1. Harmonicas. When ordering a new box of harmonicas, let $X$ denote the time until the box arrives, and let $Y$ denote the number of harmonicas that work properly.

Is $X$ a continuous or discrete random variable? Why?

Is $Y$ a continuous or discrete random variable? Why?
2. Choosing a page at random.

A student buys a brand new calculus textbook that has 1000 pages, numbered from 1 to 1000, of course. She randomly opens the book to a page and starts to read! Assume that any of the 1000 pages are equally likely to be chosen.

Let $X$ be the page number of the chosen page. Thus, $X$ is an integer-valued random variable between 1 and 1000.

(a.) Find $P(X = 122)$.

(b.) Find $P(X = 977)$.

(c.) Find $P(X = -2)$.

(d.) Find $P(X = 1003)$.

(e.) When $x$ is an integer between 1 and 1000, find $P(X = x)$.

(f.) Find $P(X \leq 3)$.

(g.) Find $P(X \leq 122)$.

(h.) Find $P(12 \leq X \leq 17)$.

(i.) Find $P(X > 122)$.

(j.) Find $P(X = 15.73)$.

(k.) Find $P(X \leq 15.73)$. 

3. **Socks.** A matching pair of blue socks, a matching pair of red socks, and one lone white right-footed sock are in a drawer. The socks are pulled out of the drawer, one at a time.

(a.) Suppose that a person is looking for the white sock. He repeatedly does the following: He pulls out a sock, checks the color, and if it is white, he stops. If it is not white, then he replaces the sock in the drawer and starts to check again, i.e., he reaches blindly into the drawer of 5 socks. He continues to do this over and over until he finds the white sock, and then he stops. Let \( X \) be the number of draws that are necessary to find the white sock for the first time. For each positive integer \( j \), find \( P(X = j) \).

(b.) Now suppose that he searches for the white sock but, if he pulls a different colored sock from the drawer, he does not replace it. So he pulls out a sock, checks the color, and if it is white, he stops. If it is not white, then he *permanently discards* the sock and starts to check again, i.e., he reaches blindly into the drawer with the socks that remain. He continues to do this over and over again until he finds the white sock, and then he stops. Let \( X \) be the number of draws that are necessary to find the white sock for the first time. For each integer \( j \), with \( 1 \leq j \leq 5 \), find \( P(X = j) \).
4. **Three dice.** Roll three dice and let $X$ denote the sum. For which values of $j$ is $P(X = j)$ a strictly positive number?
5. Pick two cards. Pick two cards at random from a well-shuffled deck of 52 cards (pick them simultaneously, i.e., grab two cards at once—so they are not the same card!). There are 12 cards which are considered face cards (4 Jacks, 4 Queens, 4 Kings). Let $X$ be the number of face cards that you get.

Find $P(X = 0)$.

Find $P(X = 1)$.

Find $P(X = 2)$. 
6. **Design your own problem and solution.** Create your own problem about random variables. Design your problem in such a way that you would find it enjoyable and also interesting (i.e., not completely trivial) if you found this problem in a probability book. Please provide the answer for your problem too.