

$$1 - \int e^x \cos 4x dx$$

$$= \boxed{} e^x \left[\frac{1}{4} \sin 4x + \frac{1}{16} \cos 4x \right]$$

e^x	$\cos 4x$
e^x	$\frac{1}{4} \sin 4x$
e^x	$-\frac{1}{16} \cos 4x$

By using MYCAR $\boxed{} = \frac{16}{17}$

$$\text{Answer} = \frac{16}{17} e^x \left[\frac{1}{4} \sin 4x + \frac{1}{16} \cos 4x \right] + C$$

$$2. \int (x-1)^2 \sin x dx$$

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

$$+ 2 \cos x + C$$

$(x-1)^2$	$\sin x$
$2(x-1)$	$-\cos x$
2	$-\sin x$
0	$\cos x$

$$3. \int \sin^5 x \cos^3 x dx$$

$$= \int \sin x \cos x \sin^4 x \cos^2 x dx$$

$$= \int \sin x \cos x \sin^4 x (1 - \sin^2 x) dx$$

$$= \int \sin^5 x \cos x dx - \int \sin^7 x \cos x dx$$

$$= \frac{\sin 6x}{6} - \frac{\sin^8 x}{8} + C$$

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$$4. \int \frac{1}{4x - x^2 - 3} dx = \int \frac{-1}{x^2 - 4x + 3} dx$$

$$\frac{-1}{x^2 - 4x + 3} = \frac{-1}{(x-1)(x-3)} = \frac{A_1}{x-1} + \frac{A_2}{x-3}$$

$$= \frac{A_1(x-3) + A_2(x-1)}{(x-1)(x-3)}$$

$$\text{So } -1 = A_1(x-3) + A_2(x-1)$$

$$\text{if } x=3 \rightarrow 2A_2 = -1 \rightarrow A_2 = -\frac{1}{2}$$

$$\text{if } x=1 \rightarrow -2A_1 = -1 \rightarrow A_1 = \frac{1}{2}$$

then

$$\int \frac{-1}{x^2 - 4x + 3} dx = \int \frac{\frac{1}{2}}{x-1} dx - \int \frac{\frac{1}{2}}{x-3} dx$$

$$= \frac{1}{2} \ln|x-1| - \frac{1}{2} \ln|x-3| + C$$

5. $\int \frac{4}{4x^2 + 4x + 5} dx$

$$4x^2 + 4x + 5 = 4 \left[\left(x + \frac{4}{8}\right)^2 + \frac{80 - 16}{64} \right]$$

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

then

$$\int \frac{4}{4x^2 + 4x + 5} dx = \int \frac{1}{\left(x + \frac{1}{2}\right)^2 + 1} dx$$

$$x + \frac{1}{2} = u \rightarrow dx = du$$

$$= \int \frac{1}{u^2 + 1} dx = \text{Arctan}(u) + C$$

$$= \text{Arctan}\left(x + \frac{1}{2}\right) + C$$

$$6. \int \cos^2(x-2) \sin^3(x-2) dx$$

$$u = x-2 \rightarrow du = dx$$

$$\int \cos^2 u \sin u \sin^2 u du$$

$$= \int \cos^2 u \sin u (1 - \cos^2 u) du$$

$$= \int \sin u \cos^2 u du - \int \sin u \cos^4 u du$$

$$= \frac{\cos^3 u}{3} - \frac{\cos^5 u}{5} + C$$

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

$$7. \int_1^2 \frac{1}{1-x^2} dx$$

This is improper
integral since

$x=1$ is not in the

So need to find

domain of $\frac{1}{1-x^2}$

$$\lim_{T \rightarrow 1^+} \int_T^2 \frac{1}{1-x^2} dx = \lim_{T \rightarrow 1^+} \int_T^2 \frac{-1}{(x-1)(x+1)} dx$$

$$\frac{-1}{(x-1)(x+1)} = \frac{A_1}{x-1} + \frac{A_2}{x+1} = \frac{A_1(x+1) + A_2(x-1)}{(x-1)(x+1)}$$

$$\text{if } x = -1 \rightarrow -2A_2 = -1 \rightarrow A_2 = \frac{1}{2}$$

$$\text{if } x = 1 \rightarrow 2A_1 = -1 \rightarrow A_1 = -\frac{1}{2}$$

$$\begin{aligned} & \int_T^2 \frac{-\frac{1}{2}}{x-1} dx + \int_T^2 \frac{\frac{1}{2}}{x+1} dx \\ &= -\frac{1}{2} \ln|x-1| \Big|_T^2 + \frac{1}{2} \ln|x+1| \Big|_T^2 \\ &= -\frac{1}{2} \ln(1) + \frac{1}{2} \ln|T-1| + \frac{1}{2} \ln(3) - \frac{1}{2} \ln|T+1| \end{aligned}$$

Then

$$\lim_{T \rightarrow 1^+} -\frac{1}{2} \ln \frac{|T+1|}{|T-1|} + \frac{1}{2} \ln(3) = -\infty + \frac{1}{2} \ln(3) = -\infty$$