Mathletics

Chance and Probability

My name

Series F – Chance and Probability

Contents

Topic 1 – Chance and Probability (pp. 1–10)   **Date completed**

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Chance and probability – ordering events

Probability measures how likely something is to happen.
An event that is **certain** to happen has a probability of 1.
An event that is **impossible** has a probability of 0.
An event that has an **even** or **equal** chance of occurring has a probability of $\frac{1}{2}$ or 50%.

0		$\frac{1}{2}$		1
impossible	unlikely	even chance (50%)	likely	certain
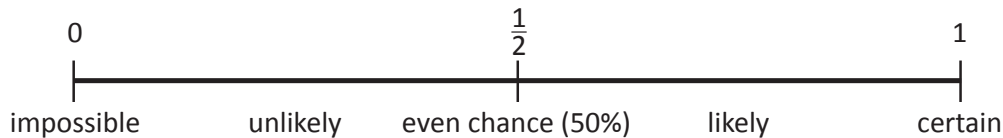
1 **Are these events impossible, certain or an even chance? Complete this table. The first one has been done for you.**

0	$\frac{1}{2}$	1
impossible	even chance (50%)	certain
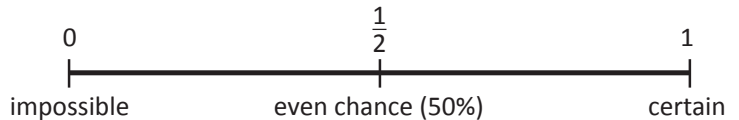
Event	Probability
The month after June will be February.	*impossible*
You will get an odd number when you roll a single die.	
The year after 2010 will be 2007.	
When you flip a coin it will land on tails.	
The day after Saturday will be Sunday.	

2 **Draw a line to match each spinner with the correct statement:**
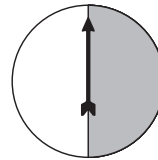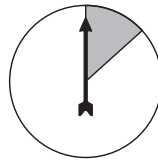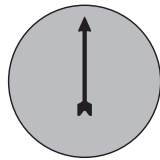
It is **unlikely** that this spinner will stop on grey.	It is **certain** that this spinner will stop on grey.	There is an **even chance** that this spinner will stop on grey.

3 **Matilda has these blocks:**
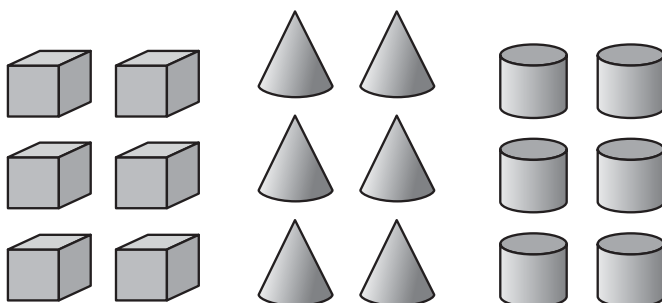
cubes   **cones**   **cylinders**

Matilda is going to put 9 blocks in a bag using some of each type and then ask a friend to choose one without looking. If she wants to make it more likely that a cylinder is chosen and less likely that a cube is chosen, how many of each block should she place in the bag? Circle the blocks she could choose.

Chance and probability – ordering events

4 Show the probability of each event by placing a, b, c and d on the probability scale below:

Spinner 1

1	2
4	3

Spinner 2

0                                  $\frac{1}{2}$ 1
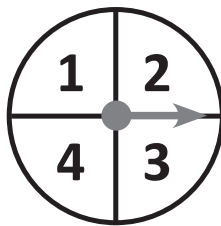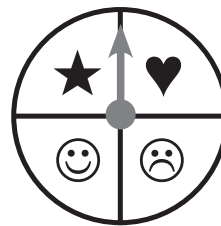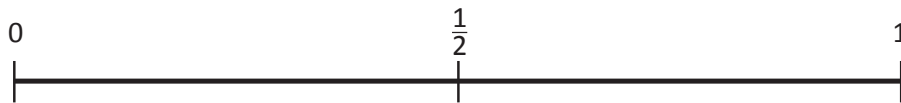
a You will get an even number when you spin Spinner 1.

b You will get an odd number when you spin Spinner 2.

c You will get a number when you spin Spinner 1.

d You will get a face when you spin Spinner 2.

---

5 This machine dispenses a random marble each time its button is pressed.
Of the 40 marbles in the machine, 2 are blue, 6 are red, 13 are green and 19 are orange.

a Which colour is most likely to be dispensed? _____

b Which colour is least likely to be dispensed? _____

c Charlie likes green but dislikes red. Adrian likes red but dislikes orange. Who is more likely to get what they want, Charlie or Adrian? Why?

_____

d Write the colour in order, from the most likely to the least likely to be dispensed:

_____

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6 Use red, yellow, green and blue pencils to shade these spinners:
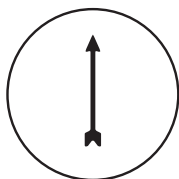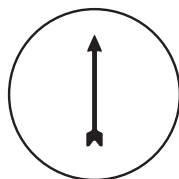
Spinner 1   **Spinner 2**   **Spinner 3**   **Spinner 4**
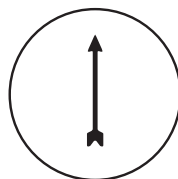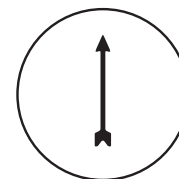
a Shade Spinner 1 so there is an equal chance of the arrow landing on red or yellow.

b Shade Spinner 2 so the arrow is most likely to land on yellow.

c Shade Spinner 3 so there is no chance of the arrow landing on blue.

d Shade Spinner 4 so the arrow is least likely to land on blue or red.

Chance and Probability

Chance and probability – relating fractions to likelihood

So far we have looked at the language of chance and outcomes either being at 0 (impossible), $\frac{1}{2}$ (even) or 1 (certain). But what is the likelihood of outcomes in the unlikely range or the likely range? Outcomes in these ranges can be expressed as either fractions, decimals or %. Remember that when finding the chance or likelihood of an event occurring, we must look at all possible outcomes.

$$chance = \frac{\text{likelihood of event occurring}}{\text{number of possible outcomes}}$$

1 **There are 20 beads in a bag that are all the same size and shape. There are 6 glass, 4 steel, 3 clay, 7 brass.**

   a If you choose one bead without looking, which bead are you most likely to get?   _____

   b Which bead are you least likely to get?   _____

   c Show the chance of selecting each type of bead as a fraction:

     glass = $\frac{6}{20}$ steel = $\frac{\square}{\square}$ brass = $\frac{\square}{\square}$ clay = $\frac{\square}{\square}$

   d Colour the word that best describes the chance of selecting a clay bead:

certain	even	unlikely	impossible

2 **Use this table to work out all the possible totals for a pair of five-sided spinners. Colour match the totals. Make all the 6s yellow, all the 4s blue and so on.**

Spinner 1

	1	2	3	4	5
1	2				6
2	3				
3	4		6		
4	5				
5	6				10

Spinner 2 (row labels)
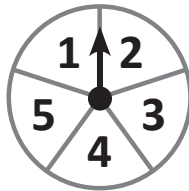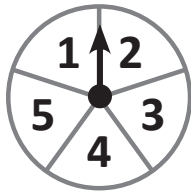
3 **Look at the table above.**

   a Which total is most likely? _____

   b What is the likelihood of this total occurring? Express your answer as a fraction: $\frac{\square}{\square}$

   c Which total is least likely? _____

   d Express its likelihood as a fraction. $\frac{\square}{\square}$

Chance and probability – relating fractions to likelihood

4 Complete these tables to show the probability that this die will land on the following numbers:

Event	Probability
1	
An odd number	
A number greater than 2	
4	

Event	Probability
3	
5	
7	
An even number	

REMEMBER
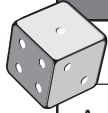
5 Tamsin is playing a game where she is given a choice of how the die should land to signal that it is her turn. Which option gives her the best chance of getting a turn?

☐ When a number less than 4 is rolled   ☐ When a number greater than 4 is rolled

6 Tilly and Bec were playing a game with these 5 cards. They laid all the cards face down and then took turns turning 2 over. If the 2 cards turned over were the least likely pair of cards, then they scored 100 points. Which two cards do you think scored 100 points? Let's work it out.

☺ A ♥ X ★

20 Possible Pair Combinations
☺A A☺ ♥☺ X☺
☺♥ A♥ ♥A XA
☺X AX ♥X X♥
☺★ A★ ♥★ X★
★☺ ★A ★♥ ★X

a How many possible combinations are there?

_____

b Look closely at the table. Colour in the pairs in the following manner:
symbol/letter   – blue
letter/symbol   – red
letter/letter   – yellow
symbol/symbol – orange

c Count how many of each colour there are in the table:

blue _____   yellow _____

red _____   orange _____

d What fraction shows the chance of choosing 2 cards with letters only?

e What fraction shows the chance of choosing 2 cards with symbols only?

f Circle the correct ending to this sentence: The pair of cards that should score 100 points because they are the least likely to be turned over are:

symbol/letter   letter/symbol

letter/letter   symbol/symbol

F SERIES   1 TOPIC

Chance and Probability

Chance and probability – chance experiments

Before we conduct a chance experiment, we need to work out what all the possible outcomes are. This helps us to look at how likely a particular outcome is and if the results are surprising or not. To do this, we can use a tree diagram. We count the boxes at the end of the diagram to find the total number of options.

1 **Lisa is ordering her lunch from the canteen. She has a choice of whole wheat or 7-grain, lettuce or tomato, tuna or ham.**

a Complete this tree diagram to show all of her options:

whole wheat

lettuce

tuna

ham

7-grain
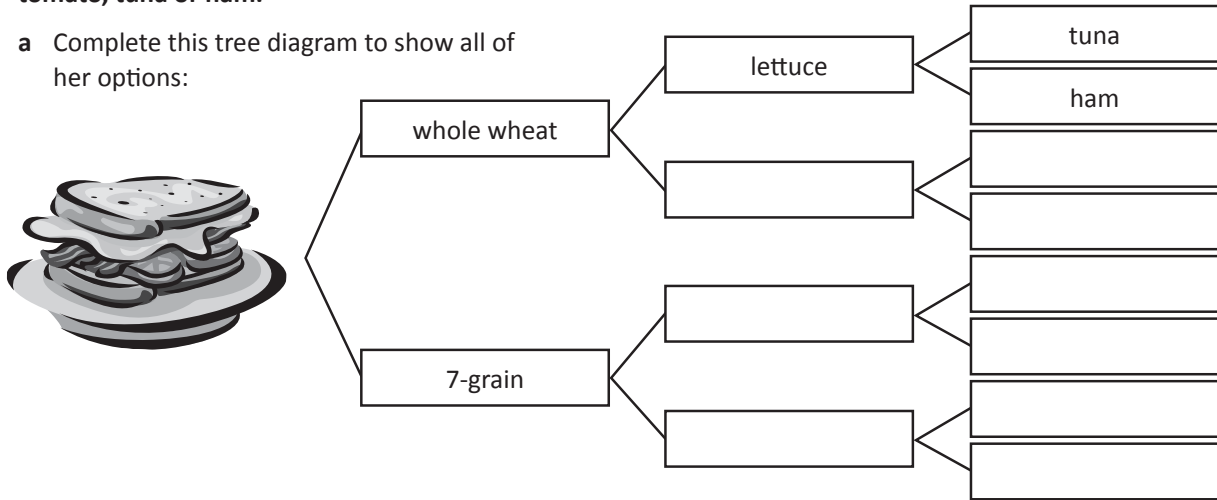
b How many different sandwich combinations does Lisa have to choose from? _____

2 **3 coins are tossed together.**

a Fill in this tree diagram to work out all the combinations that are possible when 3 coins are tossed.

1st coin   **2nd coin**   **3rd coin**

H

T
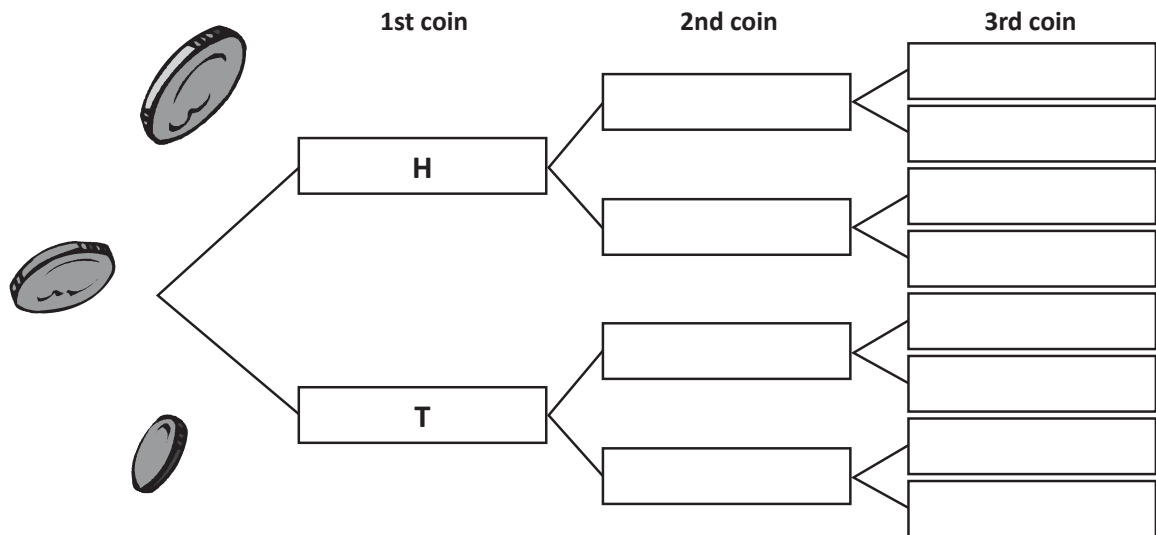
b Follow the tree branches to find out the possibility of throwing:

3 heads ☐/☐   3 tails ☐/☐   2 heads, 1 tail ☐/☐   1 head, 2 tails ☐/☐

Chance and probability – chance experiments

In the last activity, you completed a tree diagram showing all the possible outcomes of a toss of 3 coins. There are 8 different ways that the coins can land.

This is known as theoretical probability. Sometimes we refer to this as 'the odds' as in, 'the odds were against them' or 'he beat the odds'. Theoretical probability is what we expect to happen on paper, but in real life, events don't always occur that way.

The theoretical probability of the 3 coins landing on HHH is 1 out of 8. So if I toss 3 coins 8 times, I can say I should get HHH once and only once. But does this really happen?

3 **Fill in the sentences to show the theoretical probability:**

a If I toss 3 coins in the air **8 times**, HHH should appear _____*once*_____. $\frac{1}{8}$ of 8 = _____

b So if I toss 3 coins in the air **16 times**, HHH should appear _____. $\frac{1}{8}$ of 16 = _____

c If I toss 3 coins in the air **24 times**, HHH should appear _____. $\frac{1}{8}$ of 24 = _____

4 **Now try it out. Work with a partner and throw 3 coins in the air, 24 times. Record your results:**

Possibility			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
H H H																										
H H T																										
H T T																										
H T H																										
T T T																										
T T H																										
T H H																										
T H T																										

Throws

5 **What happened? How many HHH landed? Was it the same as the theoretical possibility?**

6 **Try it again. Are your results the same or different?**

Possibility			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
H H H																										
H H T																										
H T T																										
H T H																										
T T T																										
T T H																										
T H H																										
T H T																										

Throws

F SERIES   1 TOPIC

Chance and Probability

Chance and probability – fair or unfair

When everyone has the same chance of winning a game or competition, it is **fair**.
It is **unfair** when everyone does not have the same chance of winning.


For example look at the cards above. Jack wins if he draws a card with a smiley, Jo wins if she draws a card with a heart shape on it.
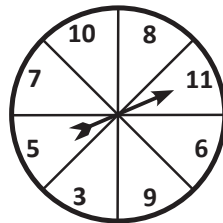Do both players have the same chance of winning?
Circle the correct statement:

Yes this is fair   No this is unfair

1 **Jess and Sam play a game with spinners where they each spin their spinner 5 times and add up all the numbers. The person with the biggest total wins.**
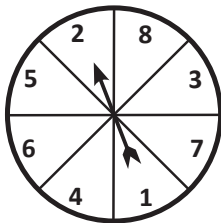
Jess' spinner   Sam's spinner

a Is this fair or unfair? _____

b Explain why:

2 **You are playing a game using a spinner and cubes. You are given a cube randomly and then the spinner is spun. If it lands on your colour cube, you are out. Colour the cubes to make the game fair.**
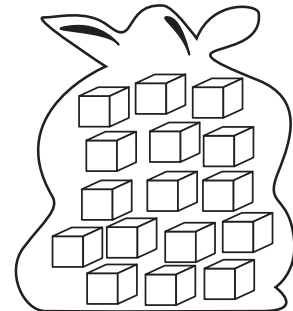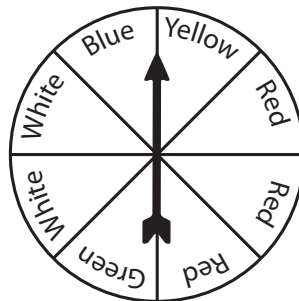
3 **Matty invented a card game for 2 players where each player has 5 cards and turns them over face down. Players then draw a card at the same time. If it has 5 dots you win a point. What should Player 2's cards look like to make the game fair?**

Player 1's cards

Player 2's cards

Chance and probability – fair or unfair

A game of chance for two players

You will need:
Two six-sided dice and two counters.

How to play:

1 Each player places a counter on their own Start space.

2 The players take it in turns to roll both dice and calculate the difference between the two numbers they roll.

Player 1 moves UP a space when the difference is 0, 1 or 2.
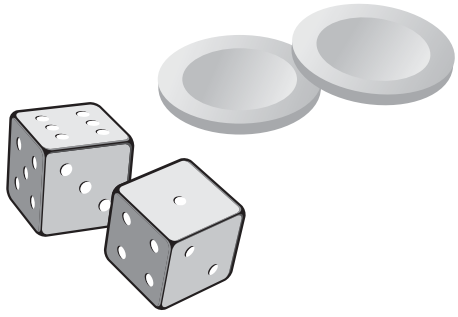
Player 1 moves DOWN a space when the difference is 3, 4 or 5.

Player 2 moves DOWN a space when the difference is 0, 1 or 2.

Player 2 moves UP a space when the difference is 3, 4 or 5.

3 The players keep taking turns.
The first player to get to Home is the winner.

Home	
Player 1 Start	**Player 2 Start**

4 Use this grid to work out the pairs of numbers that could be rolled using two dice and the differences between them.
Colour the 0, 1 and 2 differences. Circle the 3, 4 and 5 differences.

–	1	2	3	4	5	6
1	0	1	2			
2	1	0	1			
3	2	1	0			
4	3			0		
5					0	
6						0

a Is the game above fair? What did you notice?

_____

_____

b How could this game be improved?

_____

_____

F **1**

SERIES   TOPIC

Chance and Probability

The Mathletics Cup   create

Getting ready

You and a partner will use this game board to create a game. In your game, each player will choose to be 1 character. There needs to be at least 4 players. The players will take turns rolling two dice, adding the faces together. If the answer matches the number of their character, they move forward one space. The first person to the finishing line, wins.

What to do

Your job is to create a fair game by assigning the numbers 2 to 12 to the characters. Write the number clearly in the circle next to the character. How will you decide which number to place where? You may use each number once and only once.

For example, you can make Marcia '7'. If you choose to be Marcia, everytime you roll a 7, you can move. If you roll any other number, you will have to sit.

Marcia

Mike

Jan

Bobby

Cindy

Peter

Alice

Greg

Susan

Sam

Carol

FINISHING LINE
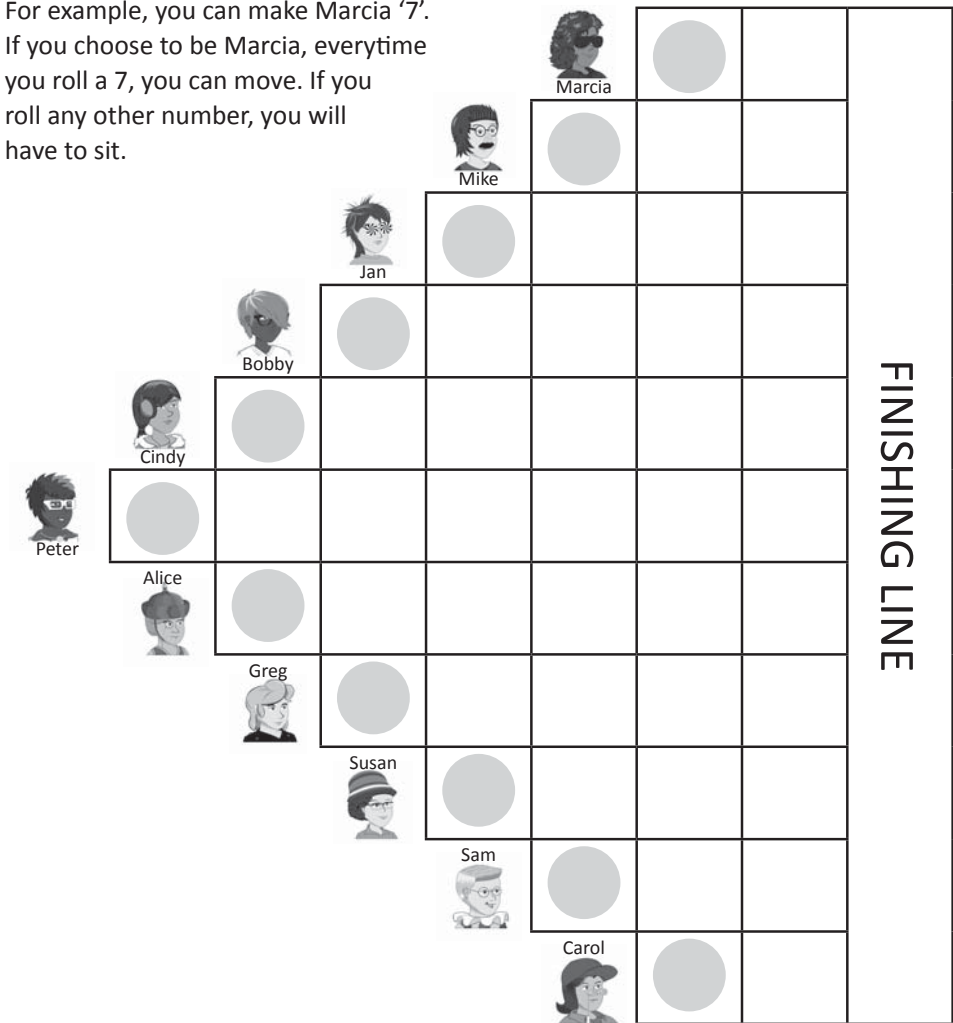
What to do next

Play your game with another pair. Does it work? Is it fair? Does the other pair agree with you?

Now play their game. Have them set it up differently. Is one game fairer than the other? Choose one game board and play best out of three games.

Greedy pig   solve

Getting ready

This is a famous game. It's played with the whole class. Your teacher will need a die and you will need your own tally board set up like this:
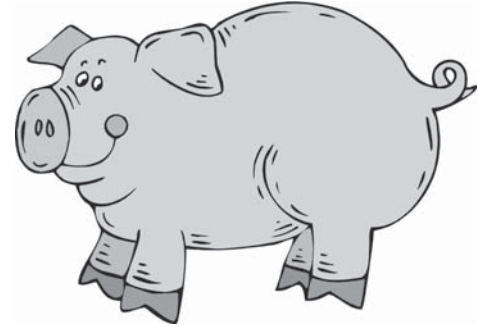
Game	Numbers	Score
1		
2		
3		
4		
5		
Total		

What to do

Everyone in the class stands up. Your teacher will roll the die 10 times. You write down the numbers as they are rolled – these will count towards your score.

The trick is that if a 2 is rolled, you lose all your points and you are out of the game. You may sit down at any stage and keep your points but you may not stand up again in the same game. The choice is up to you! The game goes on until the die has been rolled 10 times or everyone is sitting down.

Play 5 games. What is your total score? Did you develop a strategy as the games went on?

What to do next

Discuss your strategy with the class. When do you choose to sit down and why?

After listening to the strategies of others, play 5 games again. Does your score improve?

The theoretical probability of rolling a 2 is 1 in 6. How does that pan out in real life? Is a 2 rolled once every 6 throws? Why or why not?

F 1

SERIES TOPIC

Chance and Probability

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