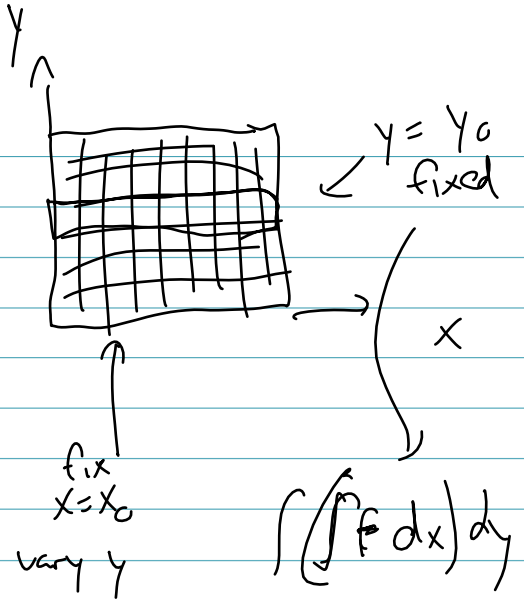


$\int \left(\int f \, dy \right) dx$ $\quad \int \left(\int f \, dx \right) dy$

Like Ch. 14 ... 1-d → 2-d ...

15.1 $\int dA$, 15.2 $\int_{\square} dA$

Math 200, Oct 30

Important notice:

$\nabla f = \lambda \nabla g + \mu \nabla h$

$f(x,y,z)$, $g(x,y,z)$, $h(x,y,z)$

5 eq, 5 unknowns

$$\int_{y=c}^{y=d} \left(\int_{x=h_1(y)}^{x=h_2(y)} f(x,y) \, dx \right) dy$$

vary x, y fixed

$$\int_{y=c}^{y=d} \text{Mess}(y) \, dy$$

2 glasses of T 2

6.(a).

Old exam problem:

Find: $\int_{y=0}^{y=2} \left(\int_{x=y}^{x=2} e^{-x^2} \, dx \right) dy$

= [Hint: exchange dx for dy ...]

Remember

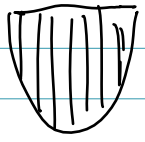
$\int x e^{-x^2} \, dx = \frac{e^{-2x}}{-2}$

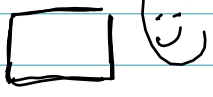
$(e^{-x^2})' = (e^{-x^2})(-2x)$

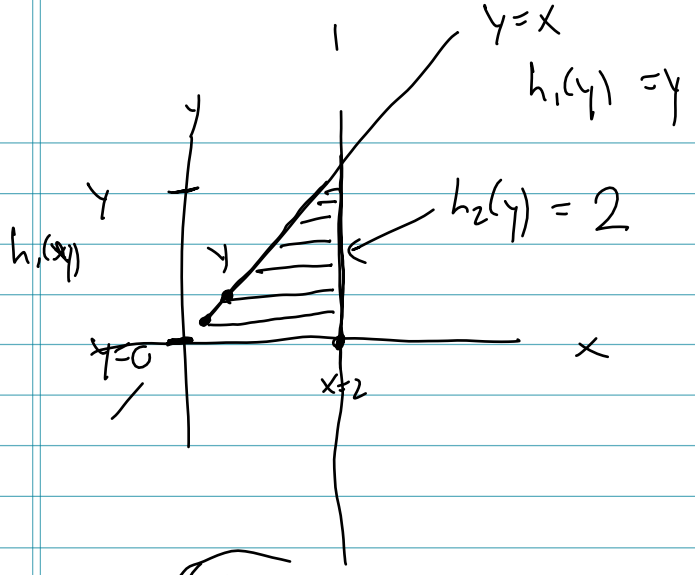
15.3 $\iint_D dA$

D region

or







$$\int_{y=c}^{y=d}\left(\int_{x=h_1(y)}^{x=h_2(y)} f(x,y)\,dx\right)dy$$

$$\int_{y=0}^{y=2}\left(\int_{y\le x\le 2}^{h_1(y)\le x\le h_2(y)} \right)$$

$$\int_{x=0}^{x=2}\left(\int_{y=0}^{y=x} e^{-x^2}\,dy\right)dx$$

$$\int_{y=0}^{y=x} e^{-x^2}\,dy = ?$$ x fixed, y varying

fixed constant $\int_{y=0}^{y=x} e^{-x^2}\,dy$ x fixed

fixed constant

$$\int_{y=0}^{y=5} C\,dy = Cy\Big|_{y=0}^{5} = C\cdot 5 - C\cdot 0 = C\cdot 5$$

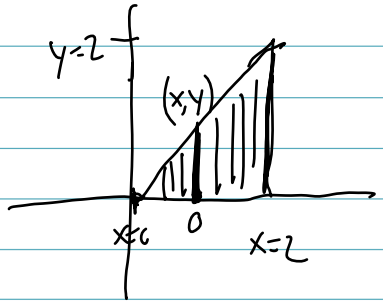
$$\int x\sin x = \begin{cases}\text{guess.}-\\ \text{Integration by parts}\end{cases}$$

$$\int x^3 e^{-x} \quad \{\text{Integration by parts}$$

This is not 1-d Calculus...

What is $0\le y\le 2$, (and for fixed y) $y\le x\le 2$.

$$\int_{y=0}^{y=2}\left(\int_{x=y}^{x=2} f(x,y)\,dx\right)dy$$



fix x, how does y vary?

$$\int_{x=0}^{x=2}\int_{y=\text{lower}(x)}^{y=\text{upper}(x)}$$

x fixed !!!!

$$\int_{y=0}^{y=x} e^{-x^2}\,dy = e^{-x^2} y \Big|_{y=0}^{y=x}$$

$$= e^{-x^2}(x) - e^{-x^2}(0)$$

$$= x e^{-x^2} = \text{Mess}(x)$$

$$\int_{x=0}^{x=2} \text{Mess}(x)\,dx = \int_{x=0}^{x=2} x e^{-x^2}\,dx$$

$$= \frac{e^{-x^2}}{-2} \Big|_{x=0}^{x=2} = \text{etc.}$$