

6. The discrete random variable X has the following probability distribution

x	a	b	c
$P(X=x)$	$\log_{36} a$	$\log_{36} b$	$\log_{36} c$

where

- a, b and c are distinct integers ($a < b < c$)
- all the probabilities are greater than zero

(a) Find

- the value of a
- the value of b
- the value of c

Show your working clearly.

(5)

The independent random variables X_1 and X_2 each have the same distribution as X

(b) Find $P(X_1 = X_2)$

(2)

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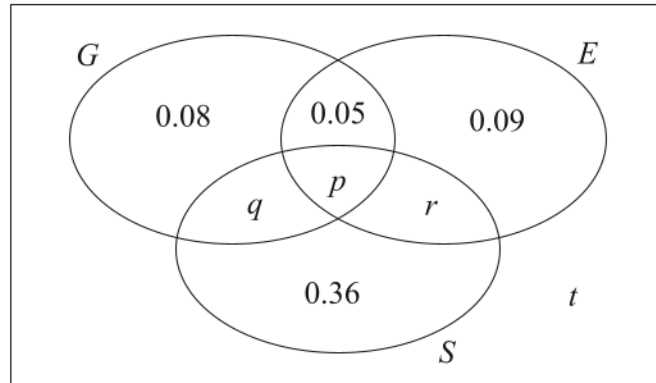
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4. A large college produces three magazines. One magazine is about green issues, one is about equality and one is about sports. A student at the college is selected at random and the events G , E and S are defined as follows

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 (3)
- (i) the value of p
 - (ii) the value of q

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

- (c) find (4)
- (i) the value of r
 - (ii) the value of t
- (d) Determine whether or not the events $(S \cap E')$ and G are independent. Show your working clearly. (3)

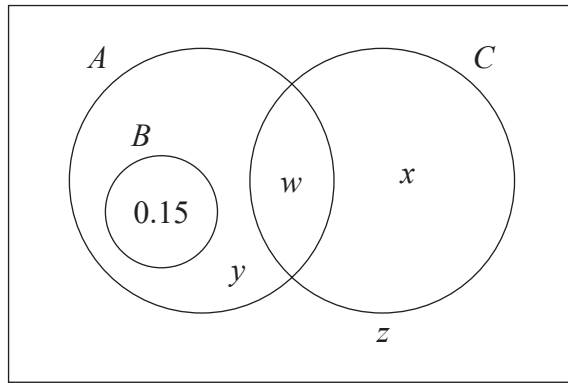


2. The Venn diagram, where w, x, y and z are probabilities, shows the probabilities of a group of students buying each of 3 magazines.

A represents the event that a student buys magazine A and $P(A) = 0.60$

B represents the event that a student buys magazine B and $P(B) = 0.15$

C represents the event that a student buys magazine C and $P(C) = 0.35$



- (a) State which two of the three events A, B and C are mutually exclusive. (1)

The events A and C are independent.

- (b) Show that $w = 0.21$ (1)

- (c) Find the value of x , the value of y and the value of z . (4)

- (d) Find the probability that a student selected at random buys only one of these magazines. (1)

- (e) Find the probability that a student selected at random buys magazine B or magazine C . (1)

- (f) Find $P(A|[B \cup C])$ (3)



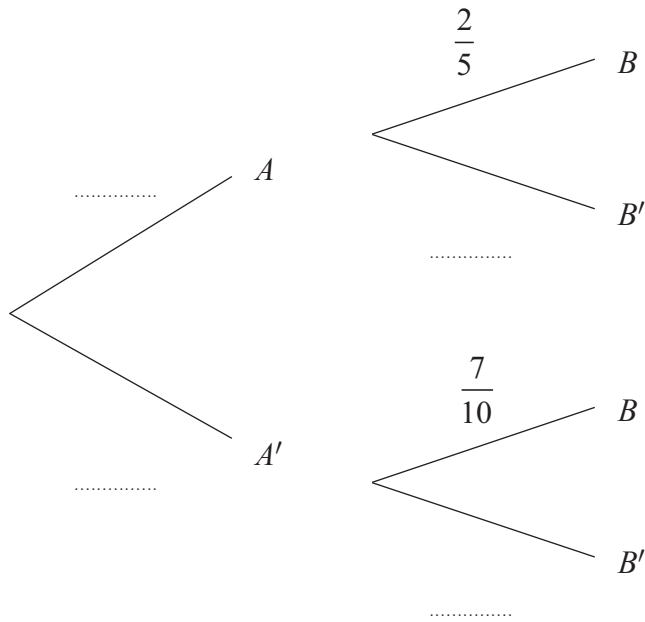
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- 4. The following incomplete tree diagram shows the relationships between the event A and the event B .



Given that $P(B) = \frac{9}{20}$

- (a) find $P(A)$ and complete the tree diagram, (6)

- (b) find $P(A' | B')$. (2)

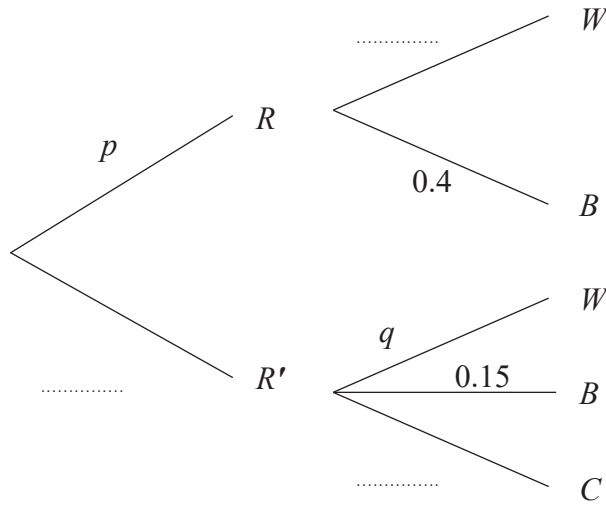
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4. The partially completed tree diagram, where p and q are probabilities, gives information about Andrew's journey to work each day.



R represents the event that it is raining
 W represents the event that Andrew walks to work
 B represents the event that Andrew takes the bus to work
 C represents the event that Andrew cycles to work

Given that $P(B) = 0.26$

- (a) find the value of p (3)

Given also that $P(R' | W) = 0.175$

- (b) find the value of q (4)

- (c) Find the probability that Andrew cycles to work. (2)

Given that Andrew did not cycle to work on Friday,

- (d) find the probability that it was raining on Friday. (3)

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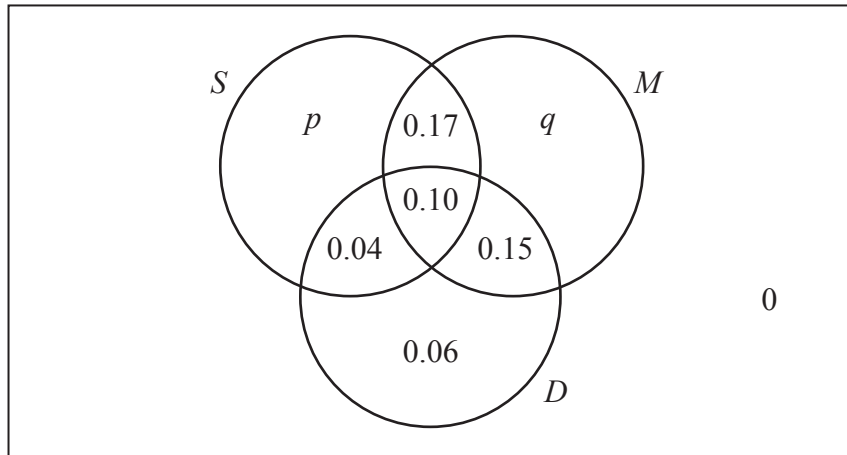


6. The Venn diagram below shows the probabilities of customers having various combinations of a starter, main course or dessert at Polly's restaurant.

S = the event a customer has a starter.

M = the event a customer has a main course.

D = the event a customer has a dessert.



Given that the events S and D are statistically independent

- (a) find the value of p . (4)
- (b) Hence find the value of q . (2)
- (c) Find
- (i) $P(D | M \cap S)$
- (ii) $P(D | M \cap S')$ (4)

One evening 63 customers are booked into Polly's restaurant for an office party. Polly has asked for their starter and main course orders before they arrive.

Of these 63 customers

27 ordered a main course and a starter,

36 ordered a main course without a starter.

- (d) Estimate the number of desserts that these 63 customers will have. (2)



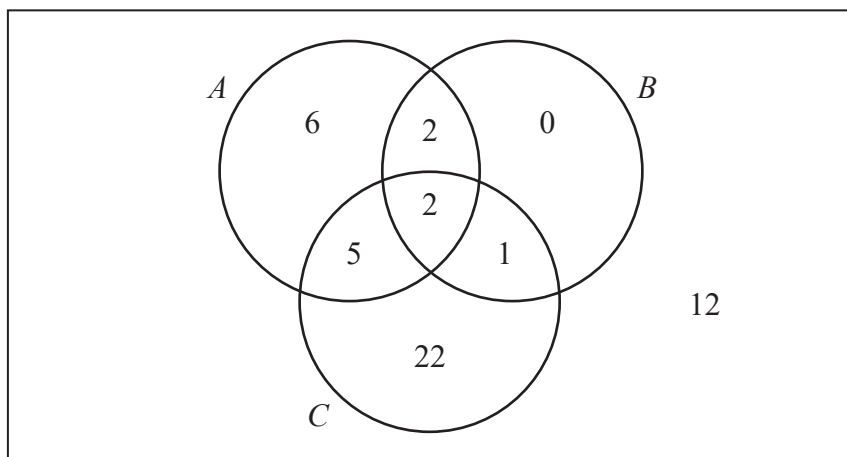
2. An integer is selected at random from the integers 1 to 50 inclusive.

A is the event that the integer selected is prime.

B is the event that the integer selected ends in a 3

C is the event that the integer selected is greater than 20

The Venn diagram shows the number of integers in each region for the events A , B and C



- (a) Describe in words the event $(A \cap B)$ (1)
- (b) Write down the probability that the integer selected is prime. (1)
- (c) Find $P([A \cup B \cup C]')$ (1)

Given that the integer selected is greater than 20

- (d) find the probability that it is prime. (2)

Using your answers to (b) and (d),

- (e) state, with a reason, whether or not the events A and C are statistically independent. (2)

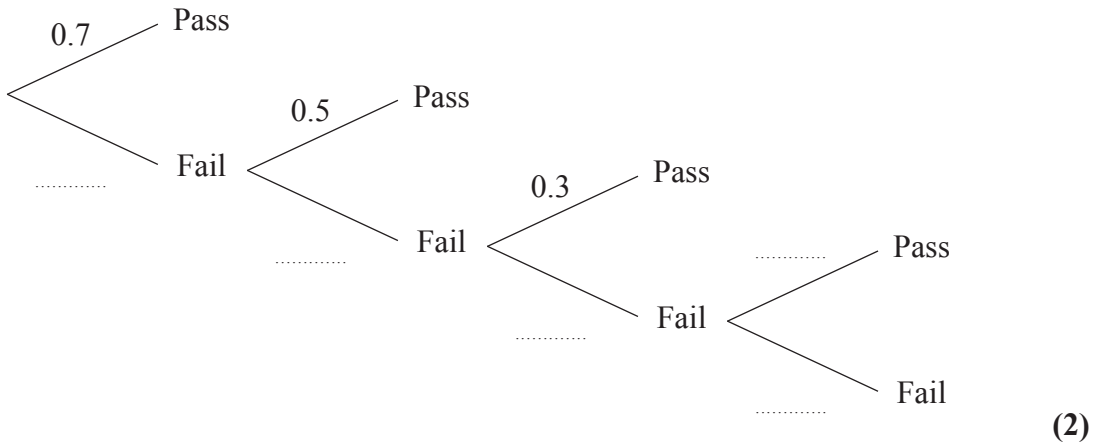
Given that the integer selected is greater than 20 and prime,

- (f) find the probability that it ends in a 3 (2)



4. A training agency awards a certificate to each student who passes a test while completing a course.
 Students failing the test will attempt the test again up to 3 more times, and, if they pass the test, will be awarded a certificate.
 The probability of passing the test at the first attempt is 0.7, but the probability of passing reduces by 0.2 at each attempt.

(a) Complete the tree diagram below to show this information.



A student who completed the course is selected at random.

- (b) Find the probability that the student was awarded a certificate. (2)
- (c) Given that the student was awarded a certificate, find the probability that the student passed on the first or second attempt. (3)

The training agency decides to alter the test taken by the students while completing the course, but will not allow more than 2 attempts. The agency requires the probability of passing the test at the first attempt to be p , and the probability of passing the test at the second attempt to be $(p - 0.2)$. The percentage of students who complete the course and are awarded a certificate is to be 95%

(d) Show that p satisfies the equation

$$p^2 - 2.2p + 1.15 = 0 \tag{3}$$

(e) Hence find the value of p , giving your answer to 3 decimal places. (3)



5. A group of 100 students are asked if they like folk music, rock music or soul music.

All students who like folk music also like rock music

No students like both rock music and soul music

75 students do not like soul music

12 students who like rock music do not like folk music

30 students like folk music

(a) Draw a Venn diagram to illustrate this information. (4)

(b) State two of these types of music that are mutually exclusive. (1)

Find the probability that a randomly chosen student

(c) does not like folk music, rock music or soul music, (1)

(d) likes rock music, (1)

(e) likes folk music or soul music. (1)

Given that a randomly chosen student likes rock music,

(f) find the probability that he or she also likes folk music. (2)



