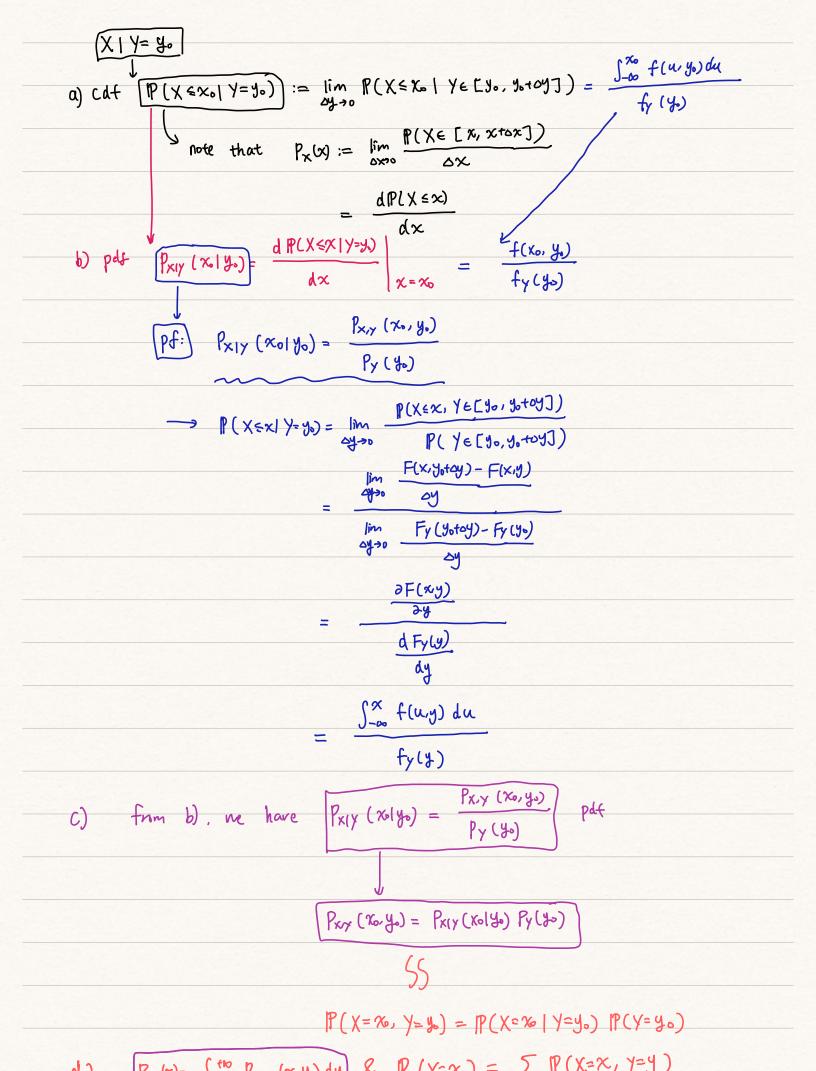
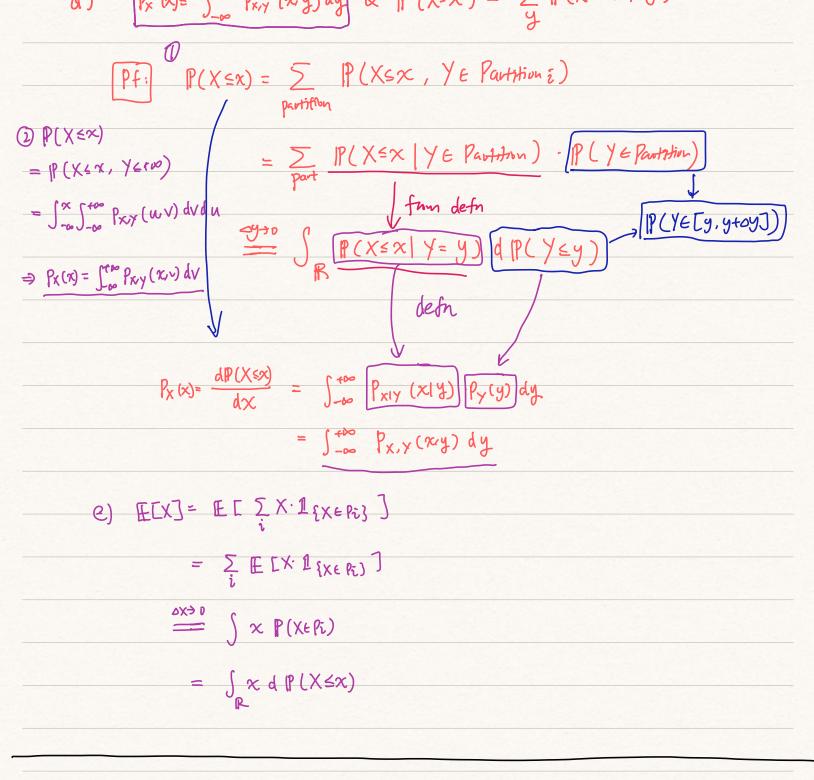
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Self - Understanding
-> disrete r.v. everything is good
       0 \begin{cases} P^{mf} & f_{x}(x) := P(X=x) \\ c4f & f_{x}(x) := P(X \leq x) \end{cases} \qquad f_{x}(x) = F_{x}(x) - F_{x}(x)
       2 Conditional distribution
            \begin{cases} \text{pmf} & f_{X|Y}(x|y) := P(X=x|Y=y) = P(\hat{X}_y=x) \\ \text{cdf} & F_{X|Y}(x|y) := P(X\leq x|Y=y) = P(\hat{X}_y\leq x) \end{cases} where \hat{X}_y=X|Y=y
                                                                                                  of tx(x) ox = P(x(X = xrox)
         continuous r. v. Something Brokes down
        = F(x)
             Conditional distribution
                                                                                        derivative)
                             F_{xy}(x|y): \neq P(X \leq x|Y = y)
F_{xy}(x|y):= \lim_{cy \to c} P(X \leq x|y \leq y \leq y + cy)
                                                                                                     = \frac{\int_{-\infty}^{\infty} f(u,y) dy}{f_{v}(y)}
                                                   not well defined
                                                Since P(XEX, Y=y) = 0
                                since fx1y(x1y) is the derivative of Fx1y(x1y)
                                then f_{X|Y}(x|y) := \lim_{\Delta x \to 0} \frac{F(x_{1}\alpha x_{1}y) - F(x_{1}y)}{\Delta x}
                                                             = \lim_{\Delta x \to 0} \lim_{\Delta y \to 0} \frac{P(x < x \leq x + 0x | y \leq y \leq y + 2y)}{\Delta x}
                                                             = \frac{f_{X,Y}(x,y)}{f_{Y}(y)}
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Change Of Variable Summary

1 - voviate case

$$\rightarrow X \sim P_{x} \qquad \underline{Y = f(x)}$$

$$\rightarrow P_{y} ?$$

(stronger condition)

Answer: Condition (Assump.) -> f(·) is monotone

then
$$P(y \in y)$$

we need $f(x) \neq 0$

$$= P(f(x) \leq y) = P(x \leq f^{-1}(y))$$

$$= \int_{X} p(x) dx \qquad X := \{x : f(x) \leq y\}$$

$$\Rightarrow y - f(x) = 0$$

$$\Rightarrow y = f(x)$$

$$\Rightarrow \int_{X} p(f^{-1}(y)) \left| \frac{df^{-1}(y)}{dy} \right| dy \qquad Y := \{y : y \leq y\}$$

$$= \frac{1}{f'(x)}$$
Implicit Function

2) Multi-variate case

$$\rightarrow (X,Y) \sim P_{X,Y} \qquad \begin{cases} V = f_1(X,Y) \\ V = f_2(X,Y) \end{cases}$$

Answer: Similarly,
$$P(U \le u, V \le v)$$

$$= P(f_1(X, Y) \le u, f_2(X, Y) \le v)$$

$$= hange of variable:$$

$$f_1(x, y) = \alpha = \int_S P_{X,Y}(x, y) dx dy \qquad S = \{(x, y): f_1(x, y) \le v\}$$

$$f_2(x, y) = b \qquad \text{change}$$

$$f_2(x, y) = f_2(x, y) = c$$

$$f_3(x, y) = c$$

$$f_3(x,$$

$\Rightarrow F(x,y;u,v) := \begin{pmatrix} u - f(x,y) \\ v - f(x,y) \end{pmatrix}$
$\Rightarrow F(x,y;u,v) := \begin{pmatrix} u - f_1(x,y) \\ v - f_2(x,y) \end{pmatrix}$