

M1 Maths

P2-2 Two-Way Tables

- using two-way tables to determine probabilities

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Summary

Two-way tables are a visual way to solve two-stage problems that involve the addition and multiplication rules where all outcomes are equally likely.

The first stage outcomes go along the top of the table and the second stage outcomes go down the side. The cells in the table then represent the overall outcomes. The probability of an event is then equal to the number of outcomes in that event divided by the total number of overall outcomes in the table.

Learn

Suppose we wanted to know the probability of getting a 5 if we roll two 6-sided dice. We can draw a table with the roll of one die along the top and the roll of the other one down the side, like this:



	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

We then put in the resulting totals:

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Counting up we can see that there are 36 possible outcomes (the white squares). These are all equally likely. 4 of the 36 give a total of 9. So, the probability of getting a 9 when you roll two dice is $\frac{4}{36}$.

A two-way table for tossing two coins would look like this:

	H	T
H	HH	TH
T	HT	TT

From this we can see that the probability of getting two heads is $\frac{1}{4}$ and the probability of getting a head and a tail is $\frac{2}{4}$

Practice

- Q1 Use the dice table above to find the probability that, if you roll 2 dice, you will get a total of:
- 7
 - 4
 - 2
 - 1
 - 11
- Q2 Draw up a table for the probabilities when rolling two 4-sided dice. Then use it to find the probabilities of getting totals of:
- 8
 - 7
 - 4

- Q3 Use the table above for the probabilities when tossing two coins to find the probabilities of getting:
- (a) 2 heads
 - (b) 2 tails
 - (c) 1 of each
- Q4 Use a table for the probabilities when tossing a coin and drolling a die to find the probabilities of getting:
- (a) a head and a 6
 - (b) a head and a number less than 6
 - (c) a tail and a 2 or 3

Solve

- Q51 A dog breeder has a 20-sided (icosahedral) die with the faces numbered 1 to 20. He rolls it twice. We want to know the probability that he gets a total of 32. We can solve this by drawing a huge two-way table, but that will take ages and be very boring. See if you can find a quicker way to get the answer.

Revise

Revision Set 1

- Q61 Draw up a two-way table for the tossing of two coins and use it to find the probability that it will give a head and a tail.
- Q62 Draw up a two-way table for the rolling of a four-sided die and a six-sided die and use it to find the probability of getting a total of 7.

Answers

- Q1 (a) $\frac{6}{36}$ (b) $\frac{3}{36}$ (c) $\frac{1}{36}$ (d) 0 (e) $\frac{2}{36}$
- Q2 (a) $\frac{1}{16}$ (b) $\frac{2}{16}$ (c) $\frac{3}{16}$
- Q3 (a) $\frac{1}{4}$ (b) $\frac{1}{14}$ (c) $\frac{1}{2}$
- Q4 (a) $\frac{1}{12}$ (b) $\frac{5}{12}$ (c) $\frac{2}{12}$

Q51 The probability is $\frac{9}{400}$. You will be introduced to a quicker method in Module 4.1.

Q61 $\frac{2}{4}$

Q62 $\frac{4}{24}$