# Geometric Distributions

*How many bottle flips does it take to go viral?*

## Learning Targets

- Calculate and interpret probabilities involving geometric random variables.
- Calculate the mean and standard deviation of a geometric distribution. Interpret these values.

# How Many Bottle Flips to Go Viral?


Scene: The senior talent show is scheduled to take place this afternoon. Michael Senatore is in stats class practicing his act - bottle flipping. He tells his friends that the probability of successfully landing the water bottle right side up is 20%. Assume that each water bottle flip is independent.

1. If he flips the bottle ten times, how many do you expect to land right side up? Justify.

2. What is the probability that he makes exactly two flips?

3. What is the probability that he makes less than two flips?

4. What is the probability that he makes at most two flips?

After the first ten flips, Michael wants to do ten more, but his teacher is getting annoyed with all the noise and tells him he must stop flipping **once the bottle lands right side up**.

5. Find the probability that he lands it on the first try.

6. Find the probability that he fails on the first try and lands it on the second try.

7. Find the probability that he fails the first two and lands it on the third try.

8. Find the probability that he fails the first three lands it on the fourth try.

Let X = the number of flips it takes for Michael to land the bottle right side it up. Fill in the table below.

| **X** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **P(X)** | | | | | | |

9. Find the probability that he lands it on the tenth try. Write a generic rule for finding the probability that he first lands the bottle on the $k^{th}$ flip.

10. How many flips do you expect it to take for the bottle to land right side up? Why?

# The Geometric Distribution

Important ideas:

## Check Your Understanding

Mason never has a pencil when test day rolls around. Because the classmates are tired of having to supply pencils for Mason, only 15% of students will give Mason a pencil when asked. Today is test day and Mason begins asking randomly selected students for a pencil. Let $Y$ = the number of students Mason asks until he finds someone who will give him a pencil.

a. Describe this probability distribution. Be sure to check the appropriate conditions.

b. What is the probability that the third person asked is the first person who gives him a pencil?

c. What is the probability that Mason gets a pencil by the third person he would ask?

d. How many people should Mason expect to ask before getting a pencil?

e. Should Mason be surprised if Mason didn't receive a pencil until he asked at least 10 people? Calculate a probability to justify your answer.

f. Find the standard deviation for the distribution of the number of people he asks for a pencil before finding someone who will give him one.

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