GCSE Maths – Probability

Sample Spaces

Worksheet

NOTES

SOLUTIONS

This worksheet will show you how to work out different types of sample space questions. Each section contains a worked example, a question with hints and then questions for you to work through on your own.

Section A

Worked Example

Two fair 6-sided dice are rolled at the same time. Construct a sample space diagram showing their combined outcomes.

Step 1: Identify the two independent events and their individual sample spaces.

Two dice are rolled – these are the independent events.
Each die roll has a sample space of $\{1, 2, 3, 4, 5, 6\}$.

Step 2: Draw the table. This should include labels for the rows and columns and contain the sample spaces of each event as headers.

		Die 1					
		1	2	3	4	5	6
D i e 2	1						
	2						
	3						
	4						
	5						
	6						

Step 3: Fill in the table by calculating each outcome.

Work out what goes in each box by taking the first number from the row and the second number from the column.

		Die 1					
		1	2	3	4	5	6
D i e 2	1	1,1	1,2	1,3	1,4	1,5	1,6
	2	2,1	2,2	2,3	2,4	2,5	2,6
	3	3,1	3,2	3,3	3,4	3,5	3,6
	4	4,1	4,2	4,3	4,4	4,5	4,6
	5	5,1	5,2	5,3	5,4	5,5	5,6
	6	6,1	6,2	6,3	6,4	6,5	6,6

Worked Example 2

Two fair 6-sided dice are rolled at the same time. Find the probability of rolling one even number and one odd number.

Step 1: Identify the two independent events and their individual sample spaces.

Two dice are rolled – these are the independent events.
Each die roll has a sample space of {1, 2, 3, 4, 5, 6}.

Step 2: Construct the table of outcomes.

		Die 1					
		1	**2**	**3**	**4**	**5**	**6**
D i e 2	**1**	1,1	1,2	1,3	1,4	1,5	1,6
	2	2,1	2,2	2,3	2,4	2,5	2,6
	3	3,1	3,2	3,3	3,4	3,5	3,6
	4	4,1	4,2	4,3	4,4	4,5	4,6
	5	5,1	5,2	5,3	5,4	5,5	5,6
	6	6,1	6,2	6,3	6,4	6,5	6,6

Step 3: Identify the target outcome.

The target outcome is a roll with one even and one odd number. There are 18 appearances of this in the table.

		Die 1					
		1	**2**	**3**	**4**	**5**	**6**
D i e 2	**1**	1,1	1,2	1,3	1,4	1,5	1,6
	2	2,1	2,2	2,3	2,4	2,5	2,6
	3	3,1	3,2	3,3	3,4	3,5	3,6
	4	4,1	4,2	4,3	4,4	4,5	4,6
	5	5,1	5,2	5,3	5,4	5,5	5,6
	6	6,1	6,2	6,3	6,4	6,5	6,6

Step 4: Calculate the required probability.

*The diagram shows there are 18 ways rolling one odd number and one even number out of 36 possible outcomes.*

$$18 \ target \ combinations \ out \ of \ 36 \ outcomes = \frac{18}{36} = \frac{1}{2}$$

The probability of rolling an odd and an even number is $\frac{1}{2}$.

Guided Example

The two fair spinners shown are spun. Their outcomes are added together to produce a result. State the sample space for each spinner and show their combined outcome in a sample space diagram.
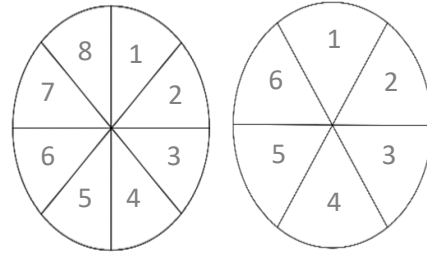
Step 1: Identify the two independent events and their individual sample spaces.

Step 2: Draw the table. This should include labels for the rows and columns and contain the sample spaces of each event as headers.

Step 3: Fill in the table by calculating each outcome.

1. Write down the sample space for each of these events.

   a) Flipping a coin.

   b) Rolling an 8-sided die.

   c) Running a random number generator numbered 1-10.

2. Lucy is playing a game. She has a 6-sided die and a coin. First, she rolls the die and records her score. Then she flips the coin.

   If the coin lands on heads, her score is doubled.

   If the coin lands on tails, her score has 2 points deducted from it.

   a) Write down the sample spaces for the coin and the die.

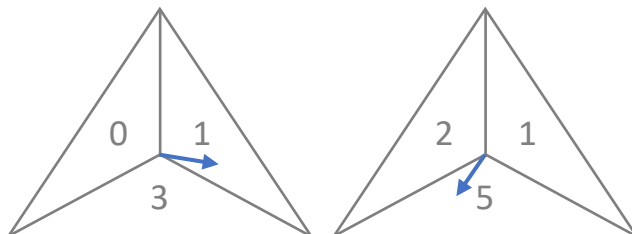   b) Construct a sample space diagram showing the possible scores she could get.

   c) Work out the probability that she scores higher than 10.

3. Jacob has 2 spinners. He spins them both and adds their results together.

Jacob says: "The probability that I score an even number is ½."

Show that he is incorrect.

4. Miles has organised a game to raise money for the local rugby club. Players must roll a 6-sided die and flip a coin.

If the coin lands on heads, the score is doubled.
If the coin lands on tails, the score is halved.

People pay 50p to play.
If they score 10 or more, they win £1.
If they score more than 5 but less than 10, they win 75p.

800 people play his game.

Use probability to estimate how much money he raises.

5. A six-sided die is rolled twice.

    a) Construct a sample space diagram to show the possible outcomes.

    b) Work out the probability that the second roll is the same as the first roll.

    c) State the probability that the second roll is NOT the same as the first roll.

    d) Work out the probability that five sequential rolls are all the same.

6. Enzo flips a fair coin ten times. He gets heads 7 times, and tails 3 times.

    Enzo says, "The coin is definitely biased because I did not get the same number of heads and tails."

    Is he correct? Explain your answer.