2. Probability

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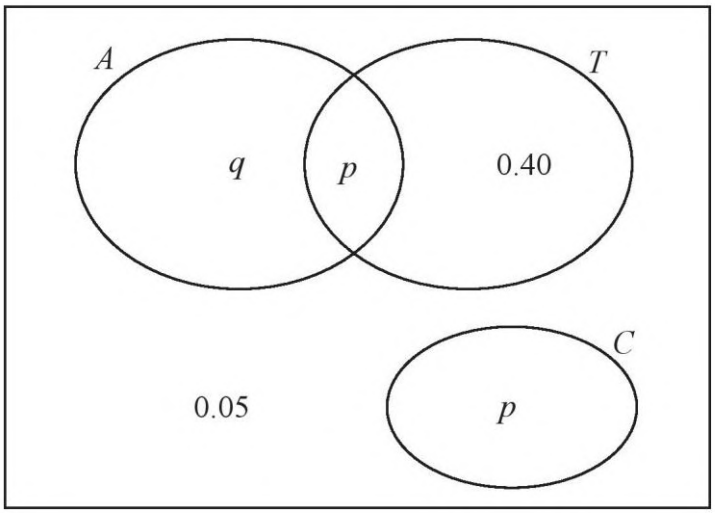
3. The Venn diagram shows the probabilities for students at a college taking part in various sports.

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 3 continued

(Total for Question 3 is 5 marks)

4. Given that

$$P(A) = 0.35 \qquad P(B) = 0.45 \qquad \text{and} \qquad P(A \cap B) = 0.13$$

find

(a) $P(A' \mid B')$

(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.

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

(5)

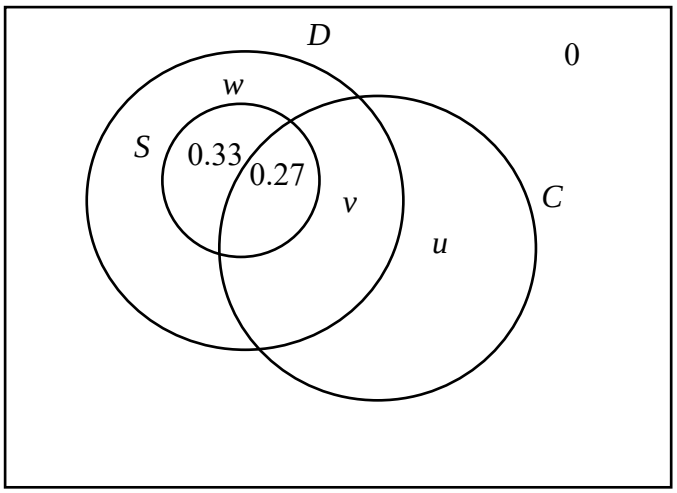
(d) Find $P([B \cup C]')$

(2)

Question 4 continued

(Total for Question 4 is 10 marks)

4. 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 $P(D \mid C) = \frac{14}{15}$,

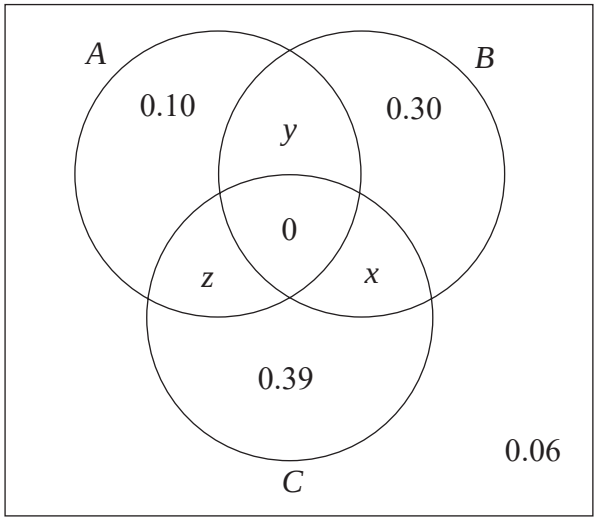
(c) calculate the value of *u*, the value of *v* and the value of *w*.

(7)

(Total 11 marks)

Question 4 continued

2. 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)

Answer ALL questions. Write your answers in the spaces provided.

1. 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.

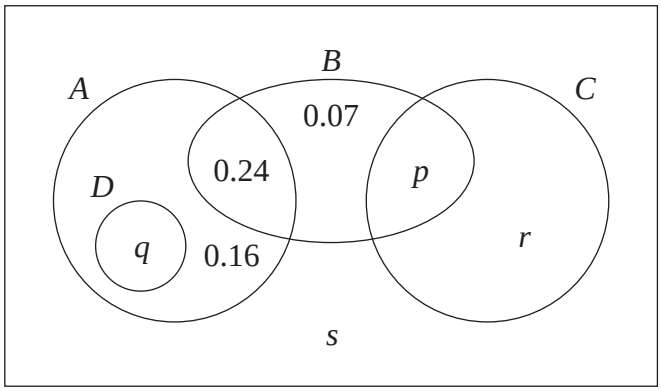
(2)

(d) Given that Sasha selects a red marble, find the probability that he selects it from bag *B*.

(2)

Question 1 continued

1. 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

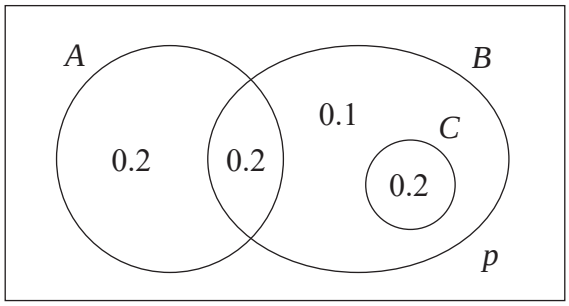
(ii) the value of s

(4)

Question 1 continued

(Total for Question 1 is 8 marks)

1.



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 mutually exclusive events from A, B and C.

(1)

5. Two bags, **A** and **B**, each contain balls which are either red or yellow or green.

Bag **A** contains 4 red, 3 yellow and n 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.

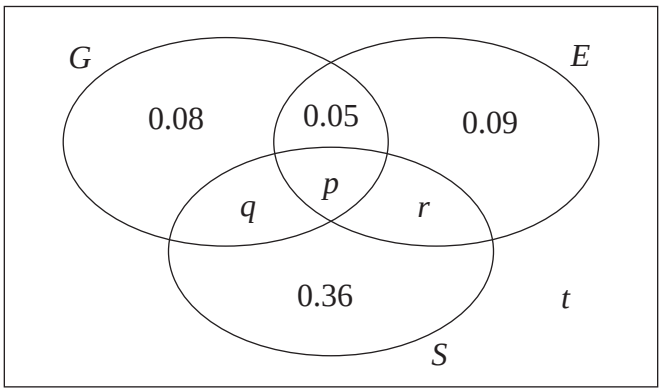
Given that $p > 0$, find the possible values of n and p.

(5)

4. 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 4 continued.

Question 4 continued.

5. 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	***B***
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)

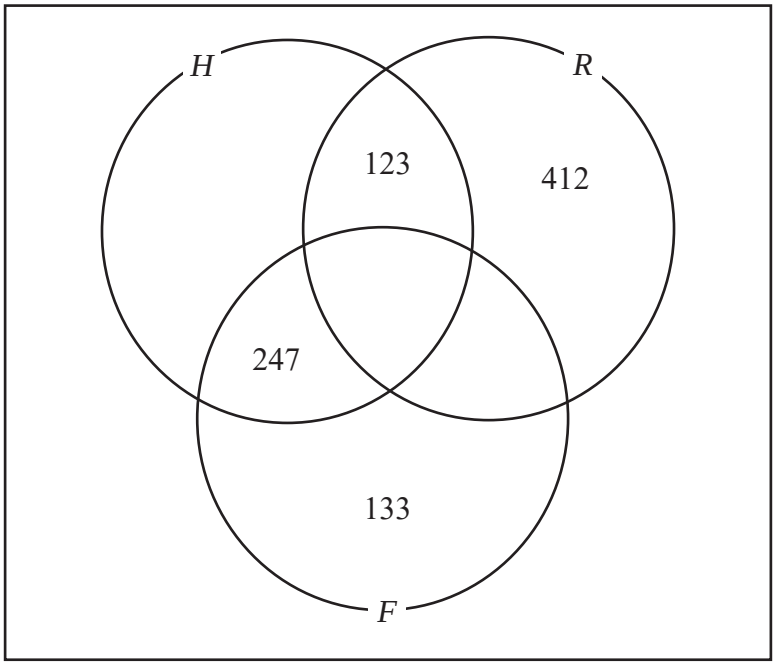
(e) Find $P([H \cup R]')$

(1)

(f) Find $P(F \mid H)$

(2)

Question 5 continued

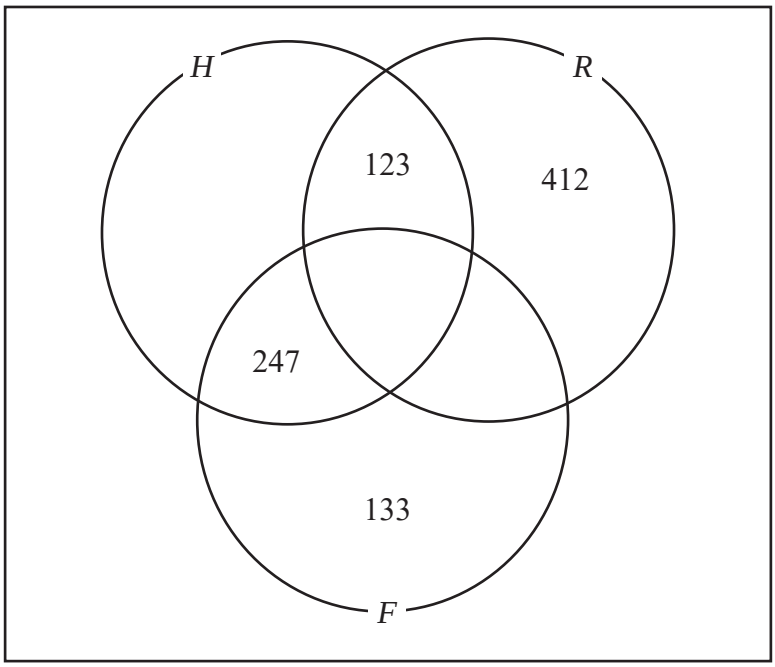


Turn over for a spare diagram if you need to redraw your Venn diagram.

Question 5 continued

Question 5 continued

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



(Total for Question 5 is 10 marks)

3. In an after-school club, students can choose to take part in Art, Music, both or neither.

There are 45 students that attend the after-school club. Of these

- 25 students take part in Art
- 12 students take part in both Art and Music
- the number of students that take part in Music is x

(a) Find the range of possible values of x

(2)

One of the 45 students is selected at random.

Event A is the event that the student selected takes part in Art.

Event M is the event that the student selected takes part in Music.

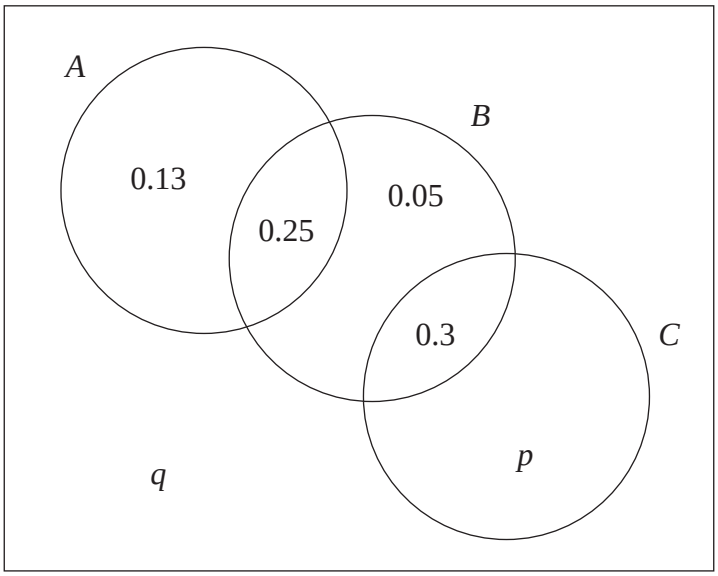
(b) Determine whether or not it is possible for the events A and M to be independent.

(4)

Question 3 continued

(Total for Question 3 is 6 marks)

1. The Venn diagram, where p and q are probabilities, shows the three events A, B and C and their associated probabilities.



(a) Find P(A)

(1)

The events B and C are independent.

(b) Find the value of p and the value of q

(3)

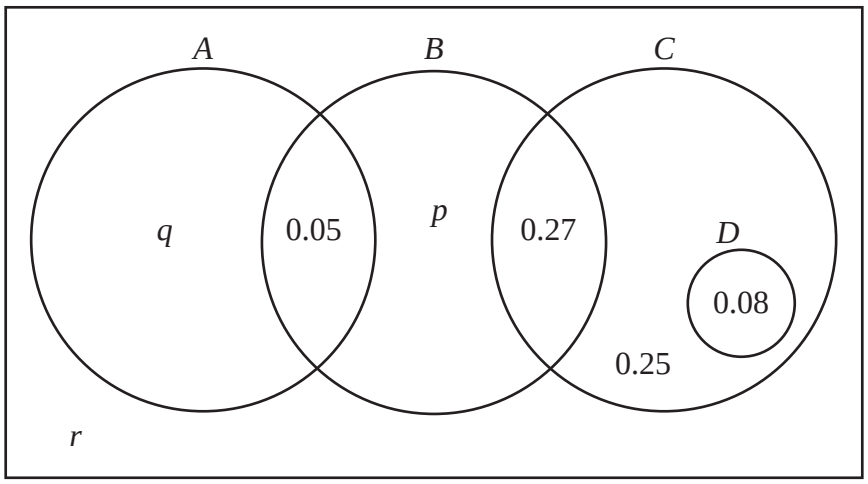
(c) Find P($A \mid B'$)

(2)

Question 1 continued

(Total for Question 1 is 6 marks)

6. The Venn diagram, where p, q and r are probabilities, shows the events A, B, C and D and associated probabilities.



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

(1)

The events B and C are independent.

(b) Find the value of p

(2)

(c) Find the greatest possible value of $\mathrm{P}(A \mid B')$

(3)

Given that $\mathrm{P}(B \mid A') = 0.5$

(d) find the value of q and the value of r

(3)

(e) Find $\mathrm{P}\left(\left[A \cup B\right]' \cap C\right)$

(1)

(f) Use set notation to write an expression for the event with probability p

(1)

Question 6 continued

2. 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)