## Edexcel A level Mathematics Probability

Section 1: Conditional probability

## Section test

1. For events A and $\mathrm{B}, \mathrm{P}(\mathrm{A})=0.5, \mathrm{P}(\mathrm{B})=0.3$ and $\mathrm{P}(\mathrm{A} \cap \mathrm{B})=0.2$. What is $P(A \cup B)$ ?
2. For events $S$ and $T, P\left(S^{\prime}\right)=0.3, P(T)=0.5$ and $P(S \cup T)=0.8$. What is $\mathrm{P}(\mathrm{S} \cap \mathrm{T})$ ?
3. Two cards are picked at random, without replacement, from a pack of 52 playing cards. What is the probability that the second card is black, given that the first is red?
4. A number is picked at random from the first 100 positive whole numbers (starting at 1 ). What is the probability that the number is divisible by 5 , given that it is even?
5. In a group of 80 students, 40 study Physics, 45 study Chemistry and 15 study both. What is the probability that a student chosen at random from those who do not study Chemistry studies Physics?
6. A bag contains 4 red and 6 blue marbles. A marble is chosen at random but not replaced in the bag. A second marble is then chosen at random. Given that the second marble is blue, what is the probability that the first marble is also blue?
7. A bag contains 10 red, 6 blue and 4 green discs. Two discs are drawn at random. What is the probability that they are both green if you know that they are the same colour?
8. Two fair tetrahedral dice, each with the numbers $1,2,3$ and 4 marked on the faces, are thrown together. One die is red and the other is green. The score on each die (the number on the face which cannot be seen) is noted.

A is the event: the score on the red die is 3
$B$ is the event: the sum of the scores is 6
C is the event: the scores on the two dice are the same
D is the event: the score on the green die is less than the score on the red die
Which statement is true?
(a) A and B are independent events
(b) A and C are independent events
(c) A and D are independent events
(d) B and C are independent events
7. If $\mathrm{P}(\mathrm{A})=\frac{1}{3}, \mathrm{P}(\mathrm{B})=\frac{3}{5}$ and $\mathrm{P}(\mathrm{A} \mid \mathrm{B})=\frac{1}{2}$, what is $\mathrm{P}(\mathrm{B} \mid \mathrm{A})$ ?
8. A and $B$ are independent events. If $P(A)=\frac{1}{3}$ and $P(B)=\frac{1}{4}$, what is $P(A \cup B)$ ?

## Edexcel A level Maths Probability 1 section test solns

## Solutions to section test

1. $P(A \cup B)=P(A)+P(B)-P(A \cap B)$

$$
\begin{aligned}
& =0.5+0.3-0.2 \\
& =0.6
\end{aligned}
$$

2. $P(S)=0.3 \Rightarrow P(S)=1-0.3=0.7$
$P(S \cup T)=P(S)+P(T)-P(S \cap T)$
$0.8=0.7+0.5-P(S \cap T)$
$P(S \cap T)=0.4$
3. If the first card is red, then 51 cards remain, of which 26 are black.

The probability that the second card is black given that the first is red $=\frac{26}{51}$
4. There are 50 even numbers in the first 100 positive numbers.
of these, 10 are divisible by 5 (these are the multiples of 10 )
Probability that number is divisible by 5 given that it is even $=\frac{10}{50}=\frac{1}{5}$
5.


From the venn diagram above, there are 35 students who do not study chemistry. Of these, 25 study Physics.
$P\left(P \mid C^{\prime}\right)=\frac{25}{35}=\frac{5}{7}$

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6. 



Let $A$ be the event that the first marble is blue
Let $B$ be the event that the second marble is blue
$P(A \cap B)=\frac{6}{10} \times \frac{5}{9}=\frac{1}{3}$
$P(B)=\left(\frac{4}{10} \times \frac{6}{9}\right)+\left(\frac{6}{10} \times \frac{5}{9}\right)=\frac{4}{15}+\frac{1}{3}=\frac{9}{15}=\frac{3}{5}$
$P(A \mid B)=\frac{P(A \cap B)}{P(B)}=\frac{1}{3} \div \frac{3}{5}=\frac{1}{3} \times \frac{5}{3}=\frac{5}{9}$
7.


Let $A$ be the event that the discs are both the same colour
Let $B$ be the event that the discs are both green
$P(A \cap B)=\frac{4}{20} \times \frac{3}{19}=\frac{1}{5} \times \frac{3}{19}=\frac{3}{95}$
$P(A)=\left(\frac{10}{20} \times \frac{9}{19}\right)+\left(\frac{6}{20} \times \frac{5}{19}\right)+\left(\frac{4}{20} \times \frac{3}{19}\right)=\frac{132}{20 \times 19}=\frac{33}{95}$
$P(B \mid A)=\frac{P(A \cap B)}{P(A)}=\frac{3}{95} \div \frac{33}{95}=\frac{3}{95} \times \frac{95}{33}=\frac{1}{11}$

## Edexcel A level Maths Probability 1 section test solns

8. 

|  | 1 | 2 | 3 | 4 |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 1,1 | 1,2 | 1,3 | 1,4 |
| 2 | 2,1 | 2,2 | 2,3 | 2,4 |
| 3 | 3,1 | 3,2 | 3,3 | 3,4 |
| 4 | 4,1 | 4,2 | 4,3 | 4,4 |

$P(A)=\frac{4}{16}=\frac{1}{4} \quad P(B)=\frac{3}{16} \quad P(C)=\frac{4}{16}=\frac{1}{4} \quad P(D)=\frac{6}{16}=\frac{3}{8}$
The event $A \cap B$ is that the score on the red die is 3 and the sum of the scores is 6. So the score on the red die is 3 and the score on the green die is 3 .
$P(A \cap B)=\frac{1}{16} \neq P(A) \times P(B)$
so $A$ and $B$ are not independent events.
The event $A \cap C$ is the event that the score on the red die is 3, and both dice show the same score, so the score on both dice must be 3.
$P(A \cap C)=\frac{1}{16}=P(A) \times P(C)$ so $A$ and $C$ are independent events.

The event $A \cap D$ is the event that the score on the red die is 3 , and the score on the green die is less than the score on the red die. This can occur in 2 ways.
$P(A \cap D)=\frac{2}{16}=\frac{1}{8} \neq P(A) \times P(D)$
so $A$ and $D$ are not independent events.
The event $B \cap C$ is the event that the sum of the scores is 6 , and the score on each die is the same. This can occur in one way.
$P(B \cap C)=\frac{1}{16} \neq P(B) \times P(C)$
sO $B$ and $C$ are not independent events.
9. $P(A \cap B)=P(A \mid B) \times P(B)$
$P(A \cap B)=P(B \mid A) \times P(A)$
Therefore $P(A \mid B) \times P(B)=P(B \mid A) \times P(A)$

$$
\begin{aligned}
& \frac{1}{2} \times \frac{3}{5}=P(B \mid A) \times \frac{1}{3} \\
& P(B \mid A)=3 \times \frac{3}{10}=\frac{9}{10}
\end{aligned}
$$

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10. Since $A$ and $B$ are independent, $P(A \cap B)=P(A) \times P(B)=\frac{1}{3} \times \frac{1}{4}=\frac{1}{12}$

$$
\begin{aligned}
P(A \cup B) & =P(A)+P(B)-P(A \cap B) \\
& =\frac{1}{3}+\frac{1}{4}-\frac{1}{12} \\
& =\frac{4+3-1}{12} \\
& =\frac{6}{12} \\
& =\frac{1}{2}
\end{aligned}
$$

