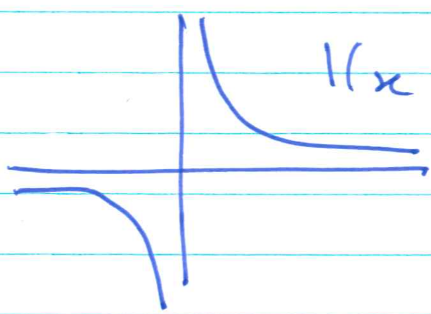
Next Week: Review

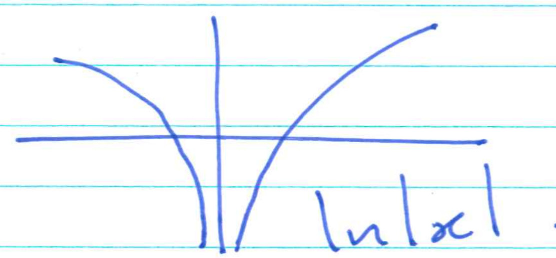
- Exam Expectations / topics / difficulty
  - what you need to know.

- HW10 Due Monday

- $\int \frac{1}{x}\,dx = \ln|x| + C.$

  defined for all $x \neq 0$.





- $\int \sin(3x)\,dx = \frac{1}{3}\left(-\cos(3x)\right).$

$\neq \frac{1}{3}\left[-\cos(3x)\right]$

Example:

$$\int \overbrace{\sin x}^{u} \, \overbrace{\cos x \, dx}^{du} .$$

Substitution? Let $u = \sin x$

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

$$du = \cos x \, dx .$$

$$= \int u^1 \, du$$

$$= \frac{1}{2} u^2 + C$$

$$= \frac{1}{2} \sin^2 x + C .$$

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Let $u = \cos x$.

$\frac{du}{dx} = -\sin x$.

$du = -\sin x \, dx$.

$-du = \sin x \, dx$

$$\int \overbrace{\cos x}^{u} \underbrace{\sin x \, dx}_{-du}.$$

$$= \int u(-du)$$

$$= -\int u \, du.$$

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

$$= -\frac{1}{2}\cos^2 x + C.$$

$-\frac{1}{2}\cos^2 x$ and $\frac{1}{2}\sin^2 x$ only differ by a constant.

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$$\sin^2 x + \cos^2 x = 1.$$

$$\sin^2 x = 1 - \cos^2 x.$$

$$\frac{1}{2}\sin^2 x = \frac{1}{2} - \frac{1}{2}\cos^2 x.$$

Take $F(x) = \int \sin x \cos x \, dx.$

Want: $F(0) = 2.$

We could use:

1) $F(x) = \dfrac{\sin^2 x}{2} + C.$

$$2 = F(0) = \frac{\overbrace{\sin^2 0}^{=0}}{2} + C.$$

$$C = 2.$$

So,

$$F(x) = \frac{\sin^2 x}{2} + 2.$$

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Or we could use:

2). $F(x) = \frac{-\cos^2 x}{2} + C.$

$$2 = F(0) = \frac{-\overset{\text{"}1}{\cos^2 0}}{2} + C.$$

$$2 = F(0) = \frac{-1}{2} + C.$$

$$C = 2 + 1/2 = 5/2.$$

So $F(x) = \frac{-\cos^2 x}{2} + 5/2.$

$$\frac{\sin^2 x}{2} + 2.$$