

Maths Questions By Topic:

Probability

A-Level Edexcel

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1. Manon has two biased spinners, one red and one green.

The random variable R represents the score when the red spinner is spun.

The random variable G represents the score when the green spinner is spun.

The probability distributions for R and G are given below.

r	2	3
P(R=r)	$\frac{1}{4}$	$\frac{3}{4}$

g	1	4
P(G=g)	$\frac{2}{3}$	$\frac{1}{3}$

Manon spins each spinner once and adds the two scores.

(a) Find the probability that

- (i) the sum of the two scores is 7
- (ii) the sum of the two scores is less than 4

(3)

The random variable X = mR + nG where m and n are integers.

$$P(X=20) = \frac{1}{6}$$
 and $P(X=50) = \frac{1}{4}$

(b) Find the value of m and the value of n

(5)

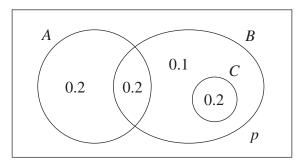
Question 1 continued



Question 1 continued	
	(Total for Question 1 is 8 marks)
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2.



The Venn diagram, where p is a probability, shows the 3 events A, B and C with their associated probabilities.

(a) Find the value of p.

(1)

(b)	Write down	a pair of	f mutually	exclusive e	events from A ,	B and	0
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(1)

Question 2 continued	
	(Total for Question 2 is 2 marks)
	(10mi tot Anconon 5 is 5 minute)



3.	Two bags, A and B, each contain balls which are either red or yellow or green.	
	Bag A contains 4 red, 3 yellow and <i>n</i> green balls. Bag B contains 5 red, 3 yellow and 1 green ball.	
	A ball is selected at random from bag A and placed into bag B . A ball is then selected at random from bag B and placed into bag A .	
	The probability that bag A now contains an equal number of red, yellow and green balls is p .	
	Given that $p > 0$, find the possible values of n and p .	(5)



Question 3 continued	



Question 3 continued	
(To	tal for Question 3 is 5 marks)



4. In a game, a player can score 0, 1, 2, 3 or 4 points each time the game is played.

The random variable S, representing the player's score, has the following probability distribution where a, b and c are constants.

S	0	1	2	3	4
P(S=s)	а	b	c	0.1	0.15

The probability of scoring less than 2 points is twice the probability of scoring at least 2 points.

Each game played is independent of previous games played.

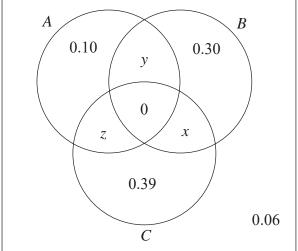
John plays the game twice and adds the two scores together to get a total.

Calculate the probability that the total is 6 points.	(6)

Question 4 continued
(Total for Question 4 is 6 marks)



5. The Venn diagram shows three events, A, B and C, and their associated probabilities.



Events *B* and *C* are mutually exclusive.

Events A and C are independent.

Showing your working, find the value of x, the value of y and the value of z.

(5)

Question 5 continued	
	(Total for Question 5 is 5 months)
	(Total for Question 5 is 5 marks)



6.	A factory buys 10% of its components from supplier A , 30% from supplier B and the rest from supplier C . It is known that 6% of the components it buys are faulty.	
	Of the components bought from supplier A , 9% are faulty and of the components bought from supplier B , 3% are faulty.	
	(a) Find the percentage of components bought from supplier C that are faulty.	(3)
	A component is selected at random.	
	(b) Explain why the event "the component was bought from supplier B" is not statistically independent from the event "the component is faulty".	(1)
		()



Question 6 continued	
	Total for Question 6 is 4 marks)
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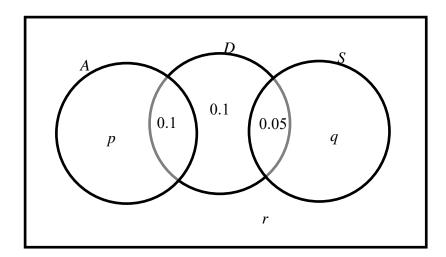


7. Alyona, Dawn and Sergei are sometimes late for school.

The events *A*, *D* and *S* are as follows:

- A Alyona is late for school
- D Dawn is late for school
- S Sergei is late for school

The Venn diagram below shows the three events A, D and S and the probabilities associated with each region of D. The constants p, q and r each represent probabilities associated with the three separate regions outside D.



(a) Write down 2 of the events A, D and S that are mutually exclusive. Give a reason for your answer.

(1)

The probability that Sergei is late for school is 0.2. The events A and D are independent.

(b) Find the value of r.

(4)

Dawn and Sergei's teacher believes that when Sergei is late for school, Dawn tends to be late for school.

(c) State whether or not D and S are independent, giving a reason for your answer.

(1)

(d) Comment on the teacher's belief in the light of your answer to part (c).

(1)

Question 7 continued	



uestion 7 continued	
	(Total for Question 7 is 7 mark



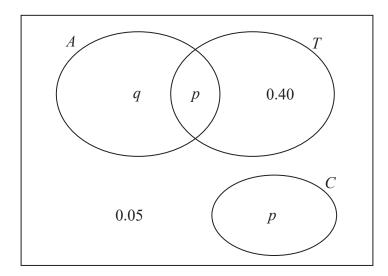
8. The Venn diagram shows the probabilities for students at a college taking part in various sports.

A represents the event that a student takes part in Athletics.

T represents the event that a student takes part in Tennis.

C represents the event that a student takes part in Cricket.

p and q are probabilities.



The probability that a student selected at random takes part in Athletics or Tennis is 0.75

(a) Find the value of p.

(1)

(b) State, giving a reason, whether or not the events *A* and *T* are statistically independent. Show your working clearly.

(3)

(c) Find the probability that a student selected at random does not take part in Athletics or Cricket.

(1)

Question 8 continued	
	(Total for Question 8 is 5 marks)



9. A company has 1825 employees.

The employees are classified as professional, skilled or elementary.

The following table shows

- the number of employees in each classification
- the two areas, A or B, where the employees live

	A	В
Professional	740	380
Skilled	275	90
Elementary	260	80

An employee is chosen at random.

Find the probability that this employee

(a) is skilled,

(1)

(b) lives in area B and is not a professional.

(1)

Some classifications of employees are more likely to work from home.

- 65% of professional employees in both area A and area B work from home
- 40% of skilled employees in both area A and area B work from home
- 5% of elementary employees in both area A and area B work from home
- Event F is that the employee is a professional
- Event *H* is that the employee works from home
- Event *R* is that the employee is from area *A*

(c) Using this information, complete the Venn diagram on the opposite page.

(4)

(d) Find $P(R' \cap F)$

(1)

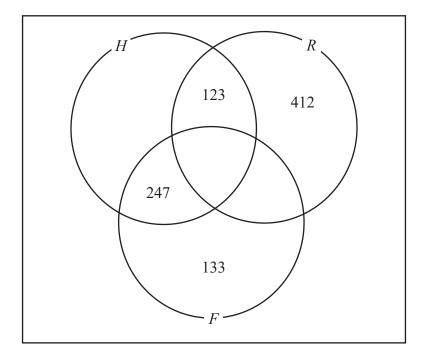
(e) Find $P([H \cup R]')$

(1)

(f) Find P(F | H)

(2)

Question 9 continued



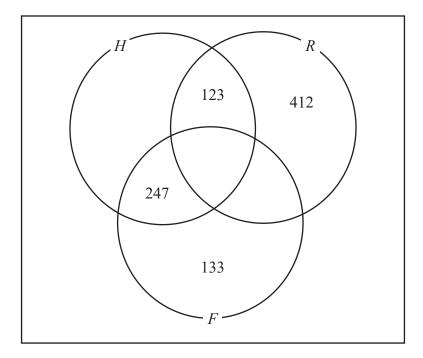
for a spare diagram if you need to redraw your Venn diagram.

Question 9 continued



Question 9 continued

Only use this diagram if you need to redraw your Venn diagram.



(Total for Question 9 is 10 marks)
(Total for Question 9 is 10 marks)
(Total for Question 9 is 10 marks)

10. A large college produces three magazines.

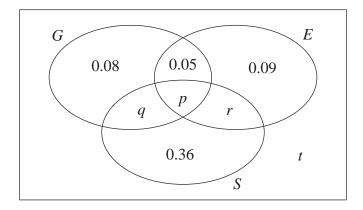
One magazine is about green issues, one is about equality and one is about sports. A student at the college is selected at random and the events G, E and S are defined as follows

G is the event that the student reads the magazine about green issues

E is the event that the student reads the magazine about equality

S is the event that the student reads the magazine about sports

The Venn diagram, where p, q, r and t are probabilities, gives the probability for each subset.



(a) Find the proportion of students in the college who read exactly one of these magazines.

(1)

No students read all three magazines and P(G) = 0.25

- (b) Find
 - (i) the value of p
 - (ii) the value of q

(3)

Given that $P(S \mid E) = \frac{5}{12}$

- (c) find
 - (i) the value of r
 - (ii) the value of t

(4)

(d) Determine whether or not the events $(S \cap E')$ and G are independent. Show your working clearly.

(3)

Question 10 continued	



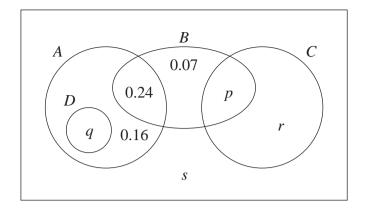
Question 10 continued				



Question 10 continued
(Total for Question 10 is 11 marks)



11. The Venn diagram shows the probabilities associated with four events, A, B, C and D



(a) Write down any pair of mutually exclusive events from A, B, C and D

(1)

Given that P(B) = 0.4

(b) find the value of p

(1)

Given also that A and B are independent

(c) find the value of q

(2)

Given further that P(B'|C) = 0.64

- (d) find
 - (i) the value of r
 - (ii) the value of s

(4)

Question 11 continued	
	(Total for Question 11 is 8 marks)



12. The discrete random variable D has the following probability distribution

d	10	20	30	40	50
P(D=d)	$\frac{k}{10}$	$\frac{k}{20}$	$\frac{k}{30}$	$\frac{k}{40}$	$\frac{k}{50}$

where k is a constant.

(a) Show that the value of k is $\frac{600}{137}$

(2)

The random variables D_1 and D_2 are independent and each have the same distribution as D.

(b) Find $P(D_1 + D_2 = 80)$

Give your answer to 3 significant figures.

(3)

A single observation of D is made.

The value obtained, d, is the common difference of an arithmetic sequence.

The first 4 terms of this arithmetic sequence are the angles, measured in degrees, of quadrilateral Q

(c) Find the exact probability that the smallest angle of Q is more than 50°

(5)

Question 12 continued	



Question 12 continued	



Question 12 continued	
	(Total for Question 12 is 10 marks)



13.	Three bags, A, B and C, each contain 1 red marble and some green marbles.	
	Bag A contains 1 red marble and 9 green marbles only Bag B contains 1 red marble and 4 green marbles only Bag C contains 1 red marble and 2 green marbles only	
	Sasha selects at random one marble from bag A . If he selects a red marble, he stops selecting. If the marble is green, he continues by selecting at random one marble from bag B . If he selects a red marble, he stops selecting. If the marble is green, he continues by selecting at random one marble from bag C .	
	(a) Draw a tree diagram to represent this information.	(2)
	(b) Find the probability that Sasha selects 3 green marbles.	(2)
	(c) Find the probability that Sasha selects at least 1 marble of each colour.	(2)
	(d) Given that Sasha selects a red marble, find the probability that he selects it from bag	B. (2)

Question 13 continued



Question 13 continued	



Question 13 continued	
	(Total for Question 13 is 8 marks)



14.	Magali is studying the mean total cloud cover, in oktas, for Leuchars in 1987 using data
	from the large data set. The daily mean total cloud cover for all 184 days from the large
	data set is summarised in the table below.

Daily mean total cloud cover (oktas)		1	2	3	4	5	6	7	8
Frequency (number of days)	0	1	4	7	10	30	52	52	28

One of the 184 days is selected at random.

Find the	probability	that it has	a daily me	an total cloud	d cover of 6 or	greater.

(1)

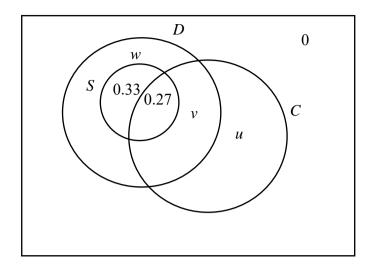
(Total for Question 14 is 1 mark)

15.	Helen believes that the random variable C , representing cloud cover from the large data set, can be modelled by a discrete uniform distribution.	
	(a) Write down the probability distribution for <i>C</i> .	(2)
	(b) Using this model, find the probability that cloud cover is less than 50%	(1)
	Helen used all the data from the large data set for Hurn in 2015 and found that the proportion of days with cloud cover of less than 50% was 0.315	
	(c) Comment on the suitability of Helen's model in the light of this information.	(1)
	(d) Suggest an appropriate refinement to Helen's model.	(1)

Question 15 continued
(Total for Question 15 is 5 marks)



16. The Venn diagram shows the probabilities of students' lunch boxes containing a drink, sandwiches and a chocolate bar.



D is the event that a lunch box contains a drink,

S is the event that a lunch box contains sandwiches,

C is the event that a lunch box contains a chocolate bar,

u, *v* and *w* are probabilities.

(a) Write down $P(S \cap D')$.

(1)

One day, 80 students each bring in a lunch box.

Given that all 80 lunch boxes contain sandwiches and a drink,

(b) estimate how many of these 80 lunch boxes will contain a chocolate bar.

(3)

Given that the events S and C are independent and that $P(D | C) = \frac{14}{15}$,

(c) calculate the value of u, the value of v and the value of w.

(7)

Question 16 continued	
	(Total for Question 16 is 11 marks)



17.	A meteorologist believes that there is a relationship between the daily mean windspeed, w kn,
	and the daily mean temperature, t °C. A random sample of 9 consecutive days is taken from
	past records from a town in the UK in July and the relevant data is given in the table below.

t	13.3	16.2	15.7	16.6	16.3	16.4	19.3	17.1	13.2
w	7	11	8	11	13	8	15	10	11

The meteorologist calculated the product moment correlation coefficient for the 9 days and obtained r = 0.609

Explain why a linear regression model based on these data is unreliable on a day when the mean temperature is 24 $^{\circ}\mathrm{C}$

(1)

(Total for Question 17 is 1 mark)

18.	Given that	
	$P(A) = 0.35$ $P(B) = 0.45$ and $P(A \cap B) = 0.13$	
	find	
	(a) $P(A' \mid B')$	(2)
	(b) Explain why the events A and B are not independent.	(2)
	(b) Explain why the events A and B are not independent.	(1)
	The event C has $P(C) = 0.20$	
	The events A and C are mutually exclusive and the events B and C are statistically independent of the events A and C are statistically independent of the events A and C are statistically independent of the events A and C are statistically independent of the events A and C are statistically independent of the events A and C are statistically independent of the events A and C are statistically independent of the events A and C are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of the events A and A are statistically independent of A and A are statistically i	endent.
	(c) Draw a Venn diagram to illustrate the events A, B and C, giving the probabilities for each region.	
	Cach region.	(5)
	(d) Find $P([B \cup C]')$	(2)
		(2)

Question 18 continued	
(Total for Question 18 is 10 marks)	



19.	A bag contains 64 coloured beads. There are r red beads, y yellow beads and 1 green beads and $r + y + 1 = 64$	ead
	Two beads are selected at random, one at a time without replacement.	
	(a) Find the probability that the green bead is one of the beads selected.	(4)
	The probability that both of the beads are red is $\frac{5}{84}$	
	(b) Show that r satisfies the equation $r^2 - r - 240 = 0$	(3)
	(c) Hence show that the only possible value of r is 16	(2)
	(d) Given that at least one of the beads is red, find the probability that they are both	red. (4)

uestion 19 continued	



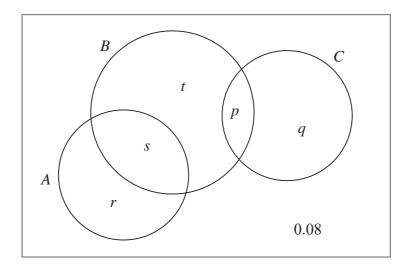
uestion 19 continued	



estion 19 continued	



20. The Venn diagram shows three events A, B and C, where p, q, r, s and t are probabilities.



P(A) = 0.5, P(B) = 0.6 and P(C) = 0.25 and the events B and C are independent.

(a) Find the value of p and the value of q.

(2)

(b) Find the value of r.

(2)

(c) Hence write down the value of s and the value of t.

(2)

(d) State, giving a reason, whether or not the events A and B are independent.

(2)

(e) Find $P(B | A \cup C)$.

(3)

Question 20 continued	Leav blan
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uestion 20 continued	



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Question 20 continued	
(Total 11 marks)	



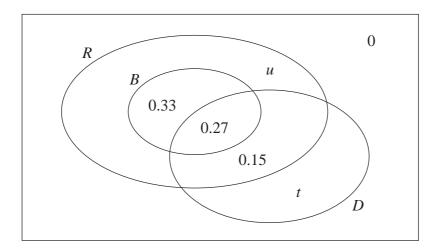
21. The Venn diagram shows the probabilities of customer bookings at Harry's hotel.

R is the event that a customer books a room

B is the event that a customer books breakfast

D is the event that a customer books dinner

u and *t* are probabilities.



(a) Write down the probability that a customer books breakfast but does not book a room. (1)

Given that the events B and D are independent

(b) find the value of t

(4)

(c) hence find the value of u

(2)

- (d) Find
 - (i) $P(D|R \cap B)$
 - (ii) $P(D|R \cap B')$

(4)

A coach load of 77 customers arrive at Harry's hotel.

Of these 77 customers

40 have booked a room and breakfast

37 have booked a room without breakfast

(e) Estimate how many of these 77 customers will book dinner.

(2)

uestion 21 continued	





nestion 22 continued	



23. In a quiz, a team gains 10 points for every question it answers correctly and loses 5 points for every question it does not answer correctly. The probability of answering a question correctly is 0.6 for each question. One round of the quiz consists of 3 questions.

The discrete random variable X represents the total number of points scored in one round. The table shows the incomplete probability distribution of X

х	30	15	0	-15
P(X = x)	0.216			0.064

(a) Show that the probability of scoring 15 points in a round is 0.432

(2)

(b) Find the probability of scoring 0 points in a round.

(1)

(c) Find the probability of scoring a total of 30 points in 2 rounds.

(3)

uestion 23 continued	



In a factory, three machines, <i>J</i> , <i>K</i> and <i>L</i> , are used to make biscuits.	
Machine J makes 25% of the biscuits.	
Machine <i>K</i> makes 45% of the biscuits.	
The rest of the biscuits are made by machine L .	
It is known that 2% of the biscuits made by machine J are broken, 3% of the biscuits made by machine K are broken and 5% of the biscuits made by machine L are broken.	ade
(a) Draw a tree diagram to illustrate all the possible outcomes and associated probabilities	ies. (2)
A biscuit is selected at random.	
(b) Calculate the probability that the biscuit is made by machine J and is not broken.	(2)
(c) Calculate the probability that the biscuit is broken.	(2)
(d) Given that the biscuit is broken, find the probability that it was not made by machine	e K. (3)

estion 24 continued	



For the events A and B ,	
$P(A' \cap B) = 0.22$ and $P(A' \cap B') = 0.18$	
(a) Find $P(A)$.	(1)
(b) Find $P(A \cup B)$.	(1)
	(1)
Given that $P(A \mid B) = 0.6$	
(c) find $P(A \cap B)$.	(3)
(d) Determine whether or not <i>A</i> and <i>B</i> are independent.	(2)

estion 25 continued	



26. The discrete random variable <i>X</i> has probability distribution

$$P(X = x) = \frac{1}{10}$$
 $x = 1, 2, 3, ... 10$

(a) Write down the name given to this distribution.

(1)

- (b) Write down the value of
 - (i) P(X = 10)
 - (ii) P(X < 10)

(2)

(Total 3 marks)

27. *A* and *B* are two events such that

$$P(B) = \frac{1}{2}$$
 $P(A \mid B) = \frac{2}{5}$ $P(A \cup B) = \frac{13}{20}$

(a) Find $P(A \cap B)$.

(2)

(b) Draw a Venn diagram to show the events A, B and all the associated probabilities. **(3)**

Find

(c) P(A)

(1)

(d) P(B|A)

(2)

(e) $P(A' \cap B)$

(1)

Question 27 continued	Leave blank
(Total 9 marks)	

8.	In a large company,	
	78% of employees are car owners, 30% of these car owners are also bike owners, 85% of those who are not car owners are bike owners.	
	(a) Draw a tree diagram to represent this information.	3)
	An employee is selected at random.	
	(b) Find the probability that the employee is a car owner or a bike owner but not both.	2)
	Another employee is selected at random.	
	Given that this employee is a bike owner,	
	(c) find the probability that the employee is a car owner.	3)
	Two employees are selected at random.	
	(d) Find the probability that only one of them is a bike owner.	3)
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stion 28 continued	



29. In a company the 200 employees are classified as full-time workers, part-time workers or contractors.

The table below shows the number of employees in each category and whether they walk to work or use some form of transport.

	Walk	Transport
Full-time worker	2	8
Part-time worker	35	75
Contractor	30	50

The events F, H and C are that an employee is a full-time worker, part-time worker or contractor respectively. Let W be the event that an employee walks to work.

An employee is selected at random.

Find

(2)

(b)
$$P([F \cap W]')$$

(2)

(c)
$$P(W \mid C)$$

(2)

Let *B* be the event that an employee uses the bus.

Given that 10% of full-time workers use the bus, 30% of part-time workers use the bus and 20% of contractors use the bus,

(d) draw a Venn diagram to represent the events F, H, C and B,

(4)

(e) find the probability that a randomly selected employee uses the bus to travel to work.

(2)

estion 29 continued	



30. A biased die with six faces is rolled. The discrete random variable *X* represents the score on the uppermost face. The probability distribution of *X* is shown in the table below.

X	1	2	3	4	5	6
P(X=x)	а	а	а	b	b	0.3

(a) Given that E(X) = 4.2 find the value of a and the value of b.

(5)

A biased die with five faces is rolled. The discrete random variable Y represents the score which is uppermost. The cumulative distribution function of Y is shown in the table below.

у	1	2	3	4	5
F(y)	$\frac{1}{10}$	$\frac{2}{10}$	3 <i>k</i>	4 <i>k</i>	5 <i>k</i>

(b) Find the value of k.

(1)

(c) Find the probability distribution of Y.

(3)

Each die is rolled once. The scores on the two dice are independent.

(d) Find the probability that the sum of the two scores equals 2

(2)

estion 30 continued	



31.

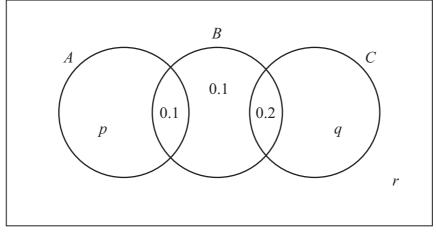


Figure 1

The Venn diagram in Figure 1 shows three events A, B and C and the probabilities associated with each region of B. The constants p, q and r each represent probabilities associated with the three separate regions outside B.

The events A and B are independent.

(a) Find the value of p.

(3)

Given that $P(B|C) = \frac{5}{11}$

(b) find the value of q and the value of r.

(4)

(c) Find $P(A \cup C | B)$.

(2)

estion 31 continued	





(Total 3 marks)

33. Given that

$$P(A) = 0.35$$
, $P(B) = 0.45$ and $P(A \cap B) = 0.13$

find

(a) $P(A \cup B)$

(2)

(b) P(A' | B')

(2)

The event C has P(C) = 0.20

The events A and C are mutually exclusive and the events B and C are independent.

(c) Find $P(B \cap C)$

(2)

(d) Draw a Venn diagram to illustrate the events *A*, *B* and *C* and the probabilities for each region.

(4)

(e) Find $P([B \cup C]')$

(2)

stion 33 continued	



	(a) State in words the relationship between two events R and S when $P(R \cap S) = 0$	(1)
	The events A and B are independent with $P(A) = \frac{1}{4}$ and $P(A \cup B) = \frac{2}{3}$	
	Find	
	(b) P(B)	(4)
	(c) $P(A' \cap B)$	(•)
		(2)
	(d) $P(B' A)$	(2)
_		
_		

Leave
blank

5.	The following shows the results of a survey on the types of exercise taken by a group of 100 people.	
	65 run	
	48 swim	
	60 cycle	
	40 run and swim	
	30 swim and cycle	
	35 run and cycle	
	25 do all three	
	(a) Draw a Venn Diagram to represent these data.	
	(4)	
	Find the probability that a randomly selected person from the survey	
	(b) takes none of these types of exercise,	
	(2)	
	(c) swims but does not run,	
	(2)	
	(d) takes at least two of these types of exercise.	
	(2)	
	Jason is one of the above group. Given that Jason runs,	
	(e) find the probability that he swims but does not cycle.	
	(3)	

estion 35 continued	



36.	Jake and Kamil are sometimes late for school. The events J and K are defined as follows	
	J = the event that Jake is late for school $K =$ the event that Kamil is late for school	
	$P(J) = 0.25, P(J \cap K) = 0.15 \text{ and } P(J' \cap K') = 0.7$	
	On a randomly selected day, find the probability that	
	(a) at least one of Jake or Kamil are late for school,	(1)
	(b) Kamil is late for school.	(2)
	Given that Jake is late for school,	
	(c) find the probability that Kamil is late.	(3)
	The teacher suspects that Jake being late for school and Kamil being late for school alinked in some way.	are
	(d) Determine whether or not J and K are statistically independent.	(2)
	(e) Comment on the teacher's suspicion in the light of your calculation in (d).	(1)
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estion 36 continued	



37. The bag *P* contains 6 balls of which 3 are red and 3 are yellow.

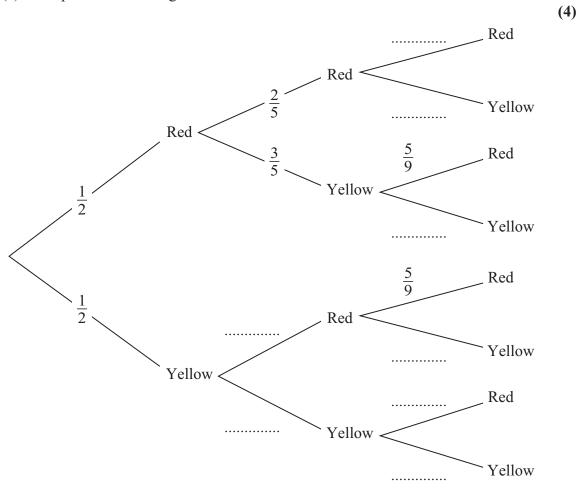
The bag Q contains 7 balls of which 4 are red and 3 are yellow.

A ball is drawn at random from bag P and placed in bag Q. A second ball is drawn at random from bag P and placed in bag Q.

A third ball is then drawn at random from the 9 balls in bag Q.

The event A occurs when the 2 balls drawn from bag P are of the same colour. The event B occurs when the ball drawn from bag Q is red.

(a) Complete the tree diagram shown below.



(b) Find P(A)

(3)

(c) Show that $P(B) = \frac{5}{9}$

(3)

(d) Show that $P(A \cap B) = \frac{2}{9}$

(2)

(e) Hence find $P(A \cup B)$

(2)

(f) Given that all three balls drawn are the same colour, find the probability that they are all red.

nestion 37 continued	
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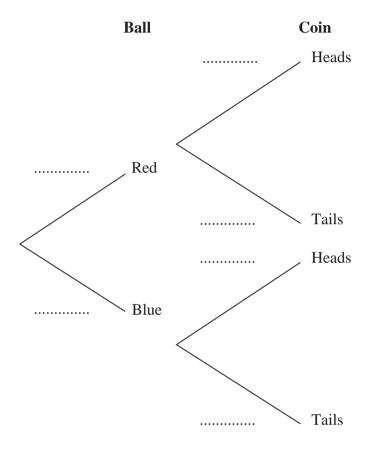
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38. An experiment consists of selecting a ball from a bag and spinning a coin. The bag contains 5 red balls and 7 blue balls. A ball is selected at random from the bag, its colour is noted and then the ball is returned to the bag.

When a red ball is selected, a biased coin with probability $\frac{2}{3}$ of landing heads is spun.

When a blue ball is selected a fair coin is spun.

(a) Complete the tree diagram below to show the possible outcomes and associated probabilities.



Shivani selects a ball and spins the appropriate coin.

(b) Find the probability that she obtains a head.

(2)

(2)

Given that Tom selected a ball at random and obtained a head when he spun the appropriate coin,

(c) find the probability that Tom selected a red ball.

(3)

Shivani and Tom each repeat this experiment.

(d) Find the probability that the colour of the ball Shivani selects is the same as the colour of the ball Tom selects.



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Question 38 continued	blank
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(Total 10 marks)	



39. The Venn diagram in Figure 1 shows the number of students in a class who read any of 3 popular magazines *A*, *B* and *C*.

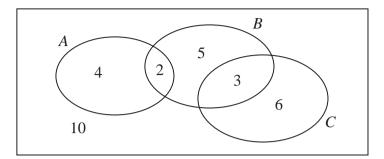


Figure 1

One of these students is selected at random.

- (a) Show that the probability that the student reads more than one magazine is $\frac{1}{6}$. (2)
- (b) Find the probability that the student reads A or B (or both). (2)
- (c) Write down the probability that the student reads both A and C. (1)

Given that the student reads at least one of the magazines,

- (d) find the probability that the student reads C. (2)
- (e) Determine whether or not reading magazine *B* and reading magazine *C* are statistically independent. (3)



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Question 39 continued	Dialik
(Total 10 marks)	





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41.	There are 180 students at a college following a general course in computing. Students course can choose to take up to three extra options.	lents on
	112 take systems support, 70 take developing software, 81 take networking, 35 take developing software and systems support, 28 take networking and developing software, 40 take systems support and networking, 4 take all three extra options.	
	(a) In the space below, draw a Venn diagram to represent this information.	(5)
	A student from the course is chosen at random.	
	Find the probability that this student takes	
	(b) none of the three extra options,	(1)
	(c) networking only.	(1)
		(1)
	Students who want to become technicians take systems support and networking that a randomly chosen student wants to become a technician,	
	that a randomly chosen student wants to become a technician,	. Given
	that a randomly chosen student wants to become a technician,	. Given
	that a randomly chosen student wants to become a technician,	. Given
	that a randomly chosen student wants to become a technician,	. Given
	that a randomly chosen student wants to become a technician,	. Given
	that a randomly chosen student wants to become a technician,	. Given
	that a randomly chosen student wants to become a technician,	. Given
	that a randomly chosen student wants to become a technician,	. Given



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Question 41 continued	l Di	lank
(Total 9 marks)		



42.	On a randomly chosen day the probability that Bill travels to school by car, by bi	cycle
	or on foot is $\frac{1}{2}$, $\frac{1}{6}$ and $\frac{1}{3}$ respectively. The probability of being late when using	these
	methods of travel is $\frac{1}{5}$, $\frac{2}{5}$ and $\frac{1}{10}$ respectively.	
	(a) Draw a tree diagram to represent this information.	(3)
	(b) Find the probability that on a randomly chosen day	
	(i) Bill travels by foot and is late,	
	(ii) Bill is not late.	(4)
	(c) Given that Bill is late, find the probability that he did not travel on foot.	(4)

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Question 42 continued	bl	lank
Question 12 continues		
(Total 11 marks)		



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43.	 (a) Given that P(A) = a and P(B) = b express P(A∪B) in terms of a and b when (i) A and B are mutually exclusive, (ii) A and B are independent. 	(2)
	Two events R and Q are such that	
	$P(R \cap Q') = 0.15$, $P(Q) = 0.35$ and $P(R Q) = 0.1$	
	Find the value of	
	(b) $P(R \cup Q)$,	(1)
	(c) $P(R \cap Q)$,	(2)
	(d) $P(R)$.	(2)

Question 43 continued	Leav blan
(Total 7 n	narks)



44.	A group of office workers were questioned for a health magazine and $\frac{2}{5}$ were found to
	take regular exercise. When questioned about their eating habits $\frac{2}{3}$ said they always eat
	breakfast and, of those who always eat breakfast $\frac{9}{25}$ also took regular exercise.
	Find the probability that a randomly selected member of the group
	(a) always eats breakfast and takes regular exercise, (2)
	(b) does not always eat breakfast and does not take regular exercise. (4)
	(c) Determine, giving your reason, whether or not always eating breakfast and taking regular exercise are statistically independent. (2)

Question 44 continued	Leav blan



45.	A disease is known to be present in 2% of a population. A test is developed to help
	determine whether or not someone has the disease.

Given that a person has the disease, the test is positive with probability 0.95

Given that a person does not have the disease, the test is positive with probability 0.03

(a) Draw a tree diagram to represent this information.

(3)

A person is selected at random from the population and tested for this disease.

(b) Find the probability that the test is positive.

(3)

A doctor randomly selects a person from the population and tests him for the disease. Given that the test is positive,

(c) find the probability that he does not have the disease.

(2)

(d) Comment on the usefulness of this test.

(1)



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Question 45 continued	DIAIIK
(Total 9 marks)	



46. A person's blood group is determined by whether or not it contains any of 3 substances A, B and C.

A doctor surveyed 300 patients' blood and produced the table below.

Blood contains	No. of Patients
only C	100
A and C but not B	100
only A	30
B and C but not A	25
only B	12
A, B and C	10
A and B but not C	3

(a) Draw a Venn diagram to represent this information.

(4)



(b) Find the probability that a randomly chosen patient's blood contains substance (C. (2)
Harry is one of the patients. Given that his blood contains substance A ,	
(c) find the probability that his blood contains all 3 substances.	(2)
Patients whose blood contains none of these substances are called universal bloods.	olood
(d) Find the probability that a randomly chosen patient is a universal blood donor.	(2)
(Total 10 m	arks)



The following shows the results of a wine tasting survey of 100 people.	
96 like wine A, 93 like wine B, 96 like wine C, 92 like A and B, 91 like B and C, 93 like A and C, 93 like all three wines.	
(a) Draw a Venn Diagram to represent these data.	(6)
Find the probability that a randomly selected person from the survey likes	
(b) none of the three wines,	(1)
(c) wine A but not wine B ,	(2)
(d) any wine in the survey except wine C ,	(2)
(e) exactly two of the three kinds of wine.	(2)
Given that a person from the survey likes wine A ,	
(f) find the probability that the person likes wine C .	(3)

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Question 47 continued	blan
(Total 16 marks))



- **48.** Tetrahedral dice have four faces. Two fair tetrahedral dice, one red and one blue, have faces numbered 0, 1, 2, and 3 respectively. The dice are rolled and the numbers face down on the two dice are recorded. The random variable *R* is the score on the red die and the random variable *B* is the score on the blue die.
 - (a) Find P(R=3 and B=0).

(2)

The random variable T is R multiplied by B.

(b) Complete the diagram below to represent the sample space that shows all the possible values of *T*.

3				
2		2		
1	0			
0				
B R	0	1	2	3

Sample space diagram of T

(3)

(c) The table below represents the probability distribution of the random variable *T*.

t	0	1	2	3	4	6	9
P(T=t)	а	b	1/8	1/8	С	1/8	d

Find the values of a, b, c and d.

stion 48 continued	



49.	A bag contains a large number of counters with one of the numbers 4, 6 or 8 written on
	each of them in the ratio 5:3:2 respectively.

A random sample of 2 counters is taken from the bag.

(a) List all the possible samples of size 2 that can be taken.

(2)

The random variable M represents the mean value of the 2 counters.

Given that $P(M = 4) = \frac{1}{4}$ and $P(M = 8) = \frac{1}{25}$

(b) find the sampling distribution for M.

(5)

A sample of n sets of 2 counters is taken. The random variable Y represents the number of these n sets that have a mean of 8

(c) Calculate the minimum value of *n* such that $P(Y \ge 1) > 0.9$

Question 49 continued	Leave



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Question 49 continued	
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(Total 10 marks)	-



50.	A bag contains a large number of 10p, 20p and 50p coins in the ratio 1:2:2	
	A random sample of 3 coins is taken from the bag.	
	Find the sampling distribution of the median of these samples.	(7)
		(1)



Question 50 continued	



uestion 50 continued	



A bag contains a large number of 1p, 2p and 5p coins.	
50% are 1p coins 20% are 2p coins 30% are 5p coins	
A random sample of 3 coins is chosen from the bag.	
(a) List all the possible samples of size 3 with median 5p.	(2)
(b) Find the probability that the median value of the sample is 5p.	(4)
(c) Find the sampling distribution of the median of samples of size 3	(5)



Question 51 continued	b



Question 51 continued	b



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Question 51 continued	
(Total 11 marks)	



A bag contains a large number of counters. A third of the counters have them and the remainder have a number 1.	ze a number 5 on
	o a number 5 on
A random sample of 3 counters is selected.	
(a) List all possible samples.	(2)
(b) Find the sampling distribution for the range.	(3)



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Question 52 continued	
(Total 5 marks)	



3.	A bag contains a large number of balls.	
	65% are numbered 1	
	35% are numbered 2	
	A random sample of 3 balls is taken from the bag.	
	Find the sampling distribution for the range of the numbers on the 3 selected balls.	(6)



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Question 53 continued	Dialik
(Total 6 marks)	

