

Math 3201

3.1 Probability vs. Odds

When there is uncertainty about the occurrence of an event, we can examine the chances of it happening by looking at probability and odds.

Probability: a ratio of favorable outcomes to the total possible outcomes.

$$\text{Probability} = \text{favorable} : \text{total} \quad \text{or} \quad \text{Probability} = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

Odds: a ratio of favorable outcomes to unfavorable outcomes.

$$\text{Odds} = \text{favorable} : \text{unfavorable}$$

Odds for

Note: Notice that probability can be written in two notations:

1. using ~~8:13~~ ← don't recommend
2. as a fraction. $\frac{8}{13}$

Odds however should only be written using $_:_$ notation.

Notation for Odds

When we do problems about odds, we examine the number of favorable outcomes and the number of unfavorable outcomes. We use the following notation:

$n(A)$ - number of favorable outcomes

$n(A')$ or not(A) - number of unfavorable outcomes

Odds in favor of an event: $n(A):n(A')$
fav not fav

Odds in against of an event: $n(A'):n(A)$
not fav

Example 1:

A student has a standard deck of playing cards, and wants to choose a heart from the deck.

(A) What is the probability of choosing a heart? ← fav

total 52 fav: hearts = 13 not fav: not hearts

$$P = \frac{\text{fav}}{\text{total}} = \frac{13}{52} = \frac{1}{4} \text{ or } 0.25 \text{ or } 25\%$$

(B) What are the odds of choosing a heart?

13:39 or 1:3

(C) What would be the probability of NOT choosing a heart?

$$P = \frac{\text{not fav}}{\text{total}} = \frac{39}{52} = \frac{3}{4} \text{ or } 0.75 \text{ or } 75\%$$

(D) What would be the odds of NOT choosing a heart?

39:13 or 3:1

(E) What is the relationship between the ratios for the odds of choosing a heart and the odds of NOT choosing a heart.

odds for and against are opposite.

Example 2:

Identify whether the following are examples of probability or odds. Explain.

(A) The chances of rolling a 2 on a fair six-sided dice is 1:6.

total: 6 numbers $\frac{1}{6}$ probability

(B) The chances of rolling a 2 on a fair six-sided dice is 1:5.

odds for 1:5
fav not fav

Note: Notice that the word "chances" shows up in both probability and odds problems.

Example 3:

(A) The odds of winning a prize in a ticket draw are 4:15. What is the probability of winning a prize?

total $4+15=19$
$$P = \frac{\text{Fav}}{\text{total}} = \frac{4}{19} = 0.21 \text{ or } 21\%$$

(B) The probability of having rain tomorrow is $\frac{3}{4}$. What are the odds of having rain?

total = 4 fav = 3
unfav = total - fav = $4 - 3 = 1$ Odds 3:1

(A) A jar contains three red marbles and some green marbles. The odds are 3:1 that a randomly chosen marble is green. How many marbles are in the jar?

d $3:1 = 9:3$ total = $9+3=12$

Probability of an Event NOT Happening

If the probability of an event happening is defined as:

$$\text{Probability} = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

then the probability of an event NOT happening would be defined as:

$$\text{Probability} = \frac{\text{unfavourable outcomes}}{\text{total outcomes}}$$

or

$$\text{Probability} = \frac{\text{total outcomes} - \text{favourable outcomes}}{\text{total outcomes}}$$

Example 4:

The probability of choosing a red candy from a bag is $\frac{2}{7}$. What is the probability of NOT choosing a red candy?

unfav = total - fav $\frac{2}{7}$
$$= 7 - 2$$

$$= 5$$

P + f -

Practice:

1. (A) What are the odds of selecting an 'e' from the word iceberg.

$$\frac{\text{no. e}}{\text{total}} = \frac{2}{7} = 0.29 \text{ or } 29\%$$

fav: 2
unfav: 5
2:5

- (B) What is the probability of selecting an 'e' from the word iceberg.

$$P = \frac{\text{fav}}{\text{total}} = \frac{2}{7} = 0.29 \text{ or } 29\%$$

2. Identify the following statements as odds or probability:

- (i) The chances of rolling a 1 on a fair six sided die is $\frac{1}{6}$.

probability

- (ii) The chances of drawing a 4 from a standard 52 card deck is 1:12.

$$\frac{4}{52} = \frac{1}{13}$$

~~probability~~

$$4:48$$

$$1:12$$

odds

3. The odds of winning a contest are 5:9. What is the probability of winning the contest?

$$\text{total} = 5 + 9 = 14$$

$$P = \frac{\text{fav}}{\text{total}} = \frac{5}{14} = 0.36 \text{ or } 36\%$$

4. The probability of you passing the next Math test is 75%. What are the odds of you passing?

$$\frac{75}{100}$$

$$\text{fav} = 75 \quad \text{unfav} = 25$$

$$\text{or } 75:25$$

$$3:1$$

5. Which of the following "odds for" and "probability" statements are correct? Explain your reasoning.

	odds for	probability
I	1:3	$\frac{1}{3}$
II	4:5	$\frac{4}{9}$
III	4:6	$\frac{2}{5}$

6. A computer randomly selects a university student's name from the university database to award a \$100 gift certificate for the bookstore. The odds against the selected student being male are 57:43. Determine the probability that the randomly selected student will be male.

total $57 + 43 = 100$ $P = \frac{\text{unfav}}{\text{total}} = \frac{43}{100} = 43\%$

7. The weather forecast says there is a 70% probability of rain tomorrow. What are the odds against rain?

$\frac{70}{100} = \frac{7}{10}$ fav: 7 3:7
unfav: 3