

EXAMPLE 3 Construct a binomial distribution

SPORTS SURVEYS According to a survey, about 41% of U.S. households have a soccer ball. Suppose you ask 6 randomly chosen U.S. households whether they have a soccer ball. Draw a histogram of the binomial distribution for your survey.

Solution

The probability that a randomly selected household has a soccer ball is $p = 0.41$. Because you survey 6 households, $n = 6$.

AVOID ERRORS

You can check your calculations for a binomial distribution by adding all the probabilities. The sum should always be 1.

$$P(k = 0) = {}_6C_0(0.41)^0(0.59)^6 \approx 0.042$$

$$P(k = 1) = {}_6C_1(0.41)^1(0.59)^5 \approx 0.176$$

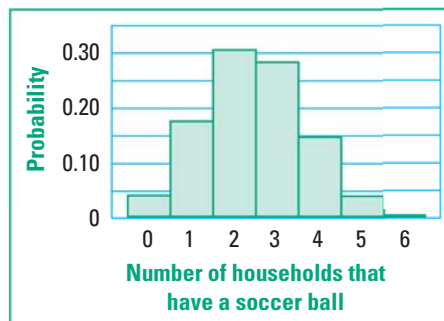
$$P(k = 2) = {}_6C_2(0.41)^2(0.59)^4 \approx 0.306$$

$$P(k = 3) = {}_6C_3(0.41)^3(0.59)^3 \approx 0.283$$

$$P(k = 4) = {}_6C_4(0.41)^4(0.59)^2 \approx 0.148$$

$$P(k = 5) = {}_6C_5(0.41)^5(0.59)^1 \approx 0.041$$

$$P(k = 6) = {}_6C_6(0.41)^6(0.59)^0 \approx 0.005$$



A histogram of the distribution is shown.

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EXAMPLE 4 Interpret a binomial distribution

Use the binomial distribution in Example 3 to answer each question.

- What is the most likely outcome of the survey?
- What is the probability that at most 2 households have a soccer ball?

Solution

- The most likely outcome of the survey is the value of k for which $P(k)$ is greatest. This probability is greatest for $k = 2$. So, the most likely outcome is that 2 of the 6 households have a soccer ball.
- The probability that at most 2 households have a soccer ball is:

$$\begin{aligned}P(k \leq 2) &= P(k = 2) + P(k = 1) + P(k = 0) \\ &\approx 0.306 + 0.176 + 0.042 \\ &\approx 0.524\end{aligned}$$

► So, the probability is about 52%.



GUIDED PRACTICE for Examples 3 and 4

In Sweden, 61% of households have a soccer ball. Suppose you ask 6 randomly chosen Swedish households whether they have a soccer ball.

- Draw a histogram showing the binomial distribution for your survey.
- What is the most likely outcome of your survey? What is the probability that at most 2 households you survey have a soccer ball?