

Hurricanes

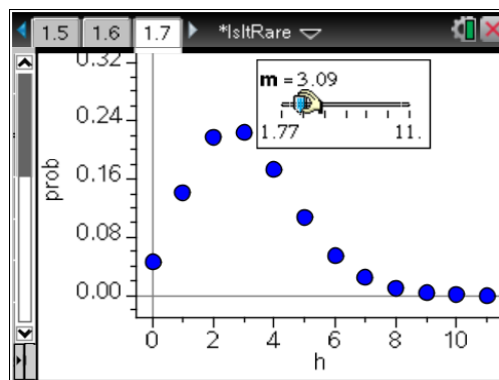
The 1995 hurricane season for the United States was the worst in recorded history, but was it outside the norm? That is, given the historical data (1.77 hurricanes per year), what is the probability of the 11 hurricanes hitting the United States that year?

To determine this, a **Poisson distribution** can be used. Using a Poisson distribution, the probability that an event occurs exactly x times is given by

$$P(m, x) = \frac{m^x e^{-m}}{x!}, \quad x=0,1,2,3\dots$$

1. Click the arrows on page 1.5 to compute the probabilities of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 hurricanes hitting the United States in one year.
2. Which numbers of hurricanes per year have the highest probability of occurring? Why is this answer reasonable?

The graph of this probability distribution is on page 1.7. Alter the average number of hurricanes occurring per year from 1.77 to 11 by dragging the slider and observe the changes in the graph.



Cumulative Probabilities

For any sample space, the sum of the probabilities of the outcomes is 1. So, for a given value of m ,

$$P(0) + P(1) + P(2) + \dots = 1$$

From this, you can use the **complement** of an event to help you find a probability. For example, given m , to find the probability that an event will happen **more than 2 times** ($x > 2$), subtract the probability that the event will happen **2 or fewer times** ($x \leq 2$) from 1.

$$\begin{aligned} P(x \leq 2) + P(x > 2) &= 1 \\ P(x > 2) &= 1 - P(x \leq 2) \\ P(x > 2) &= 1 - P(0) - P(1) - P(2) \end{aligned}$$



4.
 - a. What is the probability that 2 or fewer hurricanes will hit the United States in a year?
 - b. What is the probability that more than 2 hurricanes will hit the United States in a year?
 - c. How are the answers to part a and part b related?

Exercises:

In a Midwestern US city, there are 9 deaths per year involving car accidents with trains.

Using the Poisson Distribution for rare, independent events find the probabilities.

1. Find the probability of 0 to 9 of these deaths in one year in the city.
2. Find the probability that there are 5 or fewer of these deaths occurring in one year in the city.
3. Find the probability that there are more than 5 of these deaths occurring in one year in the city.