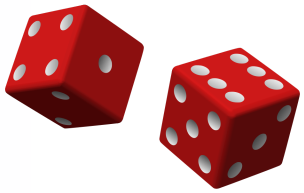
Name & Surname: _____ Class: _____ Date: _____

Sample Spaces and Probability

Listing outcomes to find theoretical probabilities



About 60 minutes Level ★★★☆☆

Finding Theoretical Probability

Use a complete list when all outcomes are **equally likely**.

- List the **sample space** - all possible mutually exclusive outcomes.
- Count total outcomes and **favourable** outcomes for the event.
- Use P(event) = favourable outcomes ÷ total outcomes. Give as a **fraction** in simplest form.

Task A

/4

Work out these totals carefully in columns.

1

$$\begin{array}{r} 426 \\ +\ 318 \\ \hline \end{array}$$

2

$$\begin{array}{r} 5000 \\ -\ 1736 \\ \hline \end{array}$$

3

$$\begin{array}{r} 342 \\ \times\ \quad 6 \\ \hline \end{array}$$

4

$$8\overline{)864}$$

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Single Events First

Practise sample spaces and probabilities for one event.

Key words

sample space: list of all possible outcomes

mutually exclusive: two outcomes cannot happen together

event: something that may happen

equally likely: each outcome has the same chance

favourable: outcome you are looking for

theoretical probability: favourable ÷ total outcomes

Task B /12

Work through single events, listing sample spaces first.

WARM UP

1 List the **sample space** for rolling a fair 1-6 die.

Answer: _____

2 List the **sample space** for tossing a fair coin.

Answer: _____

3 A fair 1-6 die is rolled. Find P(rolling a **4**).

Answer: _____

4 A fair coin is tossed. Find P(**Heads**).

Answer: _____

PRACTISE

5 A fair spinner has 4 equal sections: red, blue, green, yellow. Find P(**blue**).

Answer: _____

6 For the same 4-section **spinner**, find P(**not** yellow).

Answer: _____

7 A letter is picked at random from the word MATHS. Find P(**vowel**).

Answer: _____

8 A student says P(rolling a 7 on a normal 1-6 **die**) is $\frac{1}{6}$. Explain how you **know** they are wrong.

Answer: _____

PROBLEM SOLVING

9 A fair 10-sided die numbered 1-10 is rolled. Find P(**even** number).

Answer: _____

10 The same 10-sided **die** is rolled. Find P(multiple of **3**).

Answer: _____

11 A purse holds one £1 coin, one 50p coin, one 20p coin and one 10p coin. A coin is picked at **random**. Find P(50p).

Answer: _____

12 A bag has 6 equal counters: 2 red, 2 blue, 2 green. Explain how you **know** that P(green) = P(blue).

Answer: _____

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Combine Two Events

List combined sample spaces and work out probabilities.

Task C /12

List combined outcomes systematically, then find probabilities.

WARM UP

1 A fair coin is tossed and a fair 1-6 die is rolled. How many **total** outcomes are there?

Answer: _____

2 List the **sample space** for tossing two fair coins.

Answer: _____

3 Two fair coins are tossed. Find P(two **Heads**).

Answer: _____

4 A coin and a 1-6 die are used. Find P(**Heads** and 6).

Answer: _____

PRACTISE

5 A 3-section spinner (red, blue, green) is spun and a coin is tossed. How many **total** outcomes are there?

Answer: _____

6 Two fair 1-6 dice are rolled. How many **total** outcomes are in the **sample space**?

Answer: _____

7 Two fair 1-6 dice are rolled. Find P(double **six**).

Answer: _____

8 Two fair coins are tossed. Find P(one **Head** and one Tail).

Answer: _____

PROBLEM SOLVING

9 Bag A has counters X and Y. Bag B has counters 1, 2 and 3. One counter is picked from each **bag**. How many total **outcomes** are there?

Answer: _____

10 For the same two **bags**, find P(X and **2**).

Answer: _____

11 A 50p coin is tossed and a fair 5-section spinner numbered 1-5 is spun. Find P(Tails and an **even** number).

Answer: _____

12 A student says rolling two 1-6 dice gives 12 total **outcomes** because 6 + 6 = 12. Explain how you **know** they are wrong.

Answer: _____

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Recall and Spin

Retrieve earlier maths and test a spinner.

Task D

/11

Answer questions to score points. Aim for 8 points.

1 point
Work out $\frac{3}{4}$ of 20

1 point
Work out 7 × 8

2 points
Simplify $\frac{12}{16}$

2 points
Work out 20% of 60

2 points
Find the mean of 5, 7 and 9

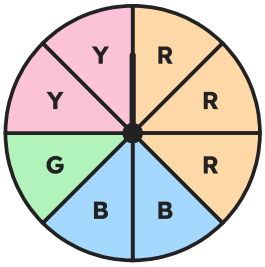
3 points
Work out $\frac{1}{3} + \frac{1}{6}$

My score: _____ out of 11 · Target: 7

Task E

/5

Spin the spinner and write each probability as a fraction.



R red (3)
B blue (2)
G green (1)
Y yellow (2)

1. **P(red) =** _____
2. **P(blue) =** _____
3. **P(not green) =** _____
4. **P(red or blue) =** _____
5. **P(yellow) =** _____

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Sort and Solve

Sort true and false ideas, then follow examples.

Task F

Example done for you

/5

Sort each statement into True or False.

● **True**: colour it blue or draw ● ▲ **False**: colour it orange or draw ▲

P(event) = **favourable** outcomes ÷ total outcomes. ●	Probabilities for all outcomes in a **sample space** add to 1.	For two coins, HT and TH are **different** outcomes.	Rolling two dice gives 12 **total** outcomes.
If you get three 6s, a 6 is less **likely** next time.	P(not blue) is the same as P(**blue**).		

Task G

/2

Follow each worked steps, then try a similar question.

WORKED EXAMPLE

A fair 1-6 die is rolled. Find P(even number).

1. List **sample space**: 1, 2, 3, 4, 5, 6
2. **Favourable** outcomes: 2, 4, 6 (3 outcomes)
3. P = 3 ÷ 6 = $\frac{3}{6}$ = $\frac{1}{2}$

Answer: $\frac{1}{2}$

YOUR TURN

A fair 1-6 die is rolled. Find P(odd number).

Answer: _____

WORKED EXAMPLE

Toss a coin and spin a 3-section spinner (R, B, G). Find P(Heads and Red).

1. Total outcomes = 2 × 3 = 6
2. List: HR, HB, HG, TR, TB, TG
3. Only 1 **favourable**: HR, so P = $\frac{1}{6}$

Answer: $\frac{1}{6}$

YOUR TURN

Toss a coin and spin the same spinner. Find P(Tails and Blue).

Answer: _____

How did I do?

Circle a face for each line.

I can list a theoretical sample space for single and combined events.	☹	😐	☺
I can calculate theoretical probabilities from equally likely outcomes.	☹	😐	☺
I can explain common probability mistakes.	☹	😐	☺

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Answer sheet: Sample Spaces and Probability

Task A

1. 426 + 318 = 744
2. 5000 − 1736 = 3264
3. 342 × 6 = 2052
4. 864 ÷ 8 = 108

Task B

1. 1, 2, 3, 4, 5, 6
2. Heads, Tails
3. $\frac{1}{6}$
4. $\frac{1}{2}$
5. $\frac{1}{4}$
6. $\frac{3}{4}$
7. $\frac{1}{5}$
8. 7 is not in the sample space 1 to 6, so the event is impossible and P = 0.
9. $\frac{1}{2}$
10. $\frac{3}{10}$
11. $\frac{1}{4}$
12. Both colours have 2 favourable outcomes out of the same 6 total, so both are $\frac{2}{6} = \frac{1}{3}$.

Task C

1. 12
2. HH, HT, TH, TT
3. $\frac{1}{4}$
4. $\frac{1}{12}$
5. 6
6. 36
7. $\frac{1}{36}$
8. $\frac{1}{2}$
9. 6
10. $\frac{1}{6}$
11. $\frac{1}{5}$
12. You multiply for combined events, 6 × 6 = 36 total outcomes, which you can show in a list or table.

Task D

1. 15
2. 56
3. $\frac{3}{4}$
4. 12
5. 7
6. $\frac{1}{2}$

Task E

1. P(red) = $\frac{3}{8}$
2. P(blue) = $\frac{1}{4}$
3. P(not green) = $\frac{7}{8}$
4. P(red or blue) = $\frac{5}{8}$
5. P(yellow) = $\frac{1}{4}$

Task F

True (blue ●): P(event) = favourable outcomes ÷ total outcomes. Probabilities for all outcomes in a sample space add to 1. For two coins, HT and TH are different outcomes.

False (orange ▲): Rolling two dice gives 12 total outcomes. If you get three 6s, a 6 is less likely next time. P(not blue) is the same as P(blue).

Task G

1. $\frac{1}{2}$
2. $\frac{1}{6}$

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