① $\int x \sec^2 x \, dx$

$u = x \qquad dv = \sec^2 x \, dx$

$du = dx \qquad v = \tan x$

$$\int u\,dv = uv - \int v\,du = x\tan x - \int \tan x\,dx$$

$$= x\tan x - \ln|\sec x| + C$$

② $\int e^x \sin x \, dx$

$u = e^x \qquad dv = \sin x \, dx$

$du = e^x dx \qquad v = -\cos x$

$$uv - \int v\,du = -e^x\cos x - \int e^x(-\cos x)\,dx$$

$$= -e^x\cos x + \int e^x \cos x\,dx$$

$u = e^x \qquad dv = \cos x\,dx$

$du = e^x dx \qquad v = \sin x$

$$\int e^x \sin x\,dx = -e^x\cos x + e^x\sin x - \int e^x \sin x\,dx + \hat{C}$$

$$2\int e^x \sin x\,dx = -e^x\cos x + e^x\sin x + \hat{C}$$

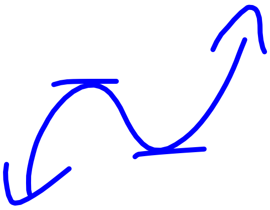
$$\int e^x \sin x\,dx = \boxed{\frac{-e^x\cos x + e^x\sin x}{2} + C}$$

$f(x) = x^3 - 6x^2 + 9x - 3$

Maximize $|f(x)|$ on $[1, 4]$

$f(1)$:

$$\begin{array}{r|rrrr} 1 & 1 & -6 & 9 & -3 \\ & & 1 & -5 & 4 \\ \hline & 1 & -5 & 4 & \boxed{1 = f(1)} \end{array}$$



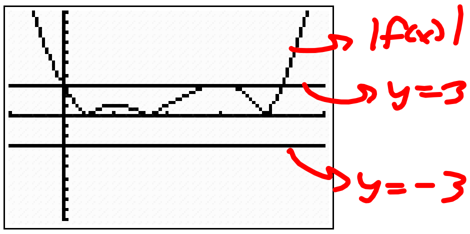
$$\begin{array}{r|rrrr} 4 & 1 & -6 & 9 & -3 \\ & & 4 & -8 & 4 \\ \hline & 1 & -2 & 1 & \boxed{1 = f(4)} \end{array}$$

$f'(x) = 3x^2 - 12x + 9 \overset{\text{SET}}{=} 0$

$x^2 - 4x + 3 = 0$

$(x-3)(x-1) = 0$

$x \in \{1, 3\}$



$f(3)$:

$$\begin{array}{r|rrrr} 3 & 1 & -6 & 9 & -3 \\ & & 3 & -9 & 0 \\ \hline & 1 & -3 & 0 & \boxed{-3 = f(3)} \end{array}$$

So max of $|f(x)|$ on $[1,4]$

is $\max\{|1|, |1|, |-3|\}$

$= \max\{1, 3\} = \boxed{3 \equiv K}$

9a

$$\int_1^\infty \frac{dx}{x^2(x+1)} = \lim_{t\to\infty}\int_1^t \frac{dx}{x^2(x+1)}$$

$$= \lim_{t\to\infty}\left[-\frac{1}{x} + \ln\left|\frac{x+1}{x}\right| + C\right]_1^t$$

$$= \lim_{t\to\infty}\left[-\frac{1}{t} + \ln\left|\frac{t+1}{t}\right| + C - \left(-\frac{1}{1} + \ln\left|\frac{1+1}{1}\right| + C\right)\right]$$

$$= \lim_{t\to\infty} \ln\left|\frac{t+1}{t}\right| + C + 1 - \ln|2| - C$$

$$= \ln\left(\lim_{t\to\infty}\left|\frac{t+1}{t}\right|\right) + 1 - \ln 2$$

$$= \ln\left|\lim_{t\to\infty}\left(\frac{t+1}{t}\right)\right| + 1 - \ln 2$$

$$= \ln|1| + 1 - \ln 2$$

$$= 0 + 1 - \ln 2 = \boxed{1 - \ln 2}$$

$$\lim_{t\to\infty}\left(\frac{t+1}{t}\right) = \lim_{t\to\infty}\left(\frac{t\left(1+\frac{1}{t}\right)}{t}\right)$$

$$= \lim_{t\to\infty}\left(\frac{1+\overbrace{\tfrac{1}{t}}^{\to 0}}{1}\right) = 1$$

Tomorrow For 10pts, Test 2.

Present a problem on the board or SmartBoard from Test 2.

Something I haven't presented.

Also, nice writeup to hand in & be shared around.

$3 \cdot 2 = 6$

$3 + 2 = 5$

$$\cancel{\int e^x \sin x\,dx = \int e^x\,dx + \int \sin x\,dx}$$

Absolutively, Posilutely Not.