

Task 16 : Answers

1) $y = \sin 5x$

Let $u = 5x$

$$\frac{du}{dx} = 5$$

$$y = \sin u$$

$$\frac{dy}{du} = \cos u$$

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

$$= \cos u \times 5$$

$$= 5 \cos 5x$$

2) $y = \cos(3x-1)$

Let $u = 3x-1$

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

$$y = \cos u$$

$$\frac{dy}{du} = -\sin u$$

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

$$= (-\sin u) \times 3$$

$$= -3 \sin(3x-1)$$

3) $f(x) = \tan(4x + \pi/4)$

Let $u = 4x + \pi/4$

$$\frac{du}{dx} = 4$$

$$y = \tan u$$

$$\frac{dy}{du} = \sec^2 u$$

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

$$= \sec^2 u \times 4$$

$$= 4 \sec^2(4x + \pi/4)$$

$$4) f(x) = e^{3x}$$

$$\text{Let } u = 3x$$

$$y = e^u$$

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

$$\frac{dy}{du} = e^u$$

$$\begin{aligned} \frac{dy}{dx} = f'(x) &= \frac{dy}{du} \times \frac{du}{dx} \\ &= e^u \times 3 \\ &= 3e^{3x} \end{aligned}$$

$$5) \text{ Let } y = e^{7x-1}$$

$$u = 7x-1$$

$$y = e^u$$

$$\frac{dy}{du} = e^u$$

$$\frac{du}{dx} = 7$$

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

$$= e^u \times 7$$

$$= 7e^{7x-1}$$

$$6) y = \ln|3x-2|$$

$$\text{Let } u = 3x-2$$

$$y = \ln u$$

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

$$\frac{dy}{du} = \frac{1}{u}$$

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

$$= \frac{1}{u} \times 3$$

$$= \frac{3}{u}$$

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

$$7) \quad y = \ln|8x+1|$$

$$u = 8x+1$$

$$\frac{du}{dx} = 8$$

$$y = \ln u$$

$$\frac{dy}{du} = \frac{1}{u}$$

$$\begin{aligned} \frac{dy}{dx} &= \frac{dy}{du} \times \frac{du}{dx} \\ &= \frac{1}{u} \times 8 \\ &= \frac{8}{(8x+1)} \end{aligned}$$

$$8) \quad f(x) = 2\sin(\pi/2 - 3x)$$

$$\text{Let } u = \pi/2 - 3x$$

$$\frac{du}{dx} = -3$$

$$y = 2\sin u$$

$$\frac{dy}{du} = 2\cos u$$

$$\begin{aligned} f'(x) &= \frac{dy}{du} \times \frac{du}{dx} \\ &= 2\cos u \times (-3) \\ &= -6\cos(\pi/2 - 3x) \end{aligned}$$

$$9) \quad f(x) = -3\cos(x/2 + \pi/6)$$

$$\text{Let } u = \frac{x}{2} + \pi/6$$

$$\frac{du}{dx} = \frac{1}{2}$$

$$y = -3\cos u$$

$$\begin{aligned} \frac{dy}{du} &= -3(-\sin u) \\ &= 3\sin u \end{aligned}$$

$$\begin{aligned} f'(x) &= \frac{dy}{du} \times \frac{du}{dx} \\ &= 3\sin u \times \frac{1}{2} \\ &= \frac{3}{2}\sin(x/2 + \pi/6) \end{aligned}$$

$\frac{x}{2}$ means $\frac{1}{2}x$

10) Let $y = e^{8-3x}$

$$u = 8-3x$$

$$\frac{du}{dx} = -3$$

$$y = e^u$$

$$\frac{dy}{du} = e^u$$

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

$$= e^u \times (-3)$$

$$= -3e^{8-3x}$$

11) Let $y = e^{x^3}$

$$u = x^3$$

$$\frac{du}{dx} = 3x^2$$

$$y = e^u$$

$$\frac{dy}{du} = e^u$$

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

$$= e^u \times 3x^2$$

$$= 3x^2 e^{x^3}$$

12) $y = 2 \ln |3-4x|$

$$u = 3-4x$$

$$\frac{du}{dx} = -4$$

$$y = 2 \ln u$$

$$\frac{dy}{du} = 2 \times \frac{1}{u} = \frac{2}{u}$$

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

$$= \frac{2}{u} \times (-4)$$

$$= -\frac{8}{u}$$

$$= \frac{-8}{(3-4x)}$$

$$13) \quad y = \frac{1}{e^{7x}}$$

$$y = e^{-7x}$$

$$\text{Let } u = -7x$$

$$y = e^u$$

$$\frac{du}{dx} = -7$$

$$\frac{dy}{du} = e^u$$

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

$$= e^u \times (-7)$$

$$= -7e^{-7x} = -\frac{7}{e^{7x}}$$

Write in same format as question

$$14) \quad f(x) = \frac{-3}{e^{2x}}$$

$$f(x) = -3e^{-2x}$$

$$\text{Let } u = -2x$$

$$y = -3e^u$$

$$\frac{du}{dx} = -2$$

$$\frac{dy}{du} = -3e^u$$

$$\begin{aligned} \frac{dy}{dx} = f'(x) &= \frac{dy}{du} \times \frac{du}{dx} \\ &= -3e^u \times (-2) \\ &= 6e^{-2x} \\ &= \frac{6}{e^{2x}} \end{aligned}$$

$$15) \quad y = \frac{\pi}{2} \tan(3x - \pi/4)$$

$$\text{Let } u = 3x - \pi/4$$

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

$$y = \frac{\pi}{2} \tan u$$

$$\frac{dy}{du} = \frac{\pi}{2} \sec^2 u$$

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

$$= \frac{\pi}{2} \sec^2 u \times 3$$

$$= \frac{3\pi}{2} \sec^2(3x - \pi/4)$$