

10.3 Experimental and Theoretical Probability

relative frequency - fraction or percent of the time that an event occurs

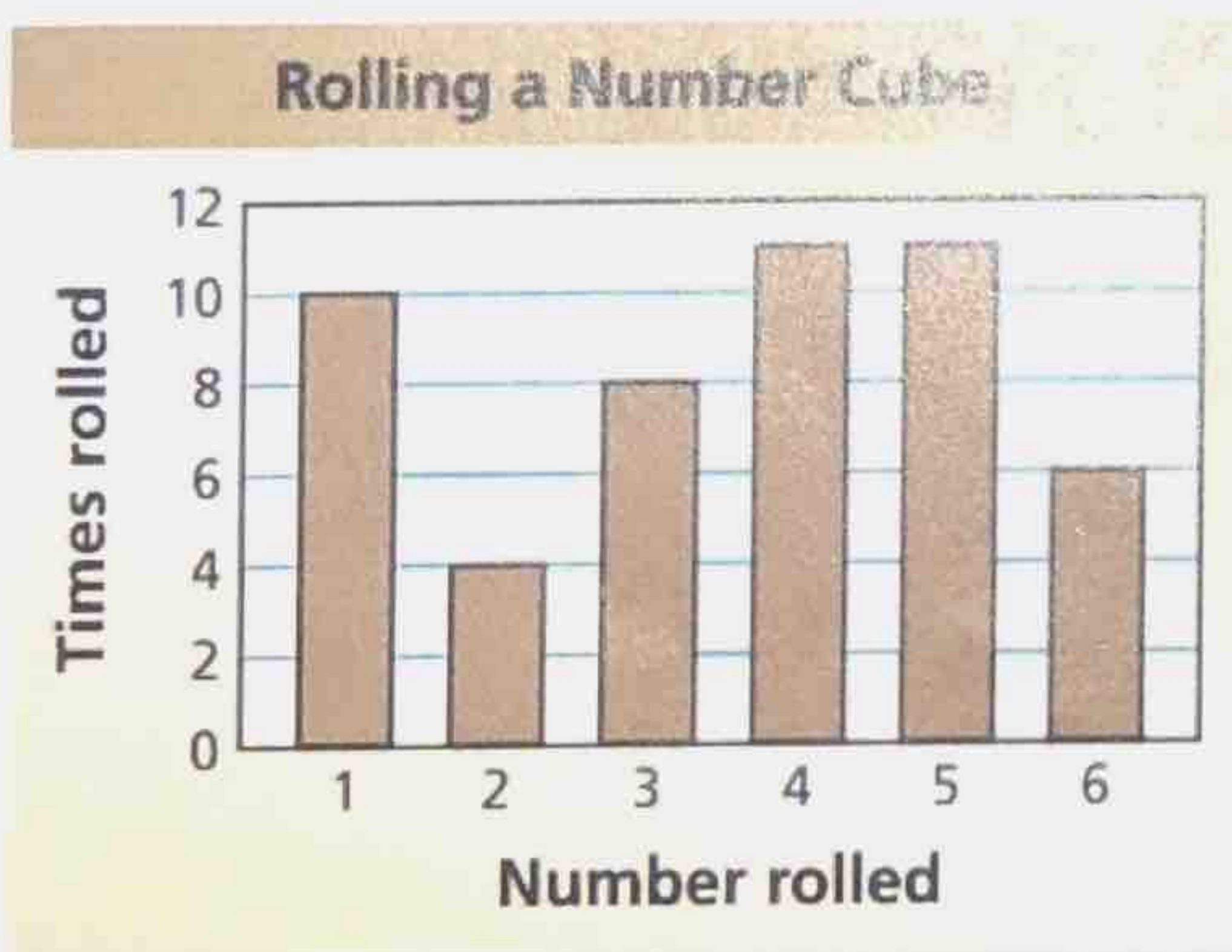
$$\text{relative frequency} = \frac{\text{number of times the event occurs}}{\text{total number of times you conduct the experiment}}$$

experimental probability - probability based on repeated trials of an experiment, this is used to make predictions when you expect the trend to continue

theoretical probability - when all outcomes are equally likely, the probability of an event is the ratio (fraction) of the number of favorable outcomes to the total number of possible outcomes (what we did yesterday in "10.2 Probability")

* As the number of trials increases, the **experimental probability** gets closer to the **theoretical probability**.

Ex: The bar graph shows the results of rolling a number cube 50 times.



- (a) What is the experimental probability of rolling an odd number?

$$P(\text{odd \#}) = P(1, 3, 5) \\ = \frac{10 + 8 + 11}{50} = \frac{29}{50} = 58\% = 0.58$$

- (b) What is the exp. prob. of rolling an even number?

$$P(\text{even \#}) = P(2, 4, 6) \\ = \frac{4 + 11 + 6}{50} = \frac{21}{50} = 42\% = 0.42$$

- (c) What is the exp. prob. Of rolling a prime number?

$$P(\text{prime \#}) = P(2, 3, 5) \\ = \frac{4 + 8 + 11}{50} = \frac{23}{50} = 46\% = 0.46$$

- (d) How close are your answers in (a) and (b) to the theoretical probability?

58% and 42% are pretty close to the theoretical probability $P(\text{odd}) = \frac{1}{2}$, $P(\text{even}) = \frac{1}{2}$.

- (e) What do you notice about the answer for (a) + (b)

$$58\% + 42\% = 100\%$$

Ex: You randomly choose one of the letters shown.



(a) What is the theoretical probability of choosing a vowel?

$$P(\text{vowel}) = P(E, O, E)$$

$$= \boxed{\frac{3}{7}} \approx 0.428571428\dots$$

$$\boxed{\approx 43\%}$$

(b) What is the theoretical probability of not choosing a vowel?

$$P(\text{not vowel}) = P(X, L, P, R)$$

$$= \boxed{\frac{4}{7}} \approx 0.571428571\dots$$

$$\boxed{\approx 57\%}$$

Ex: The theoretical probability of winning a bobblehead when spinning a prize wheel is $\frac{1}{6}$. The wheel has 3 bobblehead sections. How many sections are on the wheel?

$$\frac{\text{bobble}}{\text{total}} = \frac{\text{bobble}}{\text{total}}$$

$$\frac{1}{6} \xrightarrow{\times 3} \frac{3}{x}$$

$$\boxed{x = 18 \text{ total sections}}$$

Ex: The theoretical probability that you randomly choose a red marble from a bag is $\frac{5}{8}$. There are 40 marbles in the bag. How many are red?

$$\frac{\text{red}}{\text{total}} = \frac{\text{red}}{\text{total}}$$

$$\frac{5}{8} \xrightarrow{\times 5} \frac{r}{40}$$

$$\boxed{r = 25 \text{ red marbles}}$$