

Math 1450, Honor Calculus Practice 7, Fall 2016.

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(u-sub.) 1. Calculate  $\int \frac{10x + 35}{\sqrt{x^2 + 7x - 3}} dx =$

let  $u = x^2 + 7x - 3$ ,  $du = (2x + 7) dx$

$$\int \frac{5(2x+7) dx}{\sqrt{x^2+7x-3}} = \int \frac{5 du}{\sqrt{u}}$$

$$= 10\sqrt{u} + C$$

$$= \underline{10\sqrt{x^2+7x-3} + C}$$

(u-sub.) 2. Calculate  $\int \frac{5x}{(x^2-5)^2} dx$

let  $u = x^2 - 5$ ,  $du = 2x dx$ ,  $\frac{du}{2} = x dx$

$$= 5 \int \frac{x dx}{(x^2-5)^2} = \frac{5}{2} \int \frac{du}{u^2}$$

$$= \underline{-\frac{5}{2} \frac{1}{u} + C = -\frac{5}{2} \frac{1}{x^2-5} + C.}$$

(partial fraction)

3. Calculate  $\int \frac{5x}{x^2-x-6} dx$

$$\frac{5x}{x^2-x-6} = \frac{5x}{(x+2)(x-3)} = \frac{2}{x+2} + \frac{3}{x-3}$$

$$\text{so } \int \frac{5x}{x^2-x-6} dx = \int \left( \frac{2}{x+2} + \frac{3}{x-3} \right) dx$$

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

(partial fraction)

4. Calculate  $\int \frac{5}{x^2-x-6} dx$

$$\frac{5}{x^2-x-6} = \frac{5}{(x+2)(x-3)} = \frac{-1}{x+2} + \frac{1}{x-3}$$

$$\text{so } \int \frac{5}{x^2-x-6} dx = \int \left( \frac{-1}{x+2} + \frac{1}{x-3} \right) dx$$

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

(u-sub & partial frac.) 5. Calculate  $\int \frac{e^x}{e^{2x} + 9e^x + 14} dx$

let  $u = e^x$   
 $du = e^x dx$

$$\Rightarrow \int \frac{du}{u^2 + 9u + 14}$$

$$= \int \frac{du}{(u+2)(u+7)} = \int \left( \frac{-\frac{1}{5}}{u+2} + \frac{\frac{1}{5}}{u+7} \right) du$$

$$= -\frac{1}{5} \ln(u+2) + \frac{1}{5} \ln(u+7) + C$$

$$= -\frac{1}{5} \ln(e^x + 2) + \frac{1}{5} \ln(e^x + 7) + C$$


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(u-sub & partial frac.) Calculate  $\int \frac{\cos(x)}{\sin^2(x) - 3\sin(x) - 10} dx$

let  $u = \sin(x)$   
 $du = \cos(x) dx$

$$\Rightarrow \int \frac{du}{u^2 - 3u - 10}$$

$$= \int \frac{du}{(u-5)(u+2)} = \int \left( \frac{\frac{1}{7}}{u-5} + \frac{-\frac{1}{7}}{u+2} \right) du$$

$$= \frac{1}{7} \ln(u-5) - \frac{1}{7} \ln(u+2) + C$$

$$= \frac{1}{7} \ln(\sin(x) - 5) - \frac{1}{7} \ln(\sin(x) + 2) + C$$


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(u-sub.) 7. Calculate  $\int \frac{e^x}{e^x + 1} dx$

let  $u = e^x$   
 $du = e^x dx$

$$\Rightarrow \int \frac{du}{u+1}$$

$$= \ln(u+1) + C$$

$$= \ln(e^x + 1) + C$$


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8. Calculate  $\int \frac{e^x}{\sqrt{1 - (5e^x)^2}} dx$

let  $u = 5e^x$   
 $du = 5e^x dx$   
 $\frac{du}{5} = e^x dx$

$$\Rightarrow \frac{1}{5} \int \frac{du}{\sqrt{1-u^2}}$$

$$= \frac{1}{5} \arcsin(u) + C$$

$$= \frac{1}{5} \arcsin(5e^x) + C$$


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