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

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

using again above mention formu

$= \frac{1}{6} \int (6x+7)^{-6} (6) \, dx \longrightarrow *$ $\boxed{\frac{1}{\cancel{6}} \times \cancel{6} =}$

$= \frac{1}{6} \int \frac{(6x+7)^{-6+1}}{-6+1} + c$

$\int \frac{1}{(6x+7)^6} dx = \frac{-1}{30(6x+7)^5} + c$

3(a)

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

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

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

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

use formula $\int x^n\,dx = \frac{x^{n+1}}{n+1} + C$

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

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

$$\int \frac{1}{\sqrt{x^3}}\,dx = \frac{-2}{\sqrt{x}} + C$$

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2(b) $y = \sqrt{\frac{1-x}{1+x}}$ —— ①

Let $u = \frac{1-x}{1+x}$

$y = \sqrt{u}$ —— ②

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

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

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

$$2) \Rightarrow \frac{dy}{du} = \frac{1}{2\sqrt{u}}$$

Using chain rule

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

$$\Rightarrow \frac{dy}{du} = \frac{1}{2\sqrt{u}} \times \frac{(-2)}{(1+x)^2}$$

Use $u = \frac{1-x}{1+x}$

$$\Rightarrow \frac{dy}{du} = \frac{1}{\cancel{2}}\sqrt{\frac{1+x}{1-x}} \times \frac{(\cancel{-2})}{(1+x)^2}$$

$$\Rightarrow \frac{dy}{du} = \frac{-1}{\sqrt{1-x}\,(1+x)^{3/2}}$$

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

2(a) Let $x = u$

$$\Rightarrow y = (1+2\sqrt{u})^3 \cdot u^{2/3}$$

Solution

$$\frac{dy}{du} = (1+2\sqrt{u})^3 \frac{2}{3} u^{2/3} + u^{2/3}\, 3(1+2\sqrt{u})$$

$$\frac{dy}{du} = (1+2\sqrt{u})^3 \frac{2}{3} u^{-1/3} + 3u^{1/3}(1+2\sqrt{u})$$

$$\frac{dx}{du} = 1$$

By using chain rule

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

$$= (1+2\sqrt{u})^2 \left[(1+2\sqrt{u})\frac{2}{3}u^{-1/3} + 3u^{1/6}\right](1)$$

$$\Rightarrow \frac{dy}{dx} = (1+2\sqrt{u})^2 \left[\frac{2}{3}(1+2\sqrt{u})u^{-1/3} + 3u^{1/6}\right]$$

Use $u = x$

$$\Rightarrow \frac{dy}{dx} = (1+2\sqrt{x})^2 \left[\frac{2}{3}(1+2\sqrt{x})x^{-1/3} + 3x^{1/6}\right]$$

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

Solution

Again we use Quatient rule

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

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

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

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

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

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

Solution

Using quotient rule we have

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

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

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

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