

# Section 2.1: Continuous Random Variables

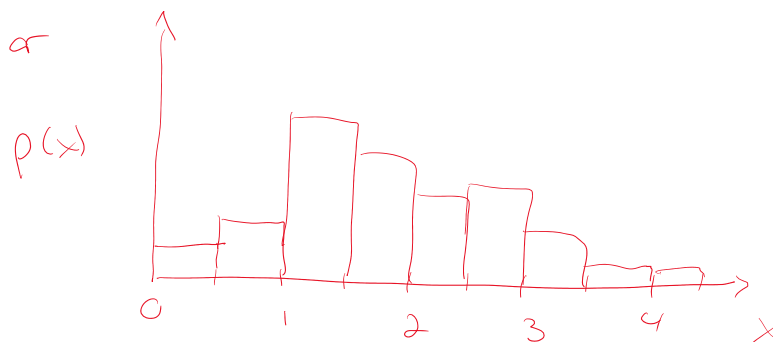
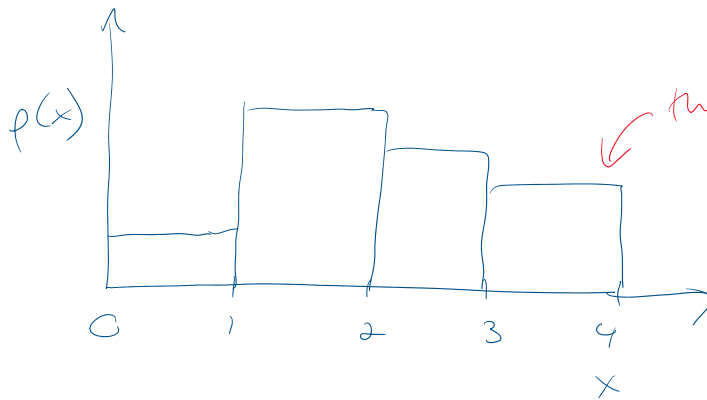
Tuesday, November 28, 2023 3:57 PM

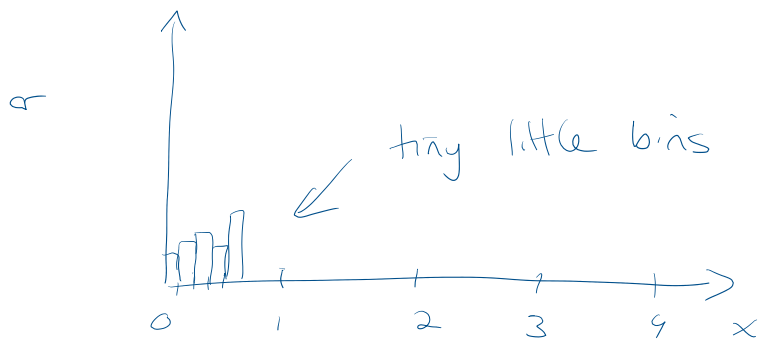
continuous random variables - can take on an infinite number of values and can always split the difference between any two values

example: if your variable is time and you have measured the values 2.78 seconds and 2.79 seconds, you in theory also measure a value of 2.785 seconds.

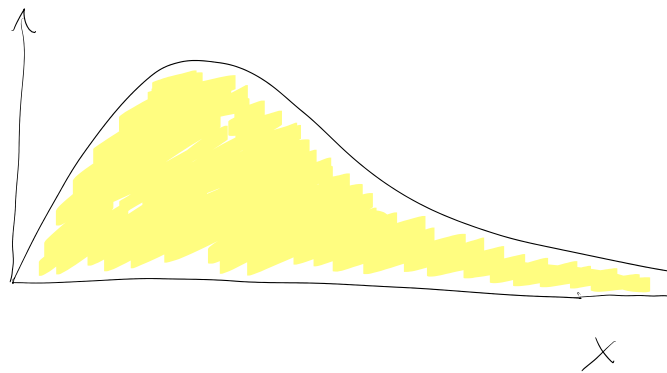
but what does a probability distribution look like if you have an infinite number of values that your variable could take?

- you could group the data into "bins" and make a histogram





and eventually, the rectangles will get so small that you can't even see them, and you will get a smooth continuous curve:



this smooth curve is called a density curve

properties of density curves:

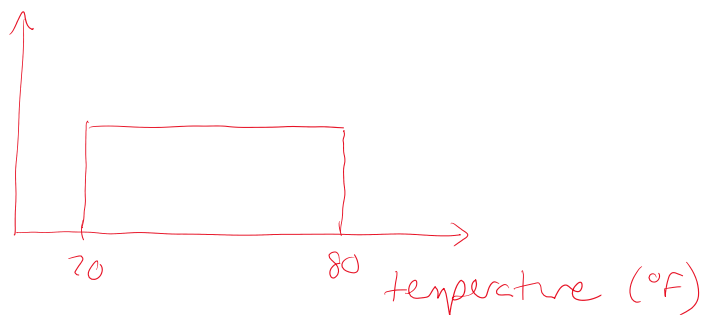
- ① it is always on or above the x-axis - the y-value is never negative
- ② the y-axis isn't probability anymore

rather, the scale on the y-axis is chosen such that the area underneath the curve is exactly equal to one (100%).

example: the continuous uniform probability distribution

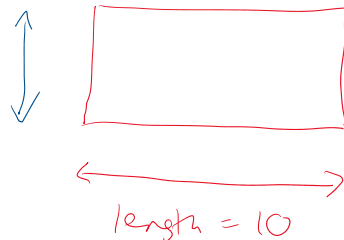
In March in Pasadena, CA, the temperature during the day is always between  $70^{\circ}\text{F}$  and  $80^{\circ}\text{F}$  with an equal probability of any temperature within that range.

a) what does the density curve look like?



b) what is the height of the rectangle?

so height must be  $\frac{1}{10}$

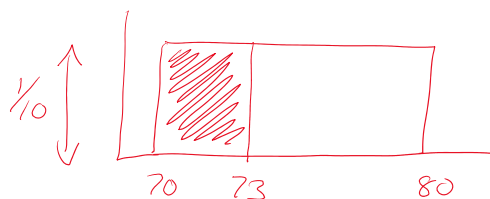


$$\text{area} = LW = 1$$

c) what is the average temperature in March in Pasadena?

by symmetry, the mean temp is  $75^{\circ}\text{F}$

d) what is the probability that the temperature is less than  $73^{\circ}\text{F}$ ?





$$\text{area} = \frac{1}{10} \cdot 3 = \frac{3}{10} \text{ or } 0.3$$

or 30%

e) what is the probability that the temperature is exactly equal to  $73^{\circ}\text{F}$ ?

73.000000000000000000000000000000...

the probability is exactly equal to zero

(when there are an infinite number of values you could measure, the chance of getting any one value is identically zero)