GCSE Mathematics

Relative Frequency & Sample Space

Questions

Pearson Edexcel GCSE & iGCSE Mathematics

Section A — Foundation

Worked Examples

[Fluency]

A coin is flipped 40 times. It lands on heads 18 times. Find the relative frequency of heads.

$$\text{Relative frequency} = \frac{18}{40} = 0.45$$

[Reasoning]

Two spinners each show 1, 2, 3. Draw a sample space and find P(same number).

Sample space: 9 outcomes. Same: (1,1)(2,2)(3,3)

$$P(\text{same}) = \frac{3}{9} = \frac{1}{3}$$

[Problem Solving]

A biased coin has theoretical P(H)=0.6. In 200 trials, 102 heads appear. Comment on whether the coin appears fair.

Relative frequency = 102/200 = 0.51

This is close to 0.5, not 0.6, suggesting the coin may not be as biased as expected. However, more trials are needed for a reliable conclusion.

[Fluency]

1. A coin is flipped 50 times and lands on heads 28 times.
Find the relative frequency of heads.

(1 mark)

[Fluency]

2. A fair coin is flipped twice. List all possible outcomes and find P(two heads).

(2 marks)

[Fluency]

3. Two fair dice are rolled. Draw a sample space diagram and find the probability that the sum of the two dice is 7.

(3 marks)

[Fluency]

4. Spinner A has sections 1, 2, 3. A fair coin shows H or T.
List all possible outcomes. Find P(even number and heads).

(2 marks)

[Fluency]

5. A drawing pin is dropped 40 times. It lands point-up 14 times.
Find the relative frequency of landing point-up.

(1 mark)

[Reasoning]

6. A bag contains red and blue counters. The theoretical probability of red is 0.3.
After 200 trials, red appears 54 times.
Comment on whether the results are consistent with the theoretical probability.

(2 marks)

[Reasoning]

7. Two fair dice are rolled. Using a sample space diagram, find the probability that the product of the two numbers is greater than 15.

(3 marks)

[Reasoning]

8. A fair die is rolled 300 times. The number 6 appears 62 times.

(a) Find the relative frequency of rolling a 6. (1)

(b) Is there evidence the die is biased? Justify your answer. (2)

(3 marks)

[Problem Solving]

9. Explain how increasing the number of trials affects the reliability of a relative frequency as an estimate for probability.

(2 marks)

[Problem Solving]

10. Spinner A has sections {1, 2, 3} and Spinner B has sections {1, 2, 3, 4}.
Both are spun once. Draw a sample space diagram.

(a) Find P(A > B). (2)

(b) Find P(A + B = 5). (2)

(4 marks)

Section B — Higher

Worked Examples

[Fluency]

In a large experiment, the relative frequency of an event is 0.42. What is the best estimate for P?

By the **Law of Large Numbers**, relative frequency → theoretical probability.

Best estimate: **P ≈ 0.42**

[Reasoning]

Two dice. Find P(sum is prime).

Prime sums possible: 2(1 way), 3(2), 5(4), 7(6), 11(2) = 15 ways

$$P(\text{prime sum}) = \frac{15}{36} = \frac{5}{12}$$

[Problem Solving]

Two dice. Given that the sum ≥ 9, find P(at least one 6).

Sum ≥ 9: 10 outcomes. Of these, with at least one 6: (3,6)(4,6)(5,6)(6,3)(6,4)(6,5)(6,6)=7

$$P(\text{at least one 6} | \text{sum} \geq 9) = \frac{7}{10}$$

[Fluency]

1. A large number of trials gives a relative frequency of 0.42 for an event.
What is the best estimate for the theoretical probability? Justify your answer.

(2 marks)

[Fluency]

2. Two fair dice are rolled. Using a sample space diagram, find the probability that the sum of the two numbers is a prime number.

(4 marks)

[Reasoning]

3. Explain, using the Law of Large Numbers, why a larger number of trials gives a more reliable estimate of probability.

(2 marks)

[Reasoning]

4. A fair die is rolled n times. The number 4 appears 85 times with relative frequency approximately equal to the theoretical probability.
Estimate the value of n.

(2 marks)

[Reasoning]

5. Two fair dice are rolled. Find the probability that the difference between the two numbers is at least 3.

(3 marks)

[Reasoning]

6. Two fair spinners each show {1, 2, 3, 4}. Both are spun.
Find the probability that the sum of the two numbers is divisible by 3.

(3 marks)

[Problem Solving]

7. A game involves rolling two dice. A player wins if the product of the two numbers is a perfect square.
Find P(win). Show your sample space or method clearly.

(3 marks)

[Problem Solving]

8. A student rolls a die 60 times. The results are:
1:8, 2:9, 3:11, 4:10, 5:7, 6:15

(a) Find the relative frequency for each outcome. (2)

(b) Do the results suggest the die is biased? Justify. (2)

(4 marks)

[Problem Solving]

9. Two fair dice are rolled. Given that the sum is at least 9, find P(at least one 6).

(4 marks)

[Problem Solving]

10. Explain the difference between theoretical probability and relative frequency.
Give a real-world example where we can only use relative frequency to estimate probability.

(3 marks)