Exercise 7.3

Find the integrals of the functions in Exercises 1 to 22:

Question 1: $\sin^2(2x + 5)$

Answer 1:

$$\sin^2(2x+5)=\frac{1-\cos 2(2x+5)}{2}=\frac{1-\cos(4x+10)}{2}$$

$$\Rightarrow \int \sin^2(2x+5)\,dx=\int\frac{1-\cos(4x+10)}{2}dx$$

$$=\frac{1}{2}\int 1\,dx-\frac{1}{2}\int\cos(4x+10)\,dx$$

$$=\frac{1}{2}x-\frac{1}{2}\left(\frac{\sin(4x+10)}{4}\right)+C$$

$$=\frac{1}{2}x-\frac{1}{8}\sin(4x+10)+C$$

Question 2: $\sin 3x.\cos 4x$

Answer 2:

It is known that, $\sin A\cos B=\frac{1}{2}\{\sin(A+B)+\sin(A-B)\}$

$$\therefore \int \sin 3x\cos 4x\,dx=\frac{1}{2}\int\{\sin(3x+4x)+\sin(3x-4x)\}\,dx$$

$$=\frac{1}{2}\int\{\sin 7x+\sin(-x)\}\,dx$$

$$=\frac{1}{2}\int\{\sin 7x-\sin x\}\,dx$$

$$=\frac{1}{2}\int\sin 7x\,dx-\frac{1}{2}\int\sin x\,dx$$

$$=\frac{1}{2}\left(\frac{-\cos 7x}{7}\right)-\frac{1}{2}(-\cos x)+C$$

$$=\frac{-\cos 7x}{14}+\frac{\cos x}{2}+C$$

Question 3: cos 2x cos 4x cos 6x

Answer 3:

It is known that, $\cos A\cos B=\frac{1}{2}\{\cos(A+B)+\cos(A-B)\}$

$$\therefore \int\cos 2x(\cos 4x\cos 6x)dx=\int\cos 2x\left[\frac{1}{2}\{\cos(4x+6x)+\cos(4x-6x)\}\right]dx$$

$$=\frac{1}{2}\int\{\cos 2x\cos 10x+\cos 2x\cos(-2x)\}\,dx$$

$$=\frac{1}{2}\int\{\cos 2x\cos 10x+\cos^2 2x\}\,dx$$

$$=\frac{1}{2}\int\left[\left\{\frac{1}{2}\cos(2x+10x)+\cos(2x-10x)\right\}+\left(\frac{1+\cos 4x}{2}\right)\right]dx$$

$$=\frac{1}{4}\int(\cos 12x+\cos 8x+1+\cos 4x)\,dx$$

$$=\frac{1}{4}\left[\frac{\sin 12x}{12}+\frac{\sin 8x}{8}+x+\frac{\sin 4x}{4}\right]+C$$

Question 4: $\sin^3(2x+1)$

Answer 4:

Let $I=\int\sin^3(2x+1)$

$$\Rightarrow \int\sin^3(2x+1)dx=\int\sin^2(2x+1)\cdot\sin(2x+1)dx$$

$$=\int(1-\cos^2(2x+1))\sin(2x+1)dx$$

Let $\cos(2x+1)=t$

$$\Rightarrow -2\sin(2x+1)dx=dt$$

$$\Rightarrow \sin(2x+1)dx=\frac{-dt}{2}$$

$$\Rightarrow I = \frac{-1}{2}\int\left(1-t^2\right)dt$$
$$= \frac{-1}{2}\left\{t - \frac{t^3}{3}\right\}$$
$$= \frac{-1}{2}\left\{\cos(2x+1) - \frac{\cos^3(2x+1)}{3}\right\}$$
$$= \frac{-\cos(2x+1)}{2} + \frac{\cos^3(2x+1)}{6} + C$$

Question 5: $\sin^3 x \cos^3 x$

Answer 5:

Let $I = \int \sin^3 x \cos^3 x \cdot dx$
$$= \int \cos^3 x \cdot \sin^2 x \cdot \sin x \cdot dx$$
$$= \int \cos^3 x\left(1-\cos^2 x\right)\sin x \cdot dx$$

Let $\cos x = t$

$\Rightarrow -\sin x \cdot dx = dt$

$$\Rightarrow I = -\int t^3\left(1-t^2\right)dt$$
$$= -\int\left(t^3 - t^5\right)dt$$
$$= -\left\{\frac{t^4}{4} - \frac{t^6}{6}\right\} + C$$
$$= -\left\{\frac{\cos^4 x}{4} - \frac{\cos^6 x}{6}\right\} + C$$
$$= \frac{\cos^6 x}{6} - \frac{\cos^4 x}{4} + C$$

Question 6: sin x sin 2x sin 3x

Answer 6:

It is known that, $\sin A \sin B = \frac{1}{2}\left\{\cos(A-B) - \cos(A+B)\right\}$

$$\therefore \int \sin x \sin 2x \sin 3x \, dx = \int \left[\sin x \cdot \frac{1}{2}\left\{\cos(2x-3x) - \cos(2x+3x)\right\}\right] dx$$

$$= \frac{1}{2}\int\left(\sin x \cos(-x) - \sin x \cos 5x\right) dx$$

$$= \frac{1}{2}\int\left(\sin x \cos x - \sin x \cos 5x\right) dx$$

$$= \frac{1}{2}\int \frac{\sin 2x}{2} dx - \frac{1}{2}\int \sin x \cos 5x \, dx$$

$$= \frac{1}{4}\left[\frac{-\cos 2x}{2}\right] - \frac{1}{2}\int\left\{\frac{1}{2}\sin(x+5x) + \sin(x-5x)\right\} dx$$

$$= \frac{-\cos 2x}{8} - \frac{1}{4}\int\left(\sin 6x + \sin(-4x)\right) dx$$

$$= \frac{-\cos 2x}{8} - \frac{1}{4}\left[\frac{-\cos 6x}{3} + \frac{\cos 4x}{4}\right] + C$$

$$= \frac{-\cos 2x}{8} - \frac{1}{8}\left[\frac{-\cos 6x}{3} + \frac{\cos 4x}{2}\right] + C$$

$$= \frac{1}{8}\left[\frac{\cos 6x}{3} - \frac{\cos 4x}{2} - \cos 2x\right] + C$$

Question 7: sin 4x sin 8x

Answer 7:

It is known that, $\sin A \sin B = \frac{1}{2}\cos(A-B) - \cos(A+B)$

$$\therefore \int \sin 4x \sin 8x \, dx = \int \left\{ \frac{1}{2}\cos(4x-8x) - \cos(4x+8x) \right\} dx$$

$$= \frac{1}{2}\int \left(\cos(-4x) - \cos 12x\right) dx$$

$$= \frac{1}{2}\int \left(\cos 4x - \cos 12x\right) dx$$

$$= \frac{1}{2}\left[\frac{\sin 4x}{4} - \frac{\sin 12x}{12}\right]$$

Question 8: $\frac{1-\cos x}{1+\cos x}$

Answer 8:

$$\frac{1-\cos x}{1+\cos x} = \frac{2\sin^2 \frac{x}{2}}{2\cos^2 \frac{x}{2}} \qquad \left[2\sin^2 \frac{x}{2} = 1-\cos x \text{ and } 2\cos^2 \frac{x}{2} = 1+\cos x\right]$$

$$= \tan^2 \frac{x}{2}$$

$$= \left(\sec^2 \frac{x}{2} - 1\right)$$

$$\therefore \int \frac{1-\cos x}{1+\cos x} dx = \int \left(\sec^2 \frac{x}{2} - 1\right) dx$$

$$= \left[\frac{\tan \frac{x}{2}}{\frac{1}{2}} - x\right] + C$$

$$= 2\tan \frac{x}{2} - x + C$$

Question 9:

$$\frac{\cos x}{1+\cos x}$$

Answer 9:

$$\frac{\cos x}{1+\cos x}=\frac{\cos^2\frac{x}{2}-\sin^2\frac{x}{2}}{2\cos^2\frac{x}{2}} \qquad \left[\cos x=\cos^2\frac{x}{2}-\sin^2\frac{x}{2} \text{ and } \cos x=2\cos^2\frac{x}{2}-1\right]$$

$$=\frac{1}{2}\left[1-\tan^2\frac{x}{2}\right]$$

$$\therefore \int\frac{\cos x}{1+\cos x}dx=\frac{1}{2}\int\left(1-\tan^2\frac{x}{2}\right)dx$$

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

$$=\frac{1}{2}\int\left(2-\sec^2\frac{x}{2}\right)dx$$

$$=\frac{1}{2}\left[2x-\frac{\tan\frac{x}{2}}{\frac{1}{2}}\right]+C$$

$$=x-\tan\frac{x}{2}+C$$

Question 10:

$\sin^4 x$

Answer 10:

$$\sin^4 x = \sin^2 x \sin^2 x$$
$$= \left(\frac{1-\cos 2x}{2}\right)\left(\frac{1-\cos 2x}{2}\right)$$
$$= \frac{1}{4}(1-\cos 2x)^2$$
$$= \frac{1}{4}\left[1+\cos^2 2x - 2\cos 2x\right]$$
$$= \frac{1}{4}\left[1+\left(\frac{1+\cos 4x}{2}\right)-2\cos 2x\right]$$
$$= \frac{1}{4}\left[1+\frac{1}{2}+\frac{1}{2}\cos 4x - 2\cos 2x\right]$$
$$= \frac{1}{4}\left[\frac{3}{2}+\frac{1}{2}\cos 4x - 2\cos 2x\right]$$

$$\therefore \int \sin^4 x \, dx = \frac{1}{4}\int\left[\frac{3}{2}+\frac{1}{2}\cos 4x - 2\cos 2x\right]dx$$
$$= \frac{1}{4}\left[\frac{3}{2}x+\frac{1}{2}\left(\frac{\sin 4x}{4}\right)-\frac{2\sin 2x}{2}\right]+C$$
$$= \frac{1}{8}\left[3x+\frac{\sin 4x}{4}-2\sin 2x\right]+C$$
$$= \frac{3x}{8}-\frac{1}{4}\sin 2x+\frac{1}{32}\sin 4x+C$$

Question 11: $\cos^4 2x$

Answer 11:

$$\cos^4 2x = \left(\cos^2 2x\right)^2$$
$$= \left(\frac{1+\cos 4x}{2}\right)^2$$
$$= \frac{1}{4}\left[1+\cos^2 4x + 2\cos 4x\right]$$
$$= \frac{1}{4}\left[1+\left(\frac{1+\cos 8x}{2}\right)+2\cos 4x\right]$$
$$= \frac{1}{4}\left[1+\frac{1}{2}+\frac{\cos 8x}{2}+2\cos 4x\right]$$
$$= \frac{1}{4}\left[\frac{3}{2}+\frac{\cos 8x}{2}+2\cos 4x\right]$$
$$\therefore \int \cos^4 2x\, dx = \int\left(\frac{3}{8}+\frac{\cos 8x}{8}+\frac{\cos 4x}{2}\right)dx$$
$$= \frac{3}{8}x+\frac{\sin 8x}{64}+\frac{\sin 4x}{8}+C$$

Question 12: $\dfrac{\sin^2 x}{1+\cos x}$

Answer 12:

$$\frac{\sin^2 x}{1+\cos x} = \frac{\left(2\sin\frac{x}{2}\cos\frac{x}{2}\right)^2}{2\cos^2\frac{x}{2}} \quad \left[\sin x = 2\sin\frac{x}{2}\cos\frac{x}{2};\ \cos x = 2\cos^2\frac{x}{2}-1\right]$$
$$= \frac{4\sin^2\frac{x}{2}\cos^2\frac{x}{2}}{2\cos^2\frac{x}{2}}$$
$$= 2\sin^2\frac{x}{2}$$
$$= 1-\cos x$$
$$\therefore \int \frac{\sin^2 x}{1+\cos x}dx = \int(1-\cos x)dx$$
$$= x-\sin x + C$$

Question 13: $\dfrac{\cos 2x-\cos 2\alpha}{\cos x-\cos \alpha}$

Answer 13:

$$\frac{\cos 2x-\cos 2\alpha}{\cos x-\cos \alpha}=\frac{-2\sin\frac{2x+2\alpha}{2}\sin\frac{2x-2\alpha}{2}}{-2\sin\frac{x+\alpha}{2}\sin\frac{x-\alpha}{2}} \quad \left[\cos C-\cos D=-2\sin\frac{C+D}{2}\sin\frac{C-D}{2}\right]$$

$$=\frac{\sin(x+\alpha)\sin(x-\alpha)}{\sin\left(\frac{x+\alpha}{2}\right)\sin\left(\frac{x-\alpha}{2}\right)}$$

$$=\frac{\left[2\sin\left(\frac{x+\alpha}{2}\right)\cos\left(\frac{x+\alpha}{2}\right)\right]\left[2\sin\left(\frac{x-\alpha}{2}\right)\cos\left(\frac{x-\alpha}{2}\right)\right]}{\sin\left(\frac{x+\alpha}{2}\right)\sin\left(\frac{x-\alpha}{2}\right)}$$

$$=4\cos\left(\frac{x+\alpha}{2}\right)\cos\left(\frac{x-\alpha}{2}\right)$$

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

$$=2\left[\cos(x)+\cos\alpha\right]$$

$$=2\cos x+2\cos\alpha$$

$$\therefore \int\frac{\cos 2x-\cos 2\alpha}{\cos x-\cos\alpha}dx=\int 2\cos x+2\cos\alpha$$

$$=2\left[\sin x+x\cos\alpha\right]+C$$

Question 14:

$$\frac{\cos x-\sin x}{1+\sin 2x}$$

Answer 14:

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

$$\left[\sin^2 x+\cos^2 x=1;\ \sin 2x=2\sin x\cos x\right]$$

$$=\frac{\cos x-\sin x}{\left(\sin x+\cos x\right)^2}$$

Let $\sin x+\cos x=t$

$\therefore \left(\cos x-\sin x\right)dx=dt$

$$\Rightarrow \int\frac{\cos x-\sin x}{1+\sin 2x}dx=\int\frac{\cos x-\sin x}{\left(\sin x+\cos x\right)^2}dx$$

$$=\int\frac{dt}{t^2}$$

$$=\int t^{-2}dt$$

$$=-t^{-1}+C$$

$$=-\frac{1}{t}+C$$

$$=\frac{-1}{\sin x+\cos x}+C$$

Question 15:

$\tan^3 2x \sec 2x$

Answer 15:

$$\tan^3 2x \sec 2x = \tan^2 2x \tan 2x \sec 2x$$
$$= \left(\sec^2 2x - 1\right)\tan 2x \sec 2x$$
$$= \sec^2 2x \cdot \tan 2x \sec 2x - \tan 2x \sec 2x$$
$$\therefore \int \tan^3 2x \sec 2x \, dx = \int \sec^2 2x \tan 2x \sec 2x \, dx - \int \tan 2x \sec 2x \, dx$$
$$= \int \sec^2 2x \tan 2x \sec 2x \, dx - \frac{\sec 2x}{2} + C$$

Let $\sec 2x = t$

$\therefore 2\sec 2x \tan 2x \, dx = dt$

$$\therefore \int \tan^3 2x \sec 2x \, dx = \frac{1}{2}\int t^2 dt - \frac{\sec 2x}{2} + C$$
$$= \frac{t^3}{6} - \frac{\sec 2x}{2} + C$$
$$= \frac{(\sec 2x)^3}{6} - \frac{\sec 2x}{2} + C$$

Question 16: $\tan^4 x$

Answer 16:

$$\tan^4 x$$
$$= \tan^2 x \cdot \tan^2 x$$
$$= \left(\sec^2 x - 1\right)\tan^2 x$$
$$= \sec^2 x \tan^2 x - \tan^2 x$$
$$= \sec^2 x \tan^2 x - \left(\sec^2 x - 1\right)$$
$$= \sec^2 x \tan^2 x - \sec^2 x + 1$$

$$\therefore \int \tan^4 x\, dx = \int \sec^2 x \tan^2 x\, dx - \int \sec^2 x\, dx + \int 1 \cdot dx$$
$$= \int \sec^2 x \tan^2 x\, dx - \tan x + x + C \quad ...(1)$$

Consider $\int \sec^2 x \tan^2 x\, dx$

Let $\tan x = t \Rightarrow \sec^2 x\, dx = dt$

$$\Rightarrow \int \sec^2 x \tan^2 x dx = \int t^2 dt = \frac{t^3}{3} = \frac{\tan^3 x}{3}$$

From equation (1), we obtain

$$\int \tan^4 x\, dx = \frac{1}{3}\tan^3 x - \tan x + x + C$$

Question 17: $\dfrac{\sin^3 x + \cos^3 x}{\sin^2 x \cos^2 x}$

Answer 17:

$$\frac{\sin^3 x + \cos^3 x}{\sin^2 x \cos^2 x} = \frac{\sin^3 x}{\sin^2 x \cos^2 x} + \frac{\cos^3 x}{\sin^2 x \cos^2 x}$$
$$= \frac{\sin x}{\cos^2 x} + \frac{\cos x}{\sin^2 x}$$
$$= \tan x \sec x + \cot x \operatorname{cosec} x$$

$$\therefore \int \frac{\sin^3 x + \cos^3 x}{\sin^2 x \cos^2 x} dx = \int \left(\tan x \sec x + \cot x \operatorname{cosec} x\right) dx$$
$$= \sec x - \operatorname{cosec} x + C$$

Question 18: $\dfrac{\cos 2x+2\sin^2 x}{\cos^2 x}$

Answer 18:

$$\frac{\cos 2x+2\sin^2 x}{\cos^2 x}$$

$$=\frac{\cos 2x+(1-\cos 2x)}{\cos^2 x} \qquad [\cos 2x=1-2\sin^2 x]$$

$$=\frac{1}{\cos^2 x}$$

$$=\sec^2 x$$

$$\therefore \int\frac{\cos 2x+2\sin^2 x}{\cos^2 x}\,dx=\int\sec^2 x\,dx=\tan x+C$$

Question 19: $\dfrac{1}{\sin x\cos^3 x}$

Answer 19:

$$\frac{1}{\sin x\cos^3 x}=\frac{\sin^2 x+\cos^2 x}{\sin x\cos^3 x}$$

$$=\frac{\sin x}{\cos^3 x}+\frac{1}{\sin x\cos x}$$

$$=\tan x\sec^2 x+\frac{\frac{1}{\cos^2 x}}{\frac{\sin x\cos x}{\cos^2 x}}$$

$$=\tan x\sec^2 x+\frac{\sec^2 x}{\tan x}$$

$$\therefore \int\frac{1}{\sin x\cos^3 x}dx=\int\tan x\sec^2 x\,dx+\int\frac{\sec^2 x}{\tan x}\,dx$$

Let $\tan x=t \Rightarrow \sec^2 x\,dx=dt$

$$\Rightarrow \int\frac{1}{\sin x\cos^3 x}dx=\int t\,dt+\int\frac{1}{t}\,dt$$

$$=\frac{t^2}{2}+\log|t|+C$$

$$=\frac{1}{2}\tan^2 x+\log|\tan x|+C$$

Question 20:

$$\frac{\cos 2x}{(\cos x+\sin x)^2}$$

Answer 20:

$$\frac{\cos 2x}{(\cos x+\sin x)^2}=\frac{\cos 2x}{\cos^2 x+\sin^2 x+2\sin x\cos x}=\frac{\cos 2x}{1+\sin 2x}$$

$$\therefore \int\frac{\cos 2x}{(\cos x+\sin x)^2}dx=\int\frac{\cos 2x}{(1+\sin 2x)}dx$$

Let $1+\sin 2x=t$

$\Rightarrow 2\cos 2x\,dx=dt$

$$\therefore \int\frac{\cos 2x}{(\cos x+\sin x)^2}dx=\frac{1}{2}\int\frac{1}{t}dt$$

$$=\frac{1}{2}\log|t|+C$$

$$=\frac{1}{2}\log|1+\sin 2x|+C$$

$$=\frac{1}{2}\log\left|(\sin x+\cos x)^2\right|+C$$

$$=\log|\sin x+\cos x|+C$$

Question 21: $\sin^{-1}(\cos x)$

Answer 21:

$\sin^{-1}(\cos x)$

Let $\cos x = t$

Then, $\sin x = \sqrt{1-t^2}$

$\Rightarrow (-\sin x)dx = dt$

$$dx = \frac{-dt}{\sin x}$$

$$dx = \frac{-dt}{\sqrt{1-t^2}}$$

$$\therefore \int \sin^{-1}(\cos x)dx = \int \sin^{-1} t\left(\frac{-dt}{\sqrt{1-t^2}}\right)$$

$$= -\int \frac{\sin^{-1} t}{\sqrt{1-t^2}}dt$$

Let $\sin^{-1} t = u$

$$\Rightarrow \frac{1}{\sqrt{1-t^2}}dt = du$$

$$\therefore \int \sin^{-1}(\cos x)dx = \int 4du$$

$$= -\frac{u^2}{2} + C$$

$$= \frac{-(\sin^{1} t)^2}{2} + C$$

$$= \frac{-\left[\sin^{-1}(\cos x)\right]^2}{2} + C \qquad \ldots(1)$$

It is known that,

$$\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$$

$$\therefore \sin^{-1}(\cos x) = \frac{\pi}{2} - \cos^{-1}(\cos x) = \left(\frac{\pi}{2} - x\right)$$

Substituting in equation (1), we obtain

$$\int \sin^{-1}(\cos x)\,dx = \frac{-\left[\frac{\pi}{2}-x\right]^2}{2}+C$$
$$=-\frac{1}{2}\left(\frac{\pi^2}{2}+x^2-\pi x\right)+C$$
$$=-\frac{\pi^2}{8}-\frac{x^2}{2}+\frac{1}{2}\pi x+C$$
$$=\frac{\pi x}{2}-\frac{x^2}{2}+\left(C-\frac{\pi^2}{8}\right)$$
$$=\frac{\pi x}{2}-\frac{x^2}{2}+C_1$$

Question 22: $\dfrac{1}{\cos(x-a)\cos(x-b)}$

Answer 22:

$$\frac{1}{\cos(x-a)\cos(x-b)}=\frac{1}{\sin(a-b)}\left[\frac{\sin(a-b)}{\cos(x-a)\cos(x-b)}\right]$$
$$=\frac{1}{\sin(a-b)}\left[\frac{\sin\left[(x-b)-(x-a)\right]}{\cos(x-a)\cos(x-b)}\right]$$
$$=\frac{1}{\sin(a-b)}\frac{\left[\sin(x-b)\cos(x-a)-\cos(x-b)\sin(x-a)\right]}{\cos(x-a)\cos(x-b)}$$
$$=\frac{1}{\sin(a-b)}\left[\tan(x-b)-\tan(x-a)\right]$$

$$\Rightarrow \int\frac{1}{\cos(x-a)\cos(x-b)}dx=\frac{1}{\sin(a-b)}\int\left[\tan(x-b)-\tan(x-a)\right]dx$$
$$=\frac{1}{\sin(a-b)}\left[-\log\left|\cos(x-b)\right|+\log\left|\cos(x-a)\right|\right]$$
$$=\frac{1}{\sin(a-b)}\left[\log\left|\frac{\cos(x-a)}{\cos(x-b)}\right|\right]+C$$

Question 23: $\int \frac{\sin^2 x - \cos^2 x}{\sin^2 x \cos^2 x} dx$ is equal to

(A) tan *x* + cot *x* + C (B) tan *x* + cosec *x* + C

(C) – tan *x* + cot *x* + C (D) tan *x* + sec *x* + C

Answer 23:

$$\int \frac{\sin^2 x - \cos^2 x}{\sin^2 x \cos^2 x} dx = \int \left(\frac{\sin^2 x}{\sin^2 x \cos^2 x} - \frac{\cos^2 x}{\sin^2 x \cos^2 x} \right) dx$$

$$= \int \left(\sec^2 x - \operatorname{cosec}^2 x \right) dx$$

$$= \tan x + \cot x + C$$

Hence, the correct Answer is A.

Question 24: $\int \frac{e^x (1+x)}{\cos^2 (e^x x)} dx$ equals

(A) – cot (ex^x) + C (B) tan (xe^x) + C

(C) tan (e^x) + C (D) cot (e^x) + C

Answer 24:

$$\int \frac{e^x (1+x)}{\cos^2 (e^x x)} dx$$

Let $ex^x = t$

$$\Rightarrow \left(e^x \cdot x + e^x \cdot 1 \right) dx = dt$$

$$e^x (x+1) dx = dt$$

$$\therefore \int \frac{e^x (1+x)}{\cos^2 (e^x x)} dx = \int \frac{dt}{\cos^2 t}$$

$$= \int \sec^2 t \, dt$$

$$= \tan t + C$$

$$= \tan \left(e^x \cdot x \right) + C$$

Hence, the correct Answer is B.