

$$y = \sqrt{\frac{1-x}{1+x}}$$

Solution: $y = \sqrt{\frac{1-x}{1+x}}$

let $U = \frac{1-x}{1+x}$

So $y = \sqrt{U}$

$y = U^{1/2}$ ----→ (1)

$U = \frac{1-x}{1+x}$

diff w.r.t. to x

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

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

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

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

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Q2 part B

$$\frac{du}{dx} = \frac{-1-\cancel{x}-1+\cancel{x}}{(1+x)^2}$$

$$du/dx = \frac{-2}{(1+x)^2} \dashrightarrow (ii)$$

now

$$y = u^{1/2}$$

diff w, r, to, u

$$dy/du = \frac{d}{du} u^{1/2}$$

$$dy/du = \frac{1}{2} u^{\frac{1}{2}-1}$$

$$dy/du = \frac{1}{2} u^{-1/2}$$

$$dy/du = \frac{u^{-1/2}}{2}$$

$$\frac{dy}{du} = \frac{1}{2u^{1/2}}$$

$$\frac{dy}{du} = \frac{1}{2\sqrt{\frac{1-x}{1+x}}}$$

Apply Chain Rule

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

$$= \frac{1}{\cancel{2}\sqrt{\frac{1-x}{1+x}}} \cdot \frac{-\cancel{2}}{(1+x)^2}$$

$$\frac{dy}{dx} = \frac{-1}{(1+x)^2\sqrt{\frac{1-x}{1+x}}}$$

Ans.

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Q3: part A

$$\int \frac{1}{\sqrt{x^3}}\,dx$$

Solution: $\int \frac{1}{\sqrt{x^3}}\,dx$

$= \int \frac{1}{x^{3/2}}\,dx$

$= \int x^{-3/2}\,dx$

$= \dfrac{x^{-\frac{3}{2}+1}}{-\frac{3}{2}+1} + C$

$= \dfrac{x^{\frac{-3+2}{2}}}{\frac{-3+2}{2}} + C$

$= \dfrac{x^{-1/2}}{-1/2}$

$= \frac{x^{-\frac{1}{2}}}{1} \div \left(\frac{-1}{2}\right) + C$

$= x^{-\frac{1}{2}} \times \left(-\frac{2}{1}\right) + C$

$= -2x^{-1/2} + C$

$= \dfrac{-2}{x^{1/2}} + C$

$= \dfrac{-2}{\sqrt{x}} + C$

Ans.

Q3

part B

$$\int \frac{1}{(6x+7)^6}\,dx$$

$$\int (6x+7)^{-6}\,dx$$

let $U = 3x-2$

$$\frac{dU}{3} = \frac{\cancel{3}dx}{\cancel{3}}$$

$$dx = \frac{dU}{3}$$

$$dx = \frac{1}{3}dU$$

$$= \int U^{-6}\frac{1}{3}dU$$

$$= \frac{1}{3}\int U^{-6}dU$$

$$= \frac{1}{3}\frac{U^{-6+1}}{-6+1} + C$$

$$= \frac{1}{3}\frac{U^{-5}}{-5} + C$$

$$= -\frac{1}{15}U^{-5} + C$$

$$= \frac{-1}{15U^5} + C$$

$$= \frac{-1}{15(6x+7)} + C$$

Ans.