

5.5 F exp/ln functions

$$\int e^u du = e^u + c \quad \int \frac{1}{u} du = \ln|u| + c$$

1. $I = \int e^{5x} dx \quad u = 5x \quad du = 5dx \quad dx = \frac{1}{5} du$

$$I = \int e^u \left(\frac{1}{5} du\right) \\ = \frac{1}{5} e^u + c = \frac{1}{5} e^{5x} + c$$

2. $I = \int e^{-x} dx \quad u = -x, \quad du = -dx, \quad dx = -du$

$$I = \int e^u (-du) = -e^u + c = -e^{-x} + c$$

3. $I = \int e^{ax} dx = \frac{1}{a} e^{ax} + c$

4. $I = \int e^{-x/2} dx = \frac{1}{-1/2} e^{-x/2} + c = -2e^{-x/2} + c$

5. $I = \int x e^{-x^2} dx \quad u = -x^2, \quad du = -2x dx,$

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

$$I = \int e^u \left(-\frac{1}{2} du\right) = -\frac{1}{2} e^u + c = -\frac{1}{2} e^{-x^2} + c$$

6. $I = \int \frac{1}{x^{3/2}} e^{1/\sqrt{x}} dx$

$$u = \frac{1}{\sqrt{x}} = x^{-1/2} \quad du = -\frac{1}{2} x^{-3/2} dx$$

$$x^{-3/2} dx = -2 du$$

$$I = \int e^u (-2 du)$$

$$= -2 e^u + c$$

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$$7. \quad I = \int \sec^2 x e^{\tan x} dx$$

$$u = \tan x \quad du = \sec^2 x dx$$

$$I = \int e^u du = e^u + c = e^{\tan x} + c$$

$$8. \quad I = \int \frac{1}{x+1} e^{3+\ln(x+1)} dx$$

$$u = 3 + \ln(x+1) \quad du = \frac{1}{x+1} dx$$

$$I = \int e^u du = e^u + c = e^{3+\ln(x+1)} + c$$

$$9. \quad I = \int \frac{1}{x+a} dx \quad u = x+a \quad du = dx$$

$$I = \int \frac{1}{u} du = \ln|u| + c = \ln|x+a| + c$$

$$10. \quad I = \int \frac{x}{x^2+2} dx \quad u = x^2+2, \quad du = 2x dx, \quad x dx = \frac{1}{2} du$$

$$I = \int \frac{1}{u} \left(\frac{1}{2} du\right) = \frac{1}{2} \ln|u| + c = \frac{1}{2} \ln|x^2+2| + c$$

$$11. \quad I = \int \frac{x^2}{x^3+2} dx \quad u = x^3+2, \quad du = 3x^2 dx, \quad x^2 dx = \frac{1}{3} du$$

$$I = \int \frac{1}{u} \left(\frac{1}{3} du\right) = \frac{1}{3} \ln|u| + c = \frac{1}{3} \ln|x^3+2| + c$$

$$12. \quad I = \int \frac{1}{4x-7} dx \quad u = 4x-7, \quad du = 4 dx, \quad dx = \frac{1}{4} du$$

$$I = \int \frac{1}{u} \left(\frac{1}{4} du\right) = \frac{1}{4} \ln|u| + c = \frac{1}{4} \ln|4x-7| + c$$

$$13. \quad I = \int \frac{5}{2x+3} dx \quad u = 2x+3 \quad du = 2 dx \quad dx = \frac{1}{2} du$$

$$I = \int 5 \frac{1}{u} \left(\frac{1}{2} du\right) = \frac{5}{2} \ln|u| + c = \frac{5}{2} \ln|2x+3| + c$$

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14.
$$I = \int \frac{x}{x-1} dx \quad \text{TRICK!}$$

$$= \int \frac{x-1+1}{x-1} dx$$

$$= \int \frac{x-1}{x-1} + \frac{1}{x-1} dx = \int 1 + \frac{1}{x-1} dx$$

$$= x + \ln|x-1| + C$$

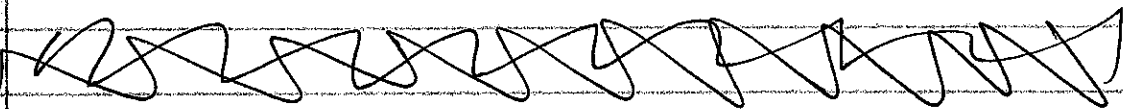
15.
$$I = \int \frac{2x+3}{x^2+3x+10} dx \quad u = x^2+3x+10$$

$$du = (2x+3) dx$$

$$I = \int \frac{du}{u} = \ln|u| + C = \ln|x^2+3x+10| + C$$

16.
$$I = \int \frac{e^x}{e^x+1} dx \quad u = e^x+1 \quad du = e^x dx$$

$$I = \int \frac{1}{u} du = \ln|u| + C = \ln|e^x+1| + C$$



17.
$$I = \int \tan x dx = \int \frac{\sin x}{\cos x} dx$$

$$u = \cos x \quad du = -\sin x dx, \quad \sin x dx = -du$$

$$I = \int \frac{1}{u} (-du) = -\ln|u| + C = -\ln|\cos x| + C$$

or $+\ln|\sec x| + C$

$$-\ln|\cos x| + C = \ln|(\cos x)^{-1}| + C$$

sec x

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18. $I = \int \frac{\cos 2x}{3 + \sin 2x} dx$ $u = 3 + \sin 2x$
 $du = 2 \cos 2x dx$
 $\cos 2x dx = \frac{1}{2} du$

$I = \int \frac{1}{u} \left(\frac{1}{2} du\right) = \frac{1}{2} \ln |3 + \sin 2x| + C$

19. $I = \int \tan(10x) dx$ $u = 10x$ $du = 10 dx$ $dx = \frac{1}{10} du$
 $I = \int \tan(u) \left(\frac{1}{10} du\right)$
 $= \frac{1}{10} \ln |\sec u| + C = \frac{1}{10} \ln |\sec 10x| + C$

20. $I = \int \frac{1}{x(\ln x + 1)} dx$ $u = \ln x + 1$ $du = \frac{1}{x} dx$

$I = \int \frac{1}{u} du = \ln |u| + C = \ln |\ln x + 1| + C$

21. $I = \int \frac{1}{\sqrt{x}(\sqrt{x} + 1)} dx$ $u = \sqrt{x} + 1$
 $du = \frac{1}{2\sqrt{x}} dx$ $\frac{1}{\sqrt{x}} dx = 2 du$

$I = \int \frac{1}{u} (2 du) = 2 \ln |u| + C = 2 \ln |\sqrt{x} + 1| + C$

22. $I = \int \frac{1}{(1+x^2)(3 - \tan^{-1} x)} dx$ $u = 3 - \tan^{-1} x$
 $du = -\frac{1}{1+x^2} dx$
 $\frac{1}{1+x^2} dx = -du$

$I = \int \frac{1}{u} (-du)$
 $= -\ln |u| + C = -\ln |3 - \tan^{-1} x| + C$