

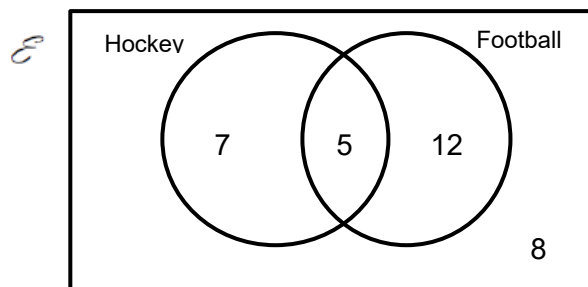
## OCR 11 Probability (Higher)

1. It is estimated that the probability of a person being left-handed is 0.23.  
How many people would you estimate to be left-handed in a population of 23 000?
2. Two fair, normal six-sided dice are rolled and the scores are added together. Draw a sample space to show this information and calculate the probability of rolling a total of 11.
3. A card is chosen at random from a standard pack of 52 playing cards.  
Given that the card chosen is black, calculate the probability that it is an ace.
4. James is either late, on time or early. The probability that he is late is 0.65. The probabilities that he is on time or early are equal. What is the probability that James is early?
5. A dartboard is divided into twenty equal sections numbered from 1 to 20. The probabilities of a dart hitting each numbered section are equal. What is the probability that a dart hits a prime number?
6. There are only 4 ham sandwiches, 3 cheese sandwiches and 2 jam sandwiches in a picnic box. Jack takes one sandwich at random and gives it to his sister. Jack then takes a second sandwich at random for himself. Work out the probability that both sandwiches are the same type.
7. A four-sided spinner can land on red, green, blue or yellow. The probability of landing on red is 40%, the probability of landing on green is  $\frac{1}{5}$  and the probability of landing on blue is 0.1. If the spinner is spun 150 times, how many times will it land on yellow?
8. A coin is biased so that the probability of getting a head is  $\frac{2}{3}$ . The coin is thrown twice.  
What is the probability of getting one head and one tail?
9. Six red discs are numbered 1, 1, 2, 2, 3, and 3. Five white discs are numbered 1, 1, 3, 5, and 5.  
A disc is chosen at random.  
What is the probability that the disc is red given that it is numbered 3?
10. There are 12 people in a cycling club. 5 are men and 7 are women. Their names are placed in a hat and 5 names are chosen at random, without replacement. What is the probability of choosing the names of all 5 men?
11. Mia thinks that her dice is biased. She rolls it 10 times and gets a six three times.  
Do you think her dice is biased? Explain your answer.
12. A bag contains only 4 red sweets, 5 green sweets and 7 purple sweets. Niamh chooses a sweet at random and eats it. She then chooses a second sweet. Given that the first sweet is not purple, find the probability that the second sweet is purple.
13. Mahmoud says that when you flip a fair coin you are just as likely to get 5 heads in a row as you are to get 10 heads in a row. Discuss his claim.

14. The table below shows the number of male and female students that play a musical instrument. Calculate the probability that a randomly selected student is a musical instrument player, given that the student is female.

	Male	Female	Total
Musical instrument	4	8	12
No musical instrument	14	24	38
Total	18	32	50

15. Students in a class are asked if they play hockey or football. The Venn diagram below shows their responses. A student who plays hockey is chosen at random. What is the probability that the student also play football?



16. Georgia has 30 individual socks in her drawer, 18 are black and the rest are blue. What is the probability that Georgia randomly picks two socks that are both the same colour?
17. Some people completed a survey about whether they had siblings.
- 25% had at least one brother and at least one sister.
  - 56% had either at least one brother or at least one sister, but not both.
  - 43% had at least one brother but no sisters.
- What percentage of people surveyed had no brothers and no sisters?
18. Tyara owns
- 2 red skirts and 1 blue skirt,
  - 1 green top, 1 blue top and 2 red tops,
  - 2 pairs of blue shoes.
- An outfit consists of a skirt, a top and a pair of shoes. What proportion of Tyara's available outfits include at least one red item?
19. John has a tin containing five chocolate biscuits and 3 ginger biscuits. He chooses three biscuits at random from the tin, without replacement. What is the probability that he chooses two of the same type?
20. Andy is playing snooker. His match is the best of 5 frames. His coach tells him that the probability of him winning each frame is 0.7. What is the probability that Andy wins the match in the fourth frame?

**Answers**

1. 5290

2.

		Dice 2					
		1	2	3	4	5	6
Dice 1	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

Probability of rolling a total of 11 =  $\frac{2}{36} = \frac{1}{18}$ .

3.  $\frac{1}{13}$ 

4. 0.175

5. Prime numbers are 2, 3, 5, 7, 11, 13, 17, 19.

Probability that a dart hits a prime number =  $\frac{8}{20} = \frac{2}{5}$ .

6. Probability that both sandwiches are the same =  $\left(\frac{4}{9} \times \frac{3}{8}\right) + \left(\frac{3}{9} \times \frac{2}{8}\right) + \left(\frac{2}{9} \times \frac{1}{8}\right) = \frac{20}{72} = \frac{5}{18}$ .

7.  $0.3 \times 150 = 45$ 8.  $\frac{4}{9}$ 9.  $\frac{2}{3}$ 

10.  $\frac{5}{12} \times \frac{4}{11} \times \frac{3}{10} \times \frac{2}{9} \times \frac{1}{8} = \frac{120}{95040} = \frac{1}{792}$

11. If the dice was not biased she would expect to get a six approximately twice ( $10 \times \frac{1}{6} = 1.6$ ).

Although her result is very close to this value she has only done 10 trials, which is unlikely to be sufficient to draw a reliable conclusion from. She should do more trials.

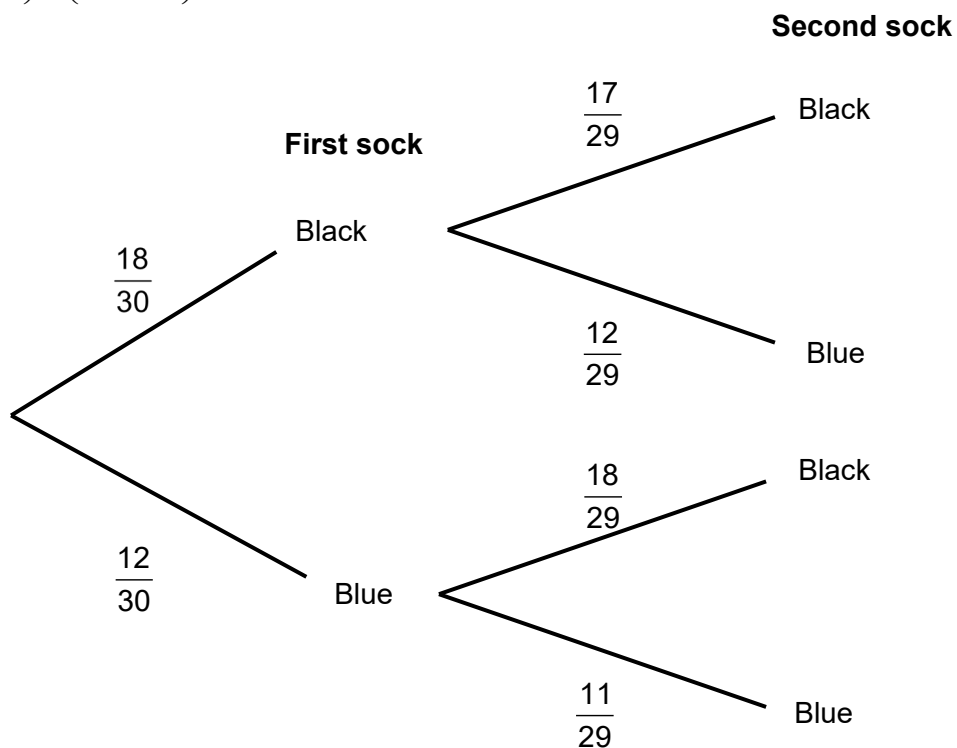
12.  $\frac{7}{15}$

13. Mahmoud is incorrect. The probability of throwing 5 heads in a row ( $0.5^5 = 0.03125$ ) is much higher than the probability of throwing 10 heads in a row ( $0.5^{10} = 0.00098$ ).

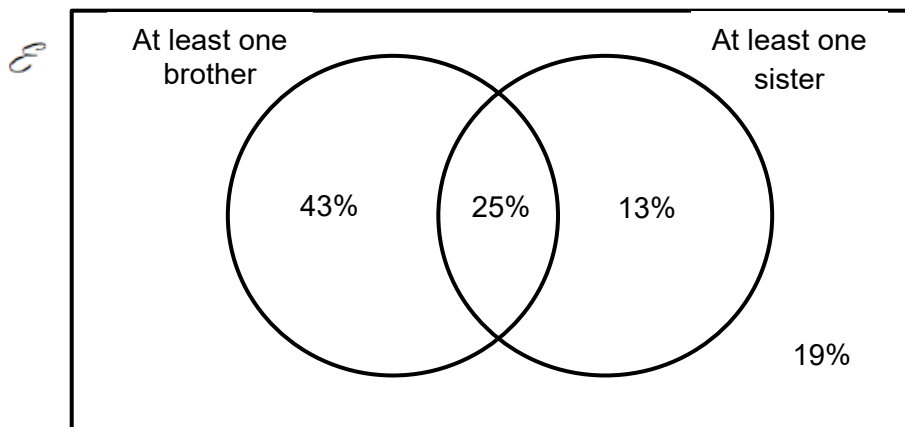
14.  $\frac{8}{32} = \frac{1}{4}$

15.  $\frac{5}{12}$

16.  $\left(\frac{18}{30} \times \frac{17}{29}\right) + \left(\frac{12}{30} \times \frac{11}{29}\right) = \frac{438}{870} = \frac{73}{145}$



17. 19% of people surveyed had no brothers and no sisters.



(Other methods may be used)

18.  $3 \text{ skirts} \times 4 \text{ tops} \times 2 \text{ pairs of shoes} = 24$  available outfits in total.

There will be  $2 \times 4 \times 2 = 16$  available outfits that include a red skirt.

There will be  $1 \times 4 \times 2 = 8$  available outfits that include a blue skirt, which are shown below.

Skirt	Top	Shoes
Blue	Green	Blue 1
Blue	Blue	Blue 1
Blue	Red 1	Blue 1
Blue	Red 2	Blue 1
Blue	Green	Blue 2
Blue	Blue	Blue 2
Blue	Red 1	Blue 2
Blue	Red 2	Blue 2

There are 4 outfits in the sample space above without a red item, hence 4 of the 24 available outfits are without a red item.

Proportion of outfits with at least one red item =  $1 -$  (proportion of outfits without a red item)

$$\begin{aligned}
 &= 1 - \frac{4}{24} \\
 &= \frac{20}{24} \\
 &= \frac{5}{6}
 \end{aligned}$$

19. Probability of choosing two biscuits of the same type =  $1 -$  (probability of choosing 3 chocolate biscuits) – (probability of choosing 3 ginger biscuits)

$$\text{Probability of choosing 3 chocolate biscuits} = \frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} = \frac{60}{336}$$

$$\text{Probability of choosing 3 ginger biscuits} = \frac{3}{8} \times \frac{2}{7} \times \frac{1}{6} = \frac{6}{336}$$

$$\text{So probability of choosing two biscuits of the same type} = 1 - \left( \frac{60}{336} + \frac{6}{336} \right) = \frac{270}{336} = \frac{45}{56}.$$

20. There are 3 combinations of winning in exactly 4 frames.

L	W	W	W
W	L	W	W
W	W	L	W

The probability for each combination is the same ( $0.7 \times 0.7 \times 0.7 \times 0.3$ ).

The total probability is  $3 \times (0.7 \times 0.7 \times 0.7 \times 0.3) = 0.3087$ .

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Calculate number of expected outcomes			
AO1	2	Draw a sample space diagram			
AO1	3	Work out a conditional probability			
AO1	4	Apply the addition law of probability			
AO1	5	Calculate a probability involving prime numbers			
AO1	6	Work out probability of a combined event			
AO1	7	Use probabilities to calculate the number of expected outcomes			
AO1	8	Calculate a probability			
AO1	9	Calculate conditional probability			
AO1	10	Apply the multiplication law of probability			
AO2	11	Compare a relative frequency to an expected outcome			
AO2	12	Calculate a conditional probability			
AO2	13	Discuss probabilities of equally likely outcomes			
AO2	14	Find a probability from a two-way table			
AO2	15	Interpret a Venn diagram			
AO3	16	Calculate conditional probability			
AO3	17	Solve a problem involving percentages			
AO3	18	List combinations and use the product rule			
AO3	19	Calculate a conditional probability			
AO3	20	Calculate probability in a real life context			

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