

Easy winnings

This investigation allows pupils to demonstrate their understanding of probability as a form of comparison of success. It is based on the idea of comparing the performance of a pair of dice to a spinner. Teachers may choose to introduce the unit by playing with dice & spinners to allow children to get a grasp on the games played, and a sense of the fairness & inequalities involved.

Less able pupils will begin by randomly recording possible combinations from dice throws. They may begin to organise their results, and spot duplications. This should lead to them devising a strategy for recording results. They may then begin to explain why the probability of rolling a double-six is not the same as spinning a 12.

Middle range pupils will record outcomes from dice rolls systematically, perhaps listing in order. They will quickly identify the reason for the inequality, and may be able to describe it using mathematical language in terms of probability. They may find a way to address the problem.

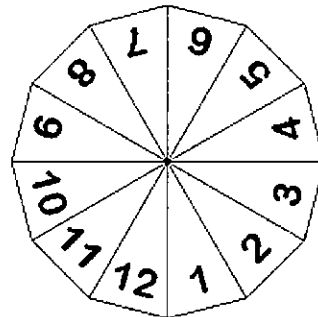
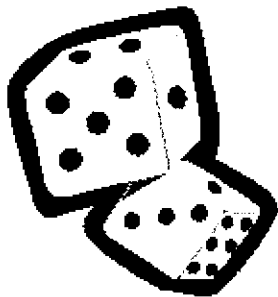
More able pupils should quickly resolve the initial problem, referring to it in mathematical terms, and using a two-way table to record results. They should devise fairer ways of playing the game, referring to equal probabilities, and may suggest designing a new spinner. They should go on to explore other aspects of the game – for example whether the spinner allows one player to move further forward more frequently than the dice.

The investigation allows pupils to explore theoretical probability. It also allows an opportunity for the key comparison between theoretical and experimental probability. Pupils could play a simple game in pairs which involves moving around a board, and record how often each type of counting device wins. This could lead to discussions as to whether the theoretical probability is always right, and of the usefulness of experimental probability to model situations.

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Focus: Probability

James and Sasha play a board game online which uses two dice to move around the board. Sasha doesn't have two dice, but uses a 12-sided spinner. The rules say that each player moves along the board the number of spaces shown on the two dice together. For example, throwing a 3 and a 6 means the player can move 9 spaces. An extra go is awarded each time the player rolls a double-six - James and Sasha agree that Sasha earns her extra 'roll' if she spins a '12'.



After playing several games, James claims that Sasha must be cheating because she gets many more extra 'rolls' than him on every game.

Your Task:

- Try to decide whether James is right. Must Sasha be cheating, or is there some other explanation for her luck?
- Use probability to explain why this problem has arisen
- Try to devise a fairer way to play the game.

Things to think about:

- What is the chance that each player will score a bonus point?
- What difference does using the spinner make?
- Are there any other problems which might occur?
- How can you collect and show your findings?

Remember to use the level ladder to help you to achieve your target level.

Key words

bias, equal, event, fair, unfair,
chance, outcome, possible, probability

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Now use the Level Ladder to achieve your target.

To get level	You should:
5	List as many possible outcomes of the dice throws as possible Check your data for errors Describe the number of chances each player has of earning an extra 'roll'
6	List all the possible outcomes of the dice throws Include all variants of the dice throw outcomes Give a reason for Sasha's apparent success
7	Systematically list all the possible outcomes of dice throws Represent probabilities as either a fraction, decimal or percentage Explain a reason for Sasha's apparent success Devise a fairer way of allocating extra 'rolls'
8	Use a two-way table to record all the possible outcomes of dice throws Check probabilities by totalling for all outcomes, and compare the resulting probabilities for the two methods Devise a fairer way of running the game with the existing tools Consider how the spinner could be made more fair
9	Compare the probabilities of getting an extra 'roll' with both methods Examine another aspect of the game, for example, whether both players can expect to achieve the same number of moves over the course of a game Consider how the spinner could be made to 'mimic' the behaviour of the die Conduct an experiment with a mock-up spinner to see if you have created an improved product

Now use the Level Ladder to assess your work and decide on improvement targets.