3 marbles are drawn, without replacement, from an urn containing 3 yellow marbles and two blue. Let $\underline{X}$ be the number of yellow marbles drawn, and $\underline{Y}$ the number of blue drawn. Make a joint prob dist table.

		X			
	$f(x,y)$	1	2	3	
Y	0	0	0	$\frac{3}{5}\cdot\frac{2}{4}\cdot\frac{1}{3}\cdot(1)$	$\frac{6}{60}$
	1	0	$\frac{36}{60}$	0	$\frac{36}{60}$
	2	$18/60$	0	0	$\frac{18}{60}$
		$\frac{18}{60}$	$\frac{36}{60}$	$\frac{6}{60}$	

X and Y are not indep because

$g(1)h(0)$

$= \frac{6}{60} \cdot \frac{18}{60}$

$\neq 0 = f(1,0)$

$P(A \cap B) = P(A)P(B) \longrightarrow$ A & B are independent

X and Y are indep if $f(x,y) = g(x)h(y)$
for all $(x,y) \in Ran(X) \times Ran(Y)$

x:	1	2	3
$g(x)$:	$\frac{18}{60}$	$\frac{36}{60}$	$\frac{6}{60}$

$$v(x|y) = \frac{f(x,y)}{h(y)}$$

fixed

Give $v(x|2)$

x:	1	2	3
$v(x\|2)$:	1	0	0

Conditional distribution

$$w(y|x) = \frac{f(x,y)}{g(x)}$$

fixed

$$\int_0^\infty x^n e^{-x}\,dx \qquad u = x^n \qquad dv = e^{-x}dx$$

$$du = nx^{n-1}dx \qquad v = -e^{-x}$$

$$\int_0^b x^n e^{-x}\,dx = -x^n e^{-x}\Big|_0^b + n\int_0^b x^{n-1}e^{-x}\,dx$$

$$= -b^n e^{-b} + n\int_0^b x^{n-1}e^{-x}\,dx$$

$$\int_0^{\infty} x^n e^{-x}\,dx = \lim_{b\to\infty}\left[\cancel{-b^n e^{-b}} + n\int_0^b x^{n-1}e^{-x}\,dx\right]$$

$$\boxed{\int_0^{\infty} x^n e^{-x}\,dx = n\int_0^{\infty} x^{n-1}e^{-x}\,dx}$$

$$\Gamma(\alpha) = \int_0^\infty x^{\alpha-1} e^{-x} dx$$

$$\Gamma(1) = \int_0^\infty e^{-x} dx = 1$$

$$\Gamma(2) = \int_0^\infty x^{2-1} e^{-x} dx = \int_0^\infty x^1 e^{-x} dx = 1 \int_0^\infty x^0 e^{-x} dx = 1$$

$$\Gamma(\alpha) = \int_0^\infty x^{\alpha-1} e^{-x} dx = (\alpha-1) \int_0^\infty x^{(\alpha-1)-1} e^{-x} dx$$

$$= (\alpha-1)\Gamma(\alpha-1)$$

$\Gamma(1) = 1$

$\boxed{\Gamma(\alpha) = (\alpha - 1)\Gamma(\alpha - 1)}$

$\Gamma(2) = 1$

$\Gamma(n) = (n-1)! \quad n = 1, 2, 3, \ldots$

$\Gamma(3) = (3-1)\Gamma(3-1) = 2\Gamma(2) = 2 \cdot 1$

$\Gamma(4) = (4-1)\Gamma(4-1) = 3\Gamma(3) = 3 \cdot 2 \cdot 1$

$\Gamma(5) = 4\Gamma(4) = 4 \cdot 3 \cdot 2 \cdot 1$

$$P(Y=1) = \sum \quad = \bigcirc$$

$$P(X \leq Y-1) = \sum_{x=} \sum_{y=} \quad = \sum_{y=} \sum_{x=} \quad =$$