Exam 2 This Wednesday 3/4/26 @ 6:30pm in ES2107

1 integration by parts
3 partial fractions
2 improper integral
2 area (that includes a word problem)

1 Disk
2 Washer

Integration by parts (Twice) use Tabular Method

$\int 8x^2 \sin(2x)\,dx$ $\quad u = 8x^2 \quad du = 16x\,dx \quad dv = \sin(2x)\,dx \quad v = \frac{-\cos(2x)}{2}$

	u	dv
+	$8x^2$	$\sin(2x)$
−	$16x$	$-\cos(2x)/2$
+	16	$-\sin(2x)/4$
	0	$+\cos(2x)/8$

$$= 8x^2\left(\frac{-\cos(2x)}{2}\right) - 16x\left(\frac{-\sin(2x)}{4}\right) + 16\frac{\cos(2x)}{8} + C$$

$$= -4x^2\cos(2x) + 4x\sin(2x) + 2\cos(2x) + C$$

HW: $\int 4x^2 \cos(3x)\,dx$

$\int 3x^3 e^{5x}\,dx$

$$\int 3x^3 e^{5x}\,dx$$

(17) $$\int \frac{x^2+2}{x^3+3x^2+2x}\,dx$$

$$x^3+3x^2+2x = x(x^2+3x+2) = x(x+2)(x+1)$$

$$\frac{x^2+2}{x(x+2)(x+1)} = \frac{A}{x} + \frac{B}{x+2} + \frac{C}{x+1}$$

$$= \frac{A(x+2)(x+1) + Bx(x+1) + Cx(x+2)}{x(x+2)(x+1)}$$

$$x^2+0x+2 = A(x^2+3x+2) + B(x^2+x) + C(x^2+2x)$$

$$\begin{cases} 1 = A+B+C \\ 0 = 3A+B+2C \\ 2 = 2A \end{cases} \Rightarrow A = 1$$

$$\Rightarrow \begin{cases} 1 = 1+B+C \\ 0 = 3+B+2C \end{cases} \Rightarrow \begin{cases} 0 = B+C \\ -3 = B+2C \end{cases}$$

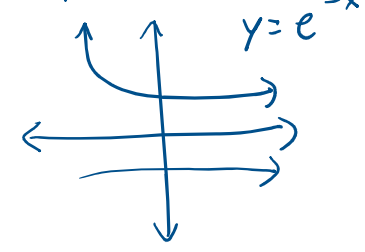
$B = -C$

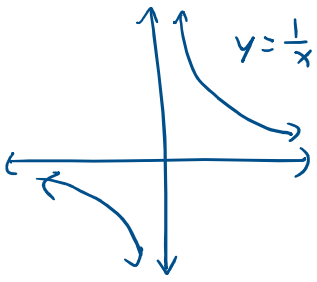
$$-3 = -C+2C$$

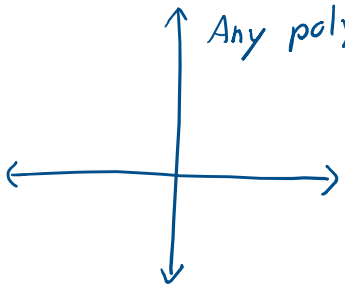
$$-3 = C \Rightarrow B = 3$$

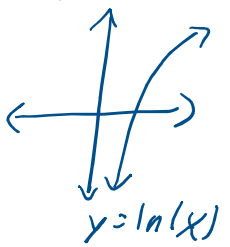
$$\int \left(\frac{1}{x} + \frac{3}{x+2} - \frac{3}{x+1}\right) dx = \ln|x| + 3\ln|x+2| - 3\ln|x+1| + C$$

Improper









(25) $$\int_0^{\infty} e^{-x/6}\,dx$$

(25) $\int_0^{} e \quad ax$

$= \lim_{N\to\infty} \int_0^N e^{-x/6}\,dx$

$= \lim_{N\to\infty} \left.\frac{e^{-x/6}}{-1/6}\right]_0^N$

$= \lim_{N\to\infty} \left(-6e^{-N/6} - \left(-6e^{-0/6}\right)\right)$ ($e^{-N/6} \to 0$)

$= 6$

If it converges

(23) $\int_1^\infty \frac{5}{\sqrt{x^1}}\,dx = \int_1^\infty 5x^{-1/2}\,dx$

$= 5 \cdot \frac{2}{1} x^{1/2}\Big]_1^\infty = \infty$

~~A~~ B ~~C D E F~~

$\int_1^\infty \frac{3}{x^2}\,dx = \int_1^\infty 3x^{-2}\,dx$

$= 3\cdot(-1)x^{-1}\Big]_1^\infty$

$= -\frac{3}{x}\Big]_1^\infty = \#$

Diverges

A B C D (E) F

$\int_1^\infty \frac{5}{\sqrt{x^1}}\,dx$ diverges

$\int_1^\infty \frac{3}{x^2}\,dx$ converges

$\int_1^\infty \frac{10}{x}\,dx = 10\ln(x)\Big]_1^\infty$

$= \infty \to$ diverges

(32) $y = x$ and $y = 7x - x^2$ Area

$x = 7x - x^2$

$x^2 - 6x = 0$

$x(x-6) = 0$

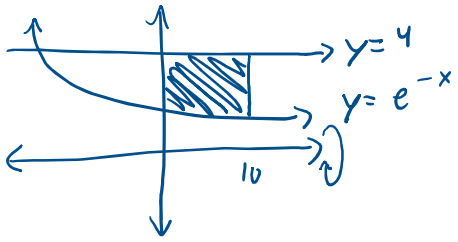
$x = 0, 6$

$\int_0^6 (7x - x^2 - x)\,dx$

$\int_0^6 (7x - x^2 - (x))\,dx$

$\int_0^6 (6x - x^2)\,dx$

(42) x-axis $\Rightarrow dx$



$$V = \pi \int_0^{10} (4)^2 - (e^{-x})^2\,dx$$

$$= \pi \int_0^{10} 16 - e^{-2x}\,dx$$

(38) $\int_0^{10} (25 + 9t - t^2) - (5 - t + t^2)\,dt$

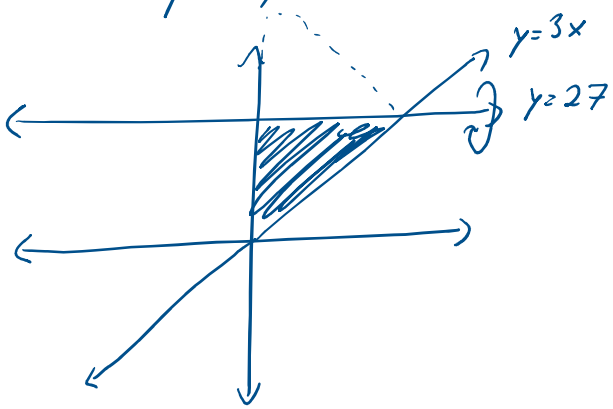
$$= \int_0^{10} (20 + 10t - 2t^2)\,dt$$

$$= \left(20t + 5t^2 - \frac{2t^3}{3}\right)\Big]_0^{10}$$

$$= 200 + 500 - \frac{2(1000)}{3}$$

(62) $y = 27 \Rightarrow dx$ problem

$y = 3x,\ x = 0,\ y = 27$



Bounds: $3x = 27$

$x = 9$

and we have $x = 0$

Disk Problem

$$V = \pi \int_0^9 (3x - 27)^2\,dx$$

$$= \pi \int_0^9 (9x^2 - 162x + 729)\,dx$$

↙ ↓

$$= \pi \int_0^9 (9x^2 - 162x + 729)\, dx$$