Task notes | Dice odds

Y9–10

Notes for parents (1).

The purpose of the activity is to help your student to:

- Carry out an experiment to estimate the probability of an outcome.
- Create a model to work out the theoretical probability of an outcome.
- Compare the results of the experiment with the model.

Here is what to do:

Read through the problem together. Discuss some outcomes that can happen when two dice are rolled. For example, the two numbers might be 4 and 5. *Does it matter if the dice are different colours?*

Are there the same number of outcomes that might happen?
With different coloured dice students are more inclined to accept that 4 then 5 is a different outcome to 5 then 4.

Discuss the game at the fair. Clarify that the player gets a prize if they select an outcome and that outcome occurs when they roll the two dice.

Which event do you think is more likely? Why?

Look for your student to say something about more outcomes matching the event they choose. For example, Even and Odd can happen with 1-2, 1-4, 1-6, 2-1, 2-3, 2-5, 3-2 etc.

Carry out twenty rolls of two dice. Each time the two dice are rolled decide whether the result is a win or loss for each event. You might end up with a table that looks something like this:

Event	Consecutive	Even and odd	Sum of seven
Win	𝍸 ||||	𝍸 𝍸 𝍸	𝍸 ||
Lose	𝍸 𝍸 𝍸 𝍸 |	𝍸 𝍸 |||	𝍸 𝍸 𝍸 𝍸

Notes for parents (2).

Although the sample size is small the data gives some basis for estimating the probability of each event. Look for your student to use fractions like this:

A consecutive win happens about 9/30 times. That is about one third.

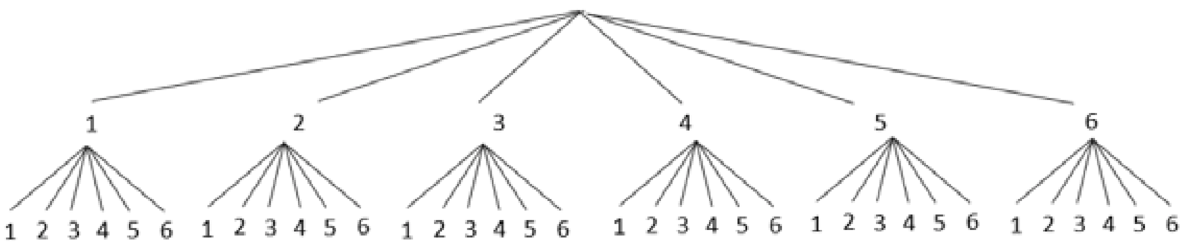
An even and odd win happens about 15/28 times. That is about one half.

A sum of seven win happens about 7/27 times. That is about one quarter.

Discuss whether these fractions reflect the mathematical chance of each event occurring. Your student should have some tools available to work out all the outcomes for rolling two dice. A table is the tidiest method. Here a table shows the possible sums of two dice. The sums of 7 are shaded so the chance of a sum of seven occurring is 6/(36) = 1/6.

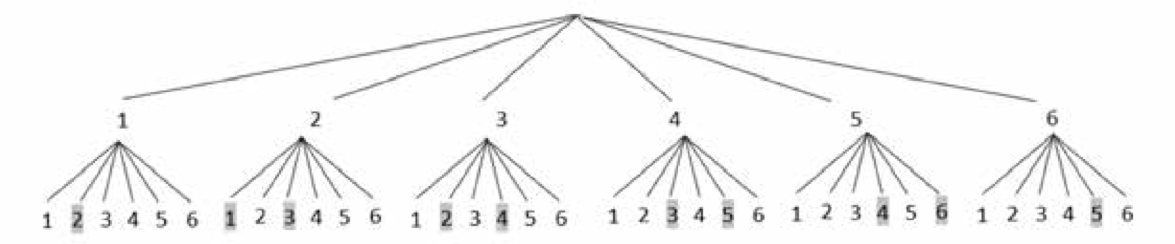
		Dice A					
		1	2	3	4	5	6
Dice B	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9
	4	5	6	7	8	9	10
	5	6	7	8	9	10	11
	6	7	8	9	10	11	12

A tree diagram might also be used but it gets quite complex in this situation. Note that the first layer of arms shows the outcomes for Dice A.

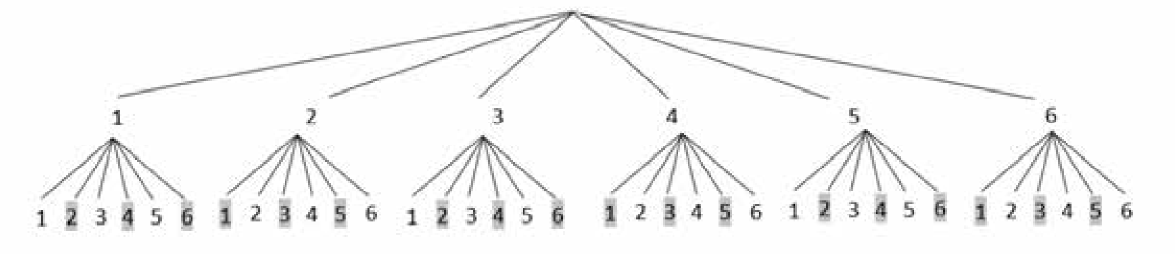


Each lower arm represents an outcome of rolling two dice. These outcomes can be checked to see which of them match the conditions of the events in the game. Below the outcomes that represent consecutive dice numbers are shaded. Ten outcomes out of 36 are consecutive pairs. The probability of that event occurring, with a single roll of two dice, is 10/36.

Notes for parents (3). Activity next page.



The ‘one even and one odd’ outcomes are shaded below. Eighteen outcomes out of 36 are consecutive pairs. The probability of that event occurring, with a single roll of two dice, is 18/36 or 1/2.



Of the three events, getting consecutive number pairs has the highest probability. Discuss whether the experimental results match the theoretical models.

Points to note

Probability is a measure of the chance of an event, just like 16cm is a measure of the length of a pencil. Probabilities can range from zero (no chance) to one (certain). A probability can be represented by a fraction, decimal or percentage, and sometimes as a ratio for odds. For example, the probability of getting heads with a single coin toss is 1/2 = 0.5 = 50%. Expressed as odds this can be written as 1:1 meaning one chance of getting heads to one chance of getting tails.

In real life probabilities are worked out in two ways. Sometimes it is possible to come up with a model of all the possible outcomes. Useful models are tables, tree diagrams, and theoretical distributions for students at senior levels of secondary school. Most often the actual probabilities cannot be found theoretically so data must be used to estimate those probabilities. For example, the probability of getting a baby girl at birth is about 47%. That probability is the result of looking at data from many births. Experimental probabilities can only be estimates. However, the larger the sample size, assuming the sample represents the whole population, the more confidence can be attached to the result.

For any sample there are always sources of variation. If a coin is tossed 30 times the results are more likely not to be 15 heads:15 tails. However, if 1000 trials of 30 single coin tosses are conducted then 15 heads:15 tails will be the centre of the distribution.

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Y9–10

There is a game at the school fair in which you roll two standard 1-6 dice.

You choose which event you want to aim for from this selection:

- The numbers are consecutive (one after the other, like 2 and 3)
- The numbers are one even and one odd (like 3 and 6)
- The numbers add to a sum of seven (like 5 + 2 = 7)

You watch some people play the game.

Here is the data recorded in a tally chart.

Event	Consecutive	Even and odd	Sum of seven
Win	|||	||||	||
Lose	𝍸 ||	𝍸 |	𝍸 |||

The game does not look fair no matter which outcome you choose.

1. Carry out 20 rolls of two dice and add the results to the tally chart above.

   Does the game look fairer as you trial more?
   Do the events appear to have the same chance of success?

2. Find a way to work out the probability of each event, using a table or a tree diagram. Which outcome has the highest chance of success?