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MECHANICAL ENGINEERING

SN 28

MAT104

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MAT 104 Answers

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

$\ln y = \ln \left(\frac{(x+1)^2 \sqrt{x-2}}{(x-2)^{3/2}} \right) = \ln (x+1)^2 + \ln \sqrt{x-2} - \ln (x-2)^{3/2}$

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

$\frac{dy}{y} = \frac{2}{\sqrt{x-2}} + \frac{1}{2\sqrt{x-2}} - \frac{3}{2(x-2)}$

$\frac{dy}{y} = \frac{2}{\sqrt{x-2}} + \frac{1}{2\sqrt{x-2}} - \frac{3}{2(x-2)}$

(2) $y = \frac{3e^{2x} \sin x}{x^{5/2}}$

$\ln y = \ln (3e^{2x}) + \ln (\sin x) - \ln (x^{5/2})$

$\frac{dy}{y} = \frac{1}{3e^{2x}} \cdot 2e^{2x} + \frac{1}{\sin x} \cdot \cos x - \frac{5}{2} \cdot \frac{1}{x^{3/2}}$

$\frac{dy}{y} = 2 + \frac{\cos x}{\sin x} - \frac{5}{2} \cdot \frac{1}{x^{3/2}}$

$\frac{dy}{y} = y \left[2 + \frac{\cot x}{\sin x} - \frac{5x^{-3/2}}{2} \right]$

(3) $\int 4 \sec^2 (3m+1) dm$

$4 \int \sec^2 (3m+1) dm$

$u = 3m+1$

$\frac{du}{dm} = 3 \quad dm = \frac{du}{3}$

$$A \sec^2 u \, du$$

$$\frac{1}{3} \tan u + C$$

$$\frac{1}{3} \tan(\sqrt{3}x+1) + C$$

$$\int \frac{2x}{\sqrt{3x^2-1}} dx$$

$$u = \sqrt{3x^2-1}; \quad u^2 = 3x^2-1; \quad 2u \cdot 2x = 6x^2-2; \quad x^2 = \frac{u^2+1}{3}$$

$$u = \sqrt{u^2+1}$$

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

$$\frac{du}{dx} = \frac{1}{3} \left(\frac{u^2+1}{3} \right)^{-1/2}$$

$$du = \frac{1}{3} \left(\frac{u^2+1}{3} \right)^{-1/2} dx$$

$$\int \frac{2x}{\sqrt{3x^2-1}} dx = \int \frac{2x}{3} \left(\frac{u^2+1}{3} \right)^{-1/2} dx$$

$$= \frac{2}{3} \int u^2 \left(\frac{u^2+1}{3} \right)^{-1/2} dx$$

$$= \frac{2}{3} \int u^2 du$$

$$\frac{2}{3} \left[\frac{u^3}{3} \right] + C = \frac{2u^3}{9} + C$$

$$\int \frac{2x}{\sqrt{3x^2-1}} dx = \frac{2(\sqrt{3x^2-1})^3}{9} + C$$

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

$$\frac{du}{dx} = \frac{1}{3} \left(\frac{u^2+1}{3} \right)^{-1/2}$$

$$\int \frac{2x}{\sqrt{3x^2-1}} dx = \int \frac{2x}{3} \left(\frac{u^2+1}{3} \right)^{-1/2} dx$$

$$\int \frac{2x}{3} \left(\frac{u^2+1}{3} \right)^{-1/2} dx$$

$$\frac{1}{3} + C = \frac{\sqrt{4x^2-1}}{2} + C$$