

Name:

Date:

Conditional probability

AS-Level Edexcel Mathematics

Mark

Score (%)

Materials

For this paper you must have:

- Ruler
- Pencil, Rubber, Protractor and Compass
- Scientific calculator, which you are expected to use when appropriate

Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown
- Do all rough work in this book. Cross out any rough work you don't want to be marked

Information

- The marks for the questions are shown in brackets

1 $P(E) = 0.25$, $P(F) = 0.4$ and $P(E \cap F) = 0.12$

(a) Find $P(E|F')$ (2)

(b) Explain, showing your working, whether or not E and F are statistically independent. Give reasons for your answer. (2)

The event G has $P(G) = 0.15$

The events E and G are mutually exclusive and the events F and G are independent.

(c) Draw a Venn diagram to illustrate the events E, F and G, giving the probabilities for each region. (5)

(d) Find $P((F \cap G)')$ (2)

(Total for question 1 is 11 marks)

2 A housing estate consists of 320 houses: 120 detached and 200 semi-detached. The numbers of children living in these houses are shown in the table.

A house on the estate is selected at random

D denotes the event 'the house is detached'

R denotes the event 'no children live in the house'

S denotes the event 'one child lives in the house'

T denotes the event 'two children live in the house'

(D' denotes the event 'not D')

Find:

(a) $P(D)$ (1)

(b) $P(D \cap R)$ (1)

(c) $P(D \cup T)$ (2)

(d) $P(D | R)$ (2)

(e) $P(R | D')$ (3)

(f) Name two of the events D, R, S and T that are mutually exclusive (1)

(g) Determine whether the events D and R are independent. Justify your answer. (2)

(h) $D' \cup T$; (2)

(i) $D \cap (R \cup S)$ (2)

(Total for question 2 is 16 marks)

- 3 Each weekday Alan drives to work. On his journey, he goes over a level crossing. Sometimes he has to wait at the level crossing for a train to pass.
- W is the event that Alan has to wait at the level crossing.
 - L is the event that Alan is late for work.

[qw"ctg"ikxgp"vjcv"R*L·W+"?"206."R*W+"?"2029"cpf"R*L W+"?"202:0

- (a) Calculate $P(L \cap W)$. (2)
- (b) Draw a Venn diagram, showing the events L and W . Fill in the probability corresponding to each of the four regions of your diagram. (3)
- (c) Determine whether the events L and W are independent, explaining your method clearly. (3)

(Total for question 3 is 8 marks)

- 4 Boxes of sweet contain toffees and chocolate. Box A contains 6 toffees and 4 chocolates, box B contains 5 toffees and 3 chocolates, and box C contains 3 toffees and 7 chocolates. One of the boxes is chosen at random and two sweets are taken out, one after the other, and eaten.

- (a) Find the probability that they are both toffees. (2)
- (b) Given that they are both toffees, find the probability that they both come from box A. (4)

(Total for question 4 is 6 marks)

5 Every year two teams, the Ramblers and the Strollers, meet each other for a quiz night. From past results it seems that in years when the Ramblers win, the probability of them winning the next year is 0.7 and in years when the Strollers win, the probability of them winning the next year is 0.5. It is not possible for the quiz to result in the scores being tied. The Ramblers won the quiz in 2009.

- (a) Draw a probability tree diagram for the three years up to 2012. (4)
- (b) Find the probability that the Strollers will win in 2012. (2)
- (c) If the Strollers win in 2012, what is the probability that it will be their first win for at least three years? (2)
- (d) Assuming that the Strollers win in 2012, find the smallest value of n such that the probability of the Ramblers winning the quiz for n consecutive years after 2012 is less than 5%. (2)

(Total for question 5 is 10 marks)

6 There are 90 players in a tennis club. Of these, 23 are juniors, the rest are seniors. 34 of the seniors and 10 of the juniors are male. There are 8 juniors who are left-handed, 5 of whom are male. There are 18 left-handed players in total, 4 of whom are female seniors.

- (a) Represent this information in a Venn diagram. (4)

What is the probability that:

- (b) a male player selected at random is left-handed? (2)
- (c) a left-handed player selected at random is a female junior? (2)
- (d) a player selected at random is either a junior or a female? (2)
- (e) a player selected at random is right-handed? (2)
- (f) a right-handed player selected at random is not a junior? (2)
- (g) a right-handed female player selected at random is a junior? (2)

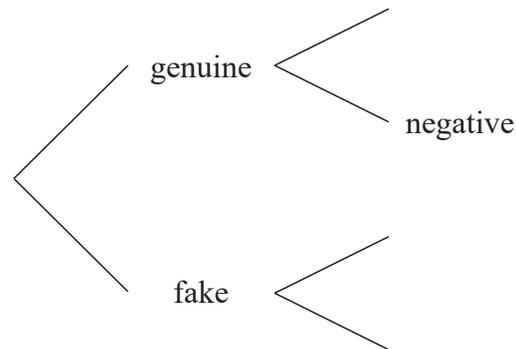
(Total for question 6 is 16 marks)

- 7 It has been estimated that 90% of paintings offered for sale at a particular auction house are genuine, and that the other 10% are fakes. The auction house has a test to determine whether or not a given painting is genuine. If this test gives a positive result, it suggests that the painting is genuine. A negative result suggests that the painting is a fake.

If a painting is genuine, the probability that the test result is positive is 0.95.

If a painting is a fake, the probability that the test result is positive is 0.2.

- (a) Copy and complete the probability tree diagram below, to illustrate the information above. (2)



Calculate the probabilities of the following events.

- (b) The test gives a positive result. (2)
- (c) The test gives a correct result (2)
- (d) The painting is genuine, given a positive result. (3)
- (e) The painting is a fake, given a negative result. (3)

A second test is more accurate, but very expensive. The auction house has a policy of only using this second test on those paintings with a negative result on the original test.

- (f) Using your answers to parts (d) and (e), explain why the auction house has this policy. (2)

The probability that the second test gives a correct result is 0.96 whether the painting is genuine or a fake.

- (g) Three paintings are independently offered for sale at the auction house.

Calculate the probability that all three paintings are genuine, are judged to be fakes in the first test, but are judged to be genuine in the second test. (4)

(Total for question 7 is 18 marks)