



THIRD SPACE  
LEARNING

# Diagnostic Questions

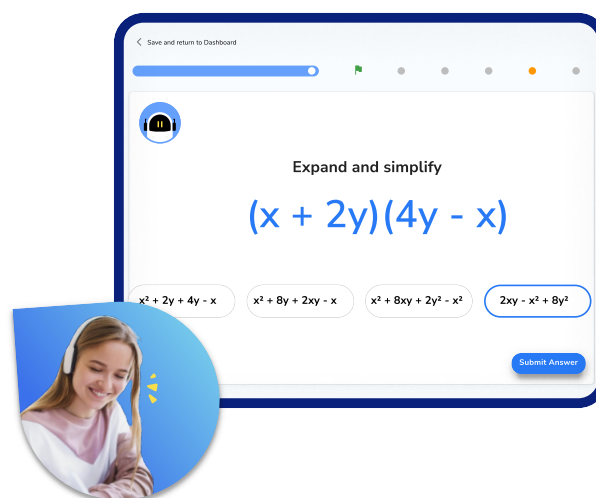
Combined Events | Probability

## This resource in a nutshell

Diagnostic questions are a quick and easy way of assessing your students' knowledge and understanding of a particular topic.

Students may be struggling with **combined events** for a number of different reasons. Diagnostic questions can help to identify the particular misconception that the student has and help to determine the specific support they will need in order to improve.

They are low stakes and support students developing metacognition around how their learning is progressing and what they need to do to improve further.



At Third Space Learning, we use diagnostic questions before and after online tutoring sessions to identify gaps and track progress, an example of this is shown above.

## How to use the questions in this resource

There are 20 multiple choice questions, each designed to assess each of the key skills required to master the given topic. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions, including: **And / Or probabilities**, **Calculations with fractions**, **Forming equations**, and **Mutually exclusive events**.

When answering these questions, students should be **encouraged to explain why they have chosen a particular answer**, and why the other three answers are incorrect. This can be done verbally in small groups, or written down on the worksheet or in their books.

This resource has been designed to be as **flexible** as possible with questions that can be easily chopped up and reordered, and come with a separate answer sheet that details all of the misconceptions highlighted in the answers.

## Diagnostic Questions: Combined Events

1. An unbiased coin and a fair 6-sided dice are thrown simultaneously, with the result recorded. What is the probability of the result being heads on the coin and a six on the dice?

A) $\frac{2}{3}$	B) $\frac{1}{12}$
C) $\frac{1}{4}$	D) $\frac{1}{8}$

2. Events  $A$  and  $B$  are independent. Given that  $P(A) = 0.2$  and  $P(B) = 0.65$ , determine  $P(A \text{ and } B)$ :

A) 0.13	B) 0.85
C) 0.013	D) 0.15

3. A fair coin is flipped two times. What is the probability of getting tails twice?

A) $\frac{1}{2}$	B) 1
C) $\frac{3}{4}$	D) $\frac{1}{4}$

## Diagnostic Questions: Combined Events

4. Two words are spelled using tiles. A tile is taken at random from word T and word U. What is the probability that the letter displayed on both tiles is a vowel?

Word T : **B I S E C T O R**

Word U : **S H A P E**

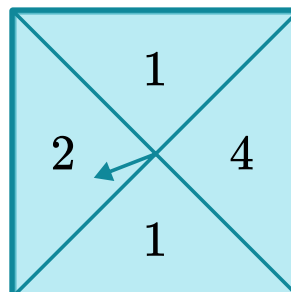
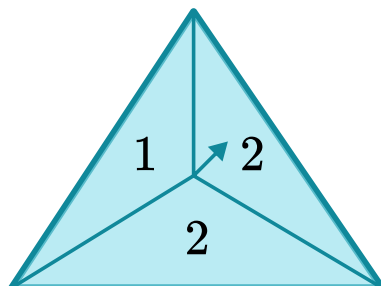
A) $\frac{31}{40}$	B) $\frac{3}{20}$
C) $\frac{5}{13}$	D) $\frac{5}{8}$

5. A £2 coin, £1 coin and a 50p coin are flipped simultaneously and the result recorded. Giving your answer as a decimal, find the probability that all three coins land heads up:

A) 0.5	B) 0.15
C) 0.125	D) 0.75

## Diagnostic Questions: Combined Events

6. You spin these two fair spinners and add the numbers together.  
What is the probability of getting a total score of 5?



A) $\frac{1}{12}$	B) 0
C) $\frac{1}{7}$	D) $\frac{3}{7}$

7. A card is drawn at random from a standard deck of playing cards.  
What is the probability that the card is a “spade” or a “5”?

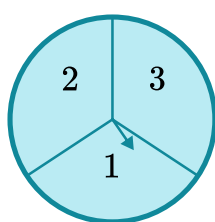
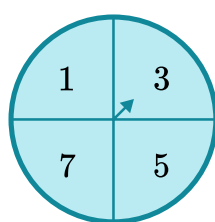
A) $\frac{1}{4}$	B) $\frac{17}{52}$
C) $\frac{1}{52}$	D) $\frac{4}{13}$

## Diagnostic Questions: Combined Events

8. The probability that I am on time for work on Saturday is 0.95  
 The probability that I am on time for work on Sunday is 0.85  
 What is the probability that I am late on Saturday but on time on Sunday?

A) 0.8075	B) 0.1425
C) 0.0425	D) 0.0075

9. Two fair spinners are spun and their scores multiplied. Use the sample space to determine the probability that the product is greater than ten:



		1st spinner			
2nd spinner	×	1	3	5	7
	1	1	3	5	7
	2	2	6	10	14
	3	3	9	15	21

A) $\frac{1}{4}$	B) $\frac{1}{3}$
C) $\frac{3}{19}$	D) $\frac{3}{8}$

## Diagnostic Questions: Combined Events

10. A tetrahedral die is rolled twice, and the scores added together. Use the sample space diagram to determine the probability that the score is a multiple of three:

+	1	2	3	4
1	2			
2		4		
3				7
4	5			

A) $\frac{7}{24}$	B) $\frac{5}{24}$
C) $\frac{1}{8}$	D) $\frac{5}{16}$

11. A numeric passcode for a mobile phone uses the digits 0-9. What is the probability of “guessing” a five-digit passcode on the first attempt?



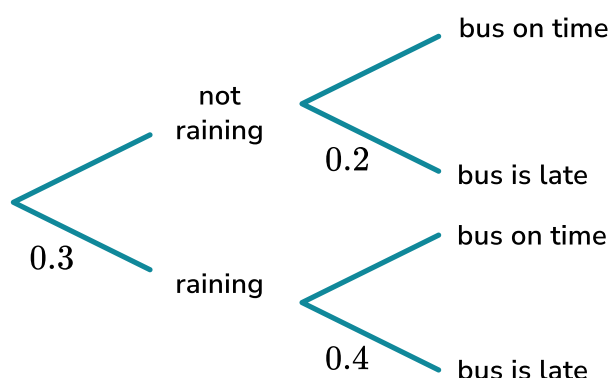
A) 0.5	B) 0.00001
C) 0.00005	D) 0.02

## Diagnostic Questions: Combined Events

12. A fair coin is flipped at the same time as an unbiased die is rolled. What is the probability of obtaining a number less than 3 on the die or a head on the coin?

A) $\frac{3}{4}$	B) $\frac{5}{6}$
C) $\frac{2}{3}$	D) $\frac{1}{2}$

13. The probability of it raining is 0.3. If it rains the probability of the bus being late is 0.4. If it is not raining the probability of the bus being late is 0.2. What is the probability that the bus is on time?



A) 0.74	B) 0.18
C) 0.56	D) 0.68



## Diagnostic Questions: Combined Events

14. A box contains 2 blue balls, 6 green balls and 4 red balls. A ball is drawn at random, the colour recorded and replaced, with the process repeated two more times. What is the probability of getting a blue ball on the first draw, a green ball on the second and a red ball on the third?

A) $\frac{1}{48}$	B) 1
C) $\frac{1}{72}$	D) $\frac{1}{36}$

15. A bag contains red disks and blue disks. A disk is drawn, its colour recorded and replaced. A second disk is then drawn, its colour recorded and replaced. The probability of drawing a red disk, then a blue disk is  $\frac{14}{81}$ . Given that there are more blue disks than red disks, what is the probability of drawing a blue disk on the next draw?

A) $\frac{2}{9}$	B) $\frac{7}{9}$
C) $\frac{67}{81}$	D) $\frac{20}{27}$

16. When a particular biased die is rolled twice, the probability of getting a six both times is 0.0144. What is the probability of getting a six on a single roll?

A) 0.012	B) 0.0072
C) 0.12	D) 0.0144

## Diagnostic Questions: Combined Events

17. When a biased coin is flipped, the probability of getting three tails in a row is  $\frac{8}{125}$ . What is the probability of getting heads on the next flip of the coin?

A) $\frac{3}{5}$	B) $\frac{367}{375}$
C) $\frac{2}{5}$	D) $\frac{117}{125}$

18. An unbiased coin is flipped 3 times. What is the probability that I get more heads than tails?

A) 0.125	B) 0.375
C) 0.875	D) 0.5

19. The probability that I have toast for breakfast on any given day is  $\frac{3}{7}$ . What is the probability that I have toast for breakfast only once over the weekend?

A) $\frac{33}{49}$	B) $\frac{24}{49}$
C) $\frac{9}{49}$	D) $\frac{12}{49}$

## Diagnostic Questions: Combined Events

20. The probability that my alarm clock wakes me is 0.8. What is the probability that my alarm clock fails to wake me at least once over the weekend?

A) 0.32	B) 0.16
C) 0.36	D) 0.04

## Diagnostic Questions: Combined Events Answers

1. An unbiased coin and a fair 6-sided dice are thrown simultaneously, with the result recorded. What is the probability of the result being heads on the coin and a six on the dice?
- A)  $\frac{2}{3}$  Student added probabilities instead of multiplying
- B)  $\frac{1}{12}$  Correct answer
- C)  $\frac{1}{4}$  Student added numerators and denominators of fractions then simplified
- D)  $\frac{1}{8}$  Student confused methods for adding and multiplying fractions
- 
2. Events  $A$  and  $B$  are independent. Given that  $P(A) = 0.2$  and  $P(B) = 0.65$ , determine  $P(A \text{ and } B)$ :
- A) 0.13 Correct answer
- B) 0.85 Student added probabilities instead of multiplying
- C) 0.013 Student adjusted result of multiplication incorrectly
- D) 0.15 Student subtracted both probabilities from one
- 
3. A fair coin is flipped two times. What is the probability of getting tails twice?
- A)  $\frac{1}{2}$  Student assumed the probability of the outcome is the same for single and multiple events
- B) 1 Student added probabilities instead of multiplying
- C)  $\frac{3}{4}$  Student mistakenly attempted to use the OR rule for mutually exclusive events
- D)  $\frac{1}{4}$  Correct answer

## Diagnostic Questions: Combined Events Answers

4. Two words are spelled using tiles. A tile is taken at random from word T and a tile is taken at random from word U. What is the probability that the letter displayed on both tiles is a vowel?

Word T : **B I S E C T O R**

Word U : **S H A P E**

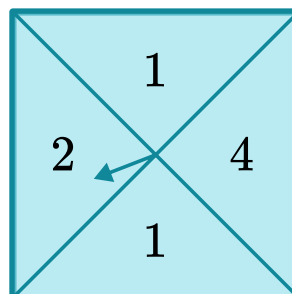
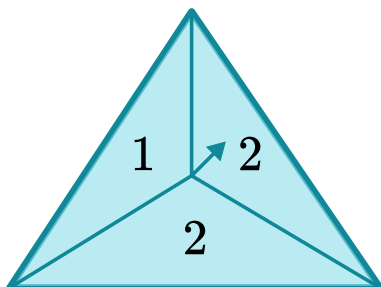
- A)  $\frac{31}{40}$  Student added probabilities instead of multiplying
- B)  $\frac{3}{20}$  Correct answer
- C)  $\frac{5}{13}$  Student formed a fraction from the total number of vowels and total number of letters
- D)  $\frac{5}{8}$  Student applied the OR rule for mutually exclusive events

5. A £2 coin, £1 coin and a 50p coin are flipped simultaneously and the result recorded. Giving your answer as a decimal, find the probability that all three coins land heads up:

- A) 0.5 Student assumed the probability of the outcome is the same for single and multiple events
- B) 0.15 Student added the probabilities, then divided by 10 to obtain a value between 0 and 1
- C) 0.125 Correct answer
- D) 0.75 Student performed one multiplication and one addition

## Diagnostic Questions: Combined Events Answers

6. You spin these two fair spinners and add the numbers together.  
What is the probability of getting a total score of 5?



- A)  $\frac{1}{12}$  Correct answer
- B) 0 Student thought a score of five was impossible due to not seeing a 5
- C)  $\frac{1}{7}$  Student found one way of making 5, but used  $(3+4)=7$  spaces from the spinners as the denominator
- D)  $\frac{3}{7}$  Student found 3 ways of making 5, and used  $(3+4)=7$  spaces from the spinners as the denominator

7. A card is drawn at random from a standard deck of playing cards.  
What is the probability that the card is a “spade” or a “5”?

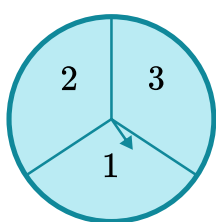
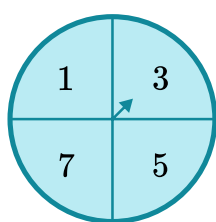
- A)  $\frac{1}{4}$  Student only looked at the probability of drawing a spade
- B)  $\frac{17}{52}$  Student counted the 5 of spades twice
- C)  $\frac{1}{52}$  Student calculated the probability of drawing a spade and a 5
- D)  $\frac{4}{13}$  Correct answer

## Diagnostic Questions: Combined Events Answers

8. The probability that I am on time for work on Saturday is 0.95  
 The probability that I am on time for work on Sunday is 0.85  
 What is the probability that I am late on Saturday but on time on Sunday?

- A) 0.8075 Student calculated the probability of being on time both days  
 B) 0.1425 Student calculated the probability of being on time on Saturday but late on Sunday  
 C) 0.0425 Correct answer  
 D) 0.0075 Student calculated the probability of being late both days

9. Two fair spinners are spun and their scores multiplied. Use the sample space to determine the probability that the product is greater than ten:



		1st spinner			
2nd spinner	×	1	3	5	7
	1	1	3	5	7
	2	2	6	10	14
	3	3	9	15	21

- A)  $\frac{1}{4}$  Correct answer  
 B)  $\frac{1}{3}$  Student included the occurrence of 10 in desired outcomes  
 C)  $\frac{3}{19}$  Student included row / column headings when working out the denominator  
 D)  $\frac{3}{8}$  Student only used the bottom two rows of the sample space

## Diagnostic Questions: Combined Events Answers

10. A tetrahedral die is rolled twice, and the scores added together. Use the sample space diagram to determine the probability that the score is a multiple of three:

+	1	2	3	4
1	2			
2		4		
3				7
4	5			

- A)  $\frac{7}{24}$  Student included row / column headings when working out the probability
- B)  $\frac{5}{24}$  Student included row / column headings when working out the denominator
- C)  $\frac{1}{8}$  Student calculated the probability that the score is a three
- D)  $\frac{5}{16}$  **Correct answer**

11. A numeric passcode for a mobile phone uses the digits 0-9. What is the probability of “guessing” a five-digit passcode on the first attempt?



- A) 0.5 Student considered five digits out of ten choices
- B) 0.00001 **Correct answer**
- C) 0.00005 Student combined multiplication and exponentiation
- D) 0.02 Student used the product of 0.1 (from ten digits) and 0.2 (from five spaces in the passcode)

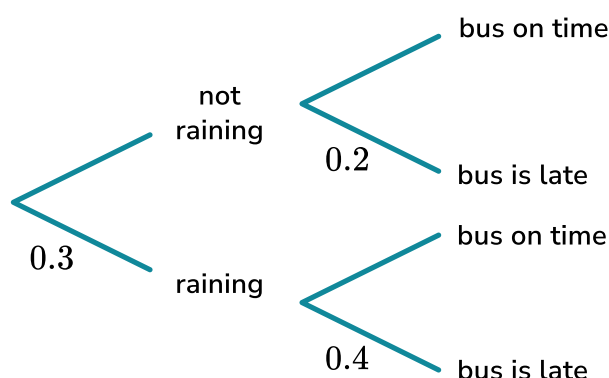


## Diagnostic Questions: Combined Events Answers

12. A fair coin is flipped at the same time as an unbiased die is rolled. What is the probability of obtaining a number less than 3 on the die or a head on the coin?

- A)  $\frac{3}{4}$  Student considered the numbers less than or equal to 3 on the die
- B)  $\frac{5}{6}$  Student found the sum of the given event probabilities without combining
- C)  $\frac{2}{3}$  Correct answer
- D)  $\frac{1}{2}$  Student drew a tree diagram but added the wrong branches

13. The probability of it raining is 0.3. If it rains the probability of the bus being late is 0.4. If it is not raining the probability of the bus being late is 0.2. What is the probability that the bus is on time?



- A) 0.74 Correct answer
- B) 0.18 Student gave the probability my bus being on time when it rains only
- C) 0.56 Student gave the probability my bus being on time when it isn't raining only
- D) 0.68 Student added the wrong branches of the tree diagram

## Diagnostic Questions: Combined Events Answers

14. A box contains 2 blue balls, 6 green balls and 4 red balls. A ball is drawn at random, the colour recorded and replaced, with the process repeated two more times. What is the probability of getting a blue ball on the first draw, a green ball on the second and a red ball on the third?
- A)  $\frac{1}{48}$  Student formed the probabilities incorrectly  $\left[\frac{1}{2} \times \frac{1}{6} \times \frac{1}{4}\right]$
- B) 1 Student added probabilities instead of multiplying
- C)  $\frac{1}{72}$  Student simplified fraction incorrectly
- D)  $\frac{1}{36}$  Correct answer
- 
15. A bag contains red disks and blue disks. A disk is drawn, its colour recorded and replaced. A second disk is then drawn, its colour recorded and replaced. The probability of drawing a red disk, then a blue disk is  $\frac{14}{81}$ . Given that there are more blue disks than red disks, what is the probability of drawing a blue disk on the next draw?
- A)  $\frac{2}{9}$  Student gave probability of drawing a red disk
- B)  $\frac{7}{9}$  Correct answer
- C)  $\frac{67}{81}$  Student found the complement of the given probability
- D)  $\frac{20}{27}$  Student made errors setting up and solving an equation
- 
16. When a particular biased die is rolled twice, the probability of getting a six both times is 0.0144. What is the probability of getting a six on a single roll?
- A) 0.012 Student did not use correct method to square root given probability
- B) 0.0072 Student halved instead of square rooting
- C) 0.12 Correct answer
- D) 0.0144 Student misunderstood the context, assuming the probability won't change

## Diagnostic Questions: Combined Events Answers

17. When a biased coin is flipped, the probability of getting three tails in a row is  $\frac{8}{125}$ . What is the probability of getting heads on the next flip of the coin?
- A)  $\frac{3}{5}$  Correct answer
- B)  $\frac{367}{375}$  Student divided by three instead of cube rooting (then subtracted from one)
- C)  $\frac{2}{5}$  Student gave the probability of getting tails on the next coin flip
- D)  $\frac{117}{125}$  Student subtracted from one without first cube rooting
- 
18. An unbiased coin is flipped 3 times. What is the probability that I get more heads than tails?
- A) 0.125 Student cubed the probability of getting heads
- B) 0.375 Student counted only the outcomes that had heads on the first flip
- C) 0.875 Student counted all outcomes where a heads occurred
- D) 0.5 Correct answer
- 
19. The probability that I have toast for breakfast on any given day is  $\frac{3}{7}$ . What is the probability that I have toast for breakfast only once over the weekend?
- A)  $\frac{33}{49}$  Student included the outcome of having toast on both days
- B)  $\frac{24}{49}$  Correct answer
- C)  $\frac{9}{49}$  Student squared the probability of having toast on any given day
- D)  $\frac{12}{49}$  Student did not count both ways this outcome could happen

## Diagnostic Questions: Combined Events Answers

20. The probability that my alarm clock wakes me is 0.8. What is the probability that my alarm clock fails to wake me at least once over the weekend?

- A) 0.32 Student calculated the probability that my alarm clock fails to wake me only once
- B) 0.16 Student forgot to add together all instances meeting the criteria
- C) 0.36 Correct answer
- D) 0.04 Student calculated the probability that my alarm clock fails to wake me on both days

# Where to go next?

For more diagnostic questions, and GCSE maths revision resources and worksheets to support students in fixing any misconceptions take a look at the free Third Space Learning [GCSE maths revision](#) pages.

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