# Probability

#### ♦ Words

Some words have special meaning in Probability:

英文	中文	意義				
Probability	機率	Describes how likely an event is to occur.				
Trial	試驗	Each repetition of an experiment.				
Outcome	結果	Each result of a trial.				
Event	事件	A set of one or more possible outcomes for a trial.				
Sample space	樣本空間*	The set of all possible outcomes for an experiment.				
Theoretical probability	理論機率*	If all possible outcomes are equally likely, the theoretical probability of an event is the ratio of the number of possible outcomes in the event to the total number of possible outcomes in the sample space.				

\*本教材的機率相關用詞有部分屬於臺灣高中才會介紹的內容,而國外有許多教 材則會在國中階段即介紹這些用詞,老師們可以斟酌使用。

#### ♦ Definition

## Probability 機率

If an experiment has n possible outcomes, and each outcome is equally likely to

1

occur, we say that the probability of each outcome happening is  $\overline{n}$ . The probability of an event is written as P(event).

Since the number of possible outcomes for any event must be less than or equal to the total number of possible outcomes in the experiment, the probability P(event) of any event satisfies  $0 \le P(event) \le 1$ .

It can be written as a fraction, a decimal, or a percent.

 $P(\text{event}) = \frac{\text{number of equally likely outcomes in the event}}{\text{total number of equally likely outcomes in the sample space}}$ 

補充:

Probability Line: Describe the probability of each event in words.



https://www.mathsisfun.com/data/probability.html

# ♦ Example

Example						
Sample space						
Find the number of possible outcomes in the sample space.						
Then list the possible outcomes.						
1. A bag contains 5 cards numbered 1~5. You choose a card at random.						
Number of possible outcomes: 5						
(There are $5$ cards in the bag.)						
Possible outcomes: {1, 2, 3, 4, 5}						
2. You toss a coin.						
Number of possible outcomes: 2						
(The coin can land on either heads or tails.)						
Possible outcomes: {Heads, Tails}						
3. You roll a number cube.						
Number of possible outcomes: 6						
(There are 6 faces on a standard die.)						
Possible outcomes: {1, 2, 3, 4, 5, 6}						

Basic Probability-1

Busie Hoouchity						
Jack has 9 cards, each with a number on it from 1 to 9.						
He picks a card at random. Find the probability of each event.						
1. the number 5						
There is only 1 card with the number 5.						
Probability of event (the number 5)						
- <u>Number of outcomes for event (the number 5)</u>						
- Total number of outcomes						
$P(\text{the number } 5) = \frac{1}{2}$						
$\frac{1}{9}$						
2. an odd number						
There are 5 odd numbers $(1, 3, 5, 7, 9)$ .						
Probability of event (an odd number)						
_ Number of outcomes for event (an odd number)						
Total number of outcomes						
P(an odd number) = 5						
$r(an odd number) = \frac{-9}{9}$						
3. a number less than 6 $(1, 2, 2, 4, 5)$						
There are 5 numbers less than $6(1, 2, 3, 4, 5)$ .						
Probability of event (a number less than 6)						
_ Number of outcomes for event (a number less than $6$ )						
Total number of outcomes						
P(a  number loss than  6) = 5						
$r (a number less than 0) = \frac{-9}{9}$						

4. a multiple of 3 There are 3 multiples of 3(3, 6, 9). Probability of event (a multiple of 3) Number of outcomes for event (a multiple of 3) Total number of outcomes  $P(\text{a multiple of } 3) = \frac{3}{9} = \frac{1}{3}$ 5. a perfect square There are 3 perfect squares (1, 4, 9). Probability of event (a perfect square) Number of outcomes for event (a perfect square) Total number of outcomes  $P(\text{a perfect square}) = \frac{3}{9} = \frac{1}{3}$ 6. a prime number There are 4 prime numbers (2, 3, 5, 7). Probability of event (a prime number) Number of outcomes for event (a prime number) Total number of outcomes  $P(\text{an odd number}) = \frac{4}{9}$ 

Basic Probability  $(0 \le P(\text{event}) \le 1)$ -2

1.	Darren has a spinner with sections labelled 1,2,3,4, and 5.								
	The table shows information about some of the probabilities.								
	Find the value of <i>x</i> .								
	Number	1 2 3 4 5							
	Probability	x 0.2 0.3 0.1							

To find the value of *x*, we need to ensure that the sum of all probabilities equals 1, as the spinner must land on one of the numbered sections.

Given:

P(1) + P(2) + P(3) + P(4) + P(5) = 1

We're given the probabilities for sections 2, 3, 4, and 5. Let's add them up and then subtract their sum from 1 to find the value of x.

x+0.2+0.3+0.1+0.25=1x=1-0.2-0.3-0.1-0.25=0.15

2.	There are only pink, yellow, and white flowers in the flower shop.							
	The table shows information about some of the probabilities.							
	Color	pink	yellow	White				
	Probability	0.5	0.2	x				
	(a) Find the probability of white flowers							
	To find the value of xxx and the number of each type of flower, we							
	need to use that the sum of probabilities must equal 1.							
	Given:							
	P(pink) + P(yellow) + P(white) = 1							
	We're given th	We're given the probabilities for pink and yellow flowers. Let's add						
	them up and th	them up and then subtract their sum from 1 to find the value of $x$ .						
	0.5 + 0.2 + x =	0.5 + 0.2 + x = 1						
	x = 1 - 0.5 - 0.2 = 0.3 So, the probability of white flowers is 0.3.							
	(b) There are 50 flowers in the flower shop. Find the number of each type of flower							
	of nower.							
	Given: Total number of flowers is 50.							
	Number of pink flowers :0.5×50=25							
	Number of yellow flowers $:0.2 \times 50 = 10$							
	Number of white flowers $:0.3 \times 50 = 15$							
	So, there are 25 pink flowers, 10 yellow flowers, and 15 white flowers							
	in the flower shop.							

### Basic Probability-3

Peter has 20 pens in a drawer. There are 4 black pens and 5 red pens. The other pens are blue. He picks a pen at random from the drawer.

(a) What is the probability that peter picks a black pen?

$$P(\text{black}) = \frac{\text{Number of black pens}}{\text{Total number of pens}}$$
$$= \frac{4}{20} = \frac{1}{5}$$

(b) What is the probability that peter picks a blue pen?

$$P(\text{blue}) = \frac{\text{Number of blue pens}}{\text{Total number of pens}}$$
$$= \frac{20 - 4 - 5}{20} = \frac{11}{20}$$

(c) What is the probability that Peter picks a yellow pen?  $P(\text{yellow}) = \frac{\text{Number of yellow pens}}{\text{Total number of pens}}$   $= \frac{0}{20} = 0$ 

**Basic Probability-4** 

A total of 180 students in the senior class were surveyed about their preferred class subjects. The table below shows the results of the survey."

Subject	History	Literature	Biology	Chemistry	Physical Education	Spanish	No Preference
Number of students	30	40	35	25	10	20	20

(d) What is the probability that a randomly selected student who participated in this survey chose Spanish as their favorite subject?

 $P(\text{Spanish}) = \frac{\text{Number of students who chose Spanish}}{\text{Total number of students}}$ 20 1

$$=\frac{20}{180}=\frac{1}{9}$$

(e) What is the probability that a randomly selected student who participated in this survey chose History as their favorite subject?

 $P(\text{History}) = \frac{\text{Number of students who chose History}}{\text{Total number of students}}$  $= \frac{30}{180} = \frac{1}{6}$ 

(f) What is the probability that a randomly selected student who participated in this survey chose Biology or Chemistry as their favorite subject?

P(Biology or Chemistry)

\_ Number of students who chose Biology or Chemistry

Total number of students

 $=\frac{35+25}{180}=\frac{60}{180}=\frac{1}{3}$ 

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