Target 6C stuff:

* Partial fractions

ex $\int \frac{1}{x^2-x-6}\,dx$

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

$\frac{1}{(x+2)(x-3)} = \frac{A}{x+2} + \frac{B}{x-3}$

$1 = A(x-3) + B(x+2)$

$0x + 1 = Ax - 3A + Bx + 2B$

$A + B = 0$
$-3A + 2B = 1$

$\rightarrow$ $-2A - 2B = 0$
$-3A + 2B = 1$

$-5A = 1$

$A = -1/5$
$B = 1/5$

$= \int \frac{-1/5}{x+2} + \frac{1/5}{x-3}\,dx$

$= -\frac{1}{5}\int \frac{1}{x+2}\,dx + 1/5 \int \frac{1}{x-3}\,dx$

$= -\frac{1}{5}\ln|x+2| + \frac{1}{5}\ln|x-3| + C$

★ Bonus ★

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

$$= \frac{Ax+B}{x^2+1} + \frac{C}{(x-3)} + \frac{D}{(x-3)^2} + \frac{E}{x+1}$$

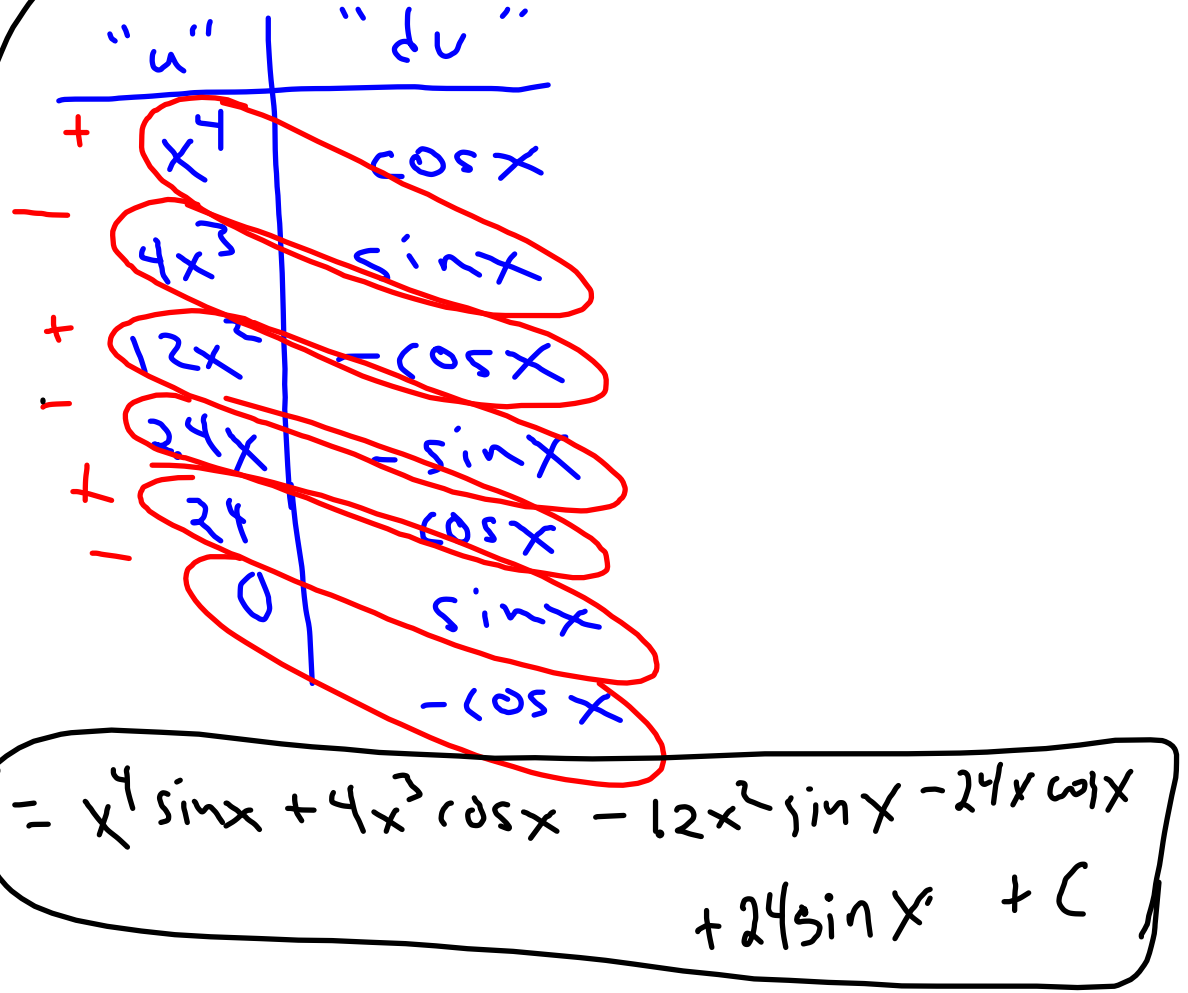
$$\frac{4x+2}{x^5(x-1)} = \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x^3} + \frac{D}{x^4} + \frac{E}{x^5} + \frac{F}{x-1}$$

$$\text{Blah} + \text{Stuff} = \frac{3}{8}$$

$$\frac{?}{4} + \frac{?}{8} + \frac{?}{2}$$

Tabular Method:

ex $\int x^4 \cos x\,dx$



$= x^4 \sin x + 4x^3 \cos x - 12x^2 \sin x - 24x \cos x + 24 \sin x + C$

ex $\int x^7 e^x dx$

$= e^x\left(x^7 - 7x^6 + 42x^5 - 210x^4 + 840x^3 - \ldots - 7!\right)$

$+ C$

ex $\int x^3 e^{2x}\,dx$

+	x^3	e^{2x}
−	$3x^2$	$\frac{1}{2}e^{2x}$
+	$6x$	$\frac{1}{4}e^{2x}$
−	6	$\frac{1}{8}e^{2x}$
+	0	$\frac{1}{16}e^{2x}$

$$= \frac{1}{2}x^3e^{2x} - \frac{3}{4}x^2e^{2x} + \frac{6}{8}xe^{2x} - \frac{6}{16}e^{2x} + C$$

$$\int u\,dv = u_0 v_0 - \int v_0\,du_0$$

$$\int u\,dv = u_0 v_0 - \left[u_1 v_1 - \int v_1\,du_1 \right]$$

$$= u_0 v_0 - u_1 v_1 + \left[u_2 v_2 - \int v_2\,du_2 \right]$$

$$= u_0 v_0 - u_1 v_1 + u_2 v_2 - \left(u_3 v_3 - \int v_3\,du_3 \right)$$

ex $\int e^x \cos x \, dx$

$= e^x \cos x + \int e^x \sin x \, dx$ $\quad u = \cos x \quad v = e^x$

$du = -\sin x \, dx \quad dv = e^x dx$

$= e^x \cos x + \left(e^x \sin x - \int e^x \cos x \, dx \right)$ $\quad u = \sin x \quad v = e^x$

$du = \cos x \, dx \quad dv = e^x dx$

hmm....

Recap:

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

u = stuff $-$ u

Solve for u.

$2u$ = stuff

u = stuff $/2$

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

TRY THIS ONE:

$$\int e^{2x} \sin 3x \, dx$$

$u = \sin 3x$ $\quad v = \frac{1}{2} e^{2x}$

$du = 3\cos 3x \, dx$ $\quad dv = e^{2x} dx$

$$\int \frac{\tan(\ln y)}{y}\, dy$$

$u = \ln y$

$du = \frac{1}{y}\, dy$

$$= \int \tan u \, du$$

$$= -\int \frac{-\sin u}{\cos u}\, du$$

$$= -\ln|\cos u| + C$$

$$= -\ln|\cos(\ln y)| + C$$