Use the joint density of X and Y to find the singlevariable density of X or of Y. (Sometimes called the marginal density of X or Y.)

In general if X and Y have joint density $f_{X,Y}(x,y)$

then X has density $f_X(x) = \int_{-\infty}^{\infty} f_{X,Y}(x,y)\,dy$ i.e. think: integrating y out of the picture.

and Y has density $f_Y(y) = \int_{-\infty}^{\infty} f_{X,Y}(x,y)\,dx$ i.e. integrate x out of the picture.

<u>Example</u> Say X, Y have joint density $f_{X,Y}(x,y) = \begin{cases} 6e^{-2x-3y} & x>0, y>0 \\ 0 & \text{otherwise} \end{cases}$

Then X has density $f_X(x) = 0$ if $x<0$

or if $x>0$: $f_X(x) = \int_0^{\infty} 6e^{-2x-3y}\,dy = \frac{6e^{-2x-3y}}{-3}\Big|_{y=0}^{\infty}$

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

Also Y has density: $f_Y(y) = 0$ if $y<0$

or if $y>0$: $f_Y(y) = \int_0^{\infty} 6e^{-2x-3y}\,dx = \frac{6e^{-2x-3y}}{-2}\Big|_{x=0}^{\infty} = 3e^{-3y}$

(for $y>0$)

This method works in general if you have the joint density of X and Y but just want the single variable density of X or of Y.