1a. Here $X$ and $Y$ are dependent. Perhaps the easiest way to see this is that their domain is not rectangular shaped (it is like a triangle shape).

1b. We have 
\[ P(X \leq 1) = \int_0^1 \int_0^{2x} \frac{1}{2} xy \, dy \, dx = \int_0^1 \frac{1}{4} x^3 \, dx = 1/16. \]

1c. The density of $X$ is 
\[ f_X(x) = \int_0^{2x} \frac{1}{4} x^3 \, dx = \frac{1}{4} x^3 \text{ for } 0 < x < 2, \text{ and } f_X(x) = 0 \text{ otherwise.} \]

1d. Yes! We have 
\[ P(X \leq 1) = \int_0^1 \frac{1}{4} x^3 \, dx = 1/16. \]

2a. We have 
\[ \int_0^\infty \int_0^\infty 10e^{-3x-2y} \, dy \, dx = \int_0^\infty 5e^{-7x} \, dx = 5/7. \]

2b. We have 
\[ f_X(x) = \int_0^\infty 10e^{-3x-2y} \, dy = 5e^{-5x} \text{ for } x > 0, \text{ and } f_X(x) = 0 \text{ otherwise.} \]

3a. Yes, $X$ and $Y$ are independent. Their density is defined in a rectangular region, and it can be factored into $x$ and $y$ parts.

3b. We have 
\[ f_X(x) = \int_0^6 \frac{1}{225} (5 - x)(6 - y) \, dy = \frac{2}{25} (5 - x), \text{ for } 0 \leq x \leq 5, \text{ and } f_X(x) = 0 \text{ otherwise.} \]

3c. We have 
\[ f_Y(y) = \int_0^5 \frac{1}{225} (5 - x)(6 - y) \, dx = \frac{1}{18} (6 - y), \text{ for } 0 \leq y \leq 6, \text{ and } f_Y(y) = 0 \text{ otherwise.} \]

4a. For $z > 0$, we have 
\[ P(Z \geq z) = P(X \geq z \& Y \geq z) = P(X \geq z)P(Y \geq z) = \left( \int_z^\infty 3e^{-3z} \, dx \right) \left( \int_z^\infty 5e^{-5y} \, dy \right) = e^{-3z}e^{-5z} = e^{-8z}. \] Thus $F_Z(z) = P(Z \leq z) = 1 - e^{-8z}$ for $z > 0$. So $f_Z(z) = 8e^{-8z}$ for $z > 0$, and $f_Z(z) = 0$ otherwise.

4b. We have 
\[ P(Z > 1/10) = \int_{1/10}^\infty 8e^{-8z} \, dz = e^{-4/5} = 0.4493. \]