7, 49 §4.3

$$\frac{d}{dx}\left[\int_0^{3x} f(u)\,du\right] = f(3x)\cdot 3$$

$$\frac{d}{dx}\left[\int_{2x}^{0} f(u)\,du\right] = -\frac{d}{dx}\left[\int_0^{2x} f(u)\,du\right]$$ etc.

§4.5
#s 1, 2, 7, 11, 15, 21, 25, 35, 37, 41, 42, 46, 51?

(10) $\int (3t+2)^{2.4}\,dt = \int u^{2.4}\,\frac{du}{3} = \frac{1}{3}\int u^{2.4}\,du$

$u = 3t+2$

$du = 3\,dt$

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

$= \frac{1}{3}\cdot\frac{u^{3.4}}{3.4} + C$

$= \frac{u^{3.4}}{10.2} + C$

(20) $\int \sqrt{x}\,\sin(x^{3/2}+1)\,dx =$

$$\left(\begin{array}{l} u = x^{\frac{3}{2}}+1 \\ du = \frac{3}{2}x^{\frac{1}{2}}\,dx = \frac{3}{2}\sqrt{x}\,dx \end{array}\right) \qquad \frac{3\sqrt{x}\,dx}{2}$$

$\Rightarrow dx = \frac{2}{3\sqrt{x}}\,du$

$= \int \sqrt{x}\,\sin(u)\,\frac{2\,du}{3\sqrt{x}}$

$= \frac{2}{3}\int \sin u\,du$

$=$

$= \frac{2}{3}\int \frac{3}{2}\sqrt{x}\,\sin(x^{\frac{3}{2}}+1)\,dx$

$= \frac{2}{3}\int \sin(x^{3/2}+1)\cdot\frac{3}{2}\sqrt{x}\,dx$

$= \frac{2}{3}\int \sin u\,du$

$= \frac{2}{3}(-\cos u) + C$

$= \boxed{-\frac{2}{3}\cos(x^{3/2}+1) + C}$

24 $\int \frac{dt}{\cos^2 t \sqrt{\tan t + 1}}$

$u = \cos^2 t \sqrt{\tan t + 1}$ $\Rightarrow du =$ OMG

$u = \tan t + 1$

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

$dt = \frac{du}{\sec^2 t}$

$$= \int \frac{\frac{du}{\sec^2 t}}{\left(\frac{\cos^2 t \sqrt{u}}{1}\right)} = \int \frac{du}{\sec^2 t} \cdot \frac{1}{\cos^2 t \sqrt{u}}$$

$$= \int \frac{du}{\sqrt{u}} = \int u^{-\frac{1}{2}} du = \frac{u^{\frac{1}{2}}}{\frac{1}{2}} + C = 2\sqrt{\tan t + 1} + C$$

$$\int \frac{dt}{\cos^2 t \sqrt{\tan t + 1}} = \int (\tan t + 1)^{-\frac{1}{2}} (\sec^2 t \, dt)$$

$$= \int u^{-\frac{1}{2}} du$$, where $u = \tan t + 1$, etc.

30 $\int x^3\sqrt{x^2+1}\,dx$

$u=x^2+1 \Rightarrow du=2x\,dx$

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

$= \int x^3\, u^{\frac{1}{2}} \cdot \frac{du}{2x}$

$\frac{1}{2}\int x^2 u^{\frac{1}{2}}du = \frac{1}{2}\int (u-1)u^{\frac{1}{2}}du$

Hmmmmm

$\left(u=x^2+1 \Rightarrow u-1=x^2 \right)$

$\frac{d}{dx}\left[2y^2\right]=4yy'$ if we assume y is some sort of f(x). If we don't, then $\frac{d}{dx}\left[2y^2\right]=0$

$= \frac{1}{2}\int \left(u^{\frac{3}{2}}-u^{\frac{1}{2}}\right)du$

$= \frac{1}{2}\left[\frac{u^{\frac{5}{2}}}{\frac{5}{2}}-\frac{u^{\frac{3}{2}}}{\frac{3}{2}}\right]+C = \frac{1}{2}\left[\frac{2}{5}u^{\frac{5}{2}}-\frac{2}{3}u^{\frac{3}{2}}\right]+C$

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

Compare & Contrast

$$\int_{60}^{100} v(t)\,dt \quad -vs- \quad \int_{60}^{100} |v(t)|\,dt$$

Displacement (Net Change) Total Distance

Assuming v(t) represents Velocity.

True/FALSE $\frac{d}{dx}\int_{a}^{b} f(x)\,dx = f(x)$ FALSE

$$\frac{d}{dx}\int_{a}^{x} f(t)\,dt = f(x)$$

$$\int_{0}^{1} x\,dx = \left[\frac{x^2}{2}\right]_0^1 = \frac{1^2}{2} - \frac{0^2}{2} = \frac{1}{2}$$

$$\frac{d}{dx}\left[\int_0^1 x\,dx\right] = \frac{d}{dx}\left[\frac{1}{2}\right] = 0$$

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§4.5 #51

$$\int_0^1 \frac{dx}{(1+\sqrt{x})^4} = \int_1^2 \frac{2x^{\frac{1}{2}}du}{u^4}$$

$u = x^{\frac{1}{2}} + 1$ $\qquad (u-1) = x^{\frac{1}{2}}$

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

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

$u \quad x=0 \quad x=1$

$\quad u=1 \quad u=2$

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