

Tree diagrams and independent events

About 55 minutes Calculator allowed 44 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/stats-tree-diagrams-and-independent-events/

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

A1 Needed today [2 marks] **A2** Last lesson [2 marks]

Write 0.0625 as a fraction in its simplest form.

Answer

Of 36 shoppers leaving a market, 28 bought bread, 9 bought cheese and 4 bought both. One is picked at random. Find the probability that they bought neither.

Answer

A3 From chapter 11 [2 marks] **A4** Maths skill [2 marks]

In a study, 111 of 500 runners who do not stretch got an injury, compared with 86 of 600 runners who stretch. Work out the relative risk of this for runners who do not stretch compared with runners who stretch. Give your answer to 2 decimal places.

Answer

In a sale, all prices are reduced by 40%. A coat costs £168 in the sale. What was its price before the sale?

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

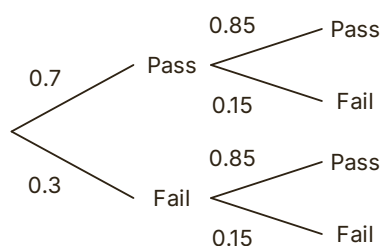
EXAMPLE 1

The probability that a bus is late is 0.15 on any day, independently of other days. Work out the probability that, on two days, (a) the bus is late on both days, (b) the bus is late on at least one of the days.

Hint "At least one" is everything except "none".

EXAMPLE 2

Sana takes a theory test and a first-aid test. She passes the theory test with probability 0.7 and the first-aid test with probability 0.85, independently. Work out the probability that she passes exactly one test.



Hint Exactly one can happen in two orders: pass then fail, or fail then pass.

B1 A machine has two parts. Part *A* fails with probability 0.08 and part *B* fails with probability 0.05, independently.

- (a) Work out the probability that both parts fail. [1 mark]

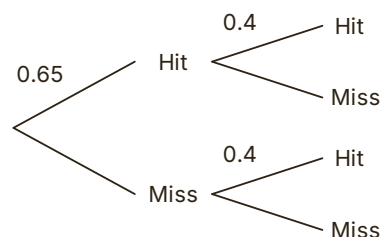
Answer

- (b) Work out the probability that at least one part fails. [2 marks]

Answer

Total for B1: 3 marks

B2 Jo throws two darts at a target. She hits it with the first dart with probability 0.65 and with the second dart with probability 0.4, independently.



- (a) Complete the tree diagram. [2 marks]

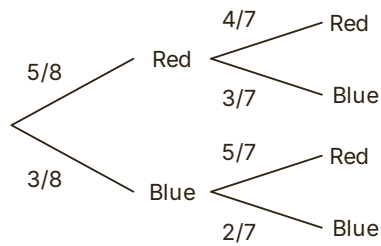
- (b) Work out the probability that Jo hits the target with exactly one dart. [2 marks]

Answer

Total for B2: 4 marks

EXAMPLE 3

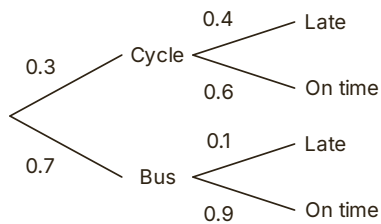
A bag has 5 red and 3 blue counters. Two counters are taken at random without replacement. Work out the probability that they are the same colour.



Hint After the first counter, there are 7 counters left, and one fewer of that colour.

EXAMPLE 4

Kai cycles to school with probability 0.3; otherwise he takes the bus. If he cycles, the probability that he is late is 0.4. If he takes the bus, it is 0.1. Work out the probability that Kai is late.



Hint The second branches depend on the first: use the right pair for each route.

- B3** A bag has 7 green and 4 yellow beads. Two beads are taken at random without replacement. Work out the probability that one bead of each colour is taken. [3 marks]

Answer

- B4** Mia's train is on time with probability 0.8. If it is on time, she gets a seat with probability 0.65. If it is late, she gets a seat with probability 0.25.

- (a) Work out the probability that Mia gets a seat. [2 marks]

Answer

- (b) Mia says, "I get a seat on more than half of my journeys." Is she right? Give a reason. [1 mark]

Total for B4: 3 marks

c Practice

- C1** Events A and B are independent. $P(A) = 0.4$ and $P(B) = 0.7$. Work out the probability that A happens and B does not. [2 marks]

Answer

- C2** A seed grows with probability 0.8, independently of other seeds. Three seeds are planted. Work out the probability that at least one seed grows. [2 marks]

Answer

- C3** A box has 12 eggs and 2 of them are cracked. Two eggs are taken at random without replacement. Work out the probability that both are cracked. [2 marks]

Answer

- C4** A counter is taken from a bag, its colour is noted and it is put back. This is done twice. The probability that both counters are red is 0.36. Each counter is red or blue. Work out the probability that one counter of each colour is taken. [3 marks]

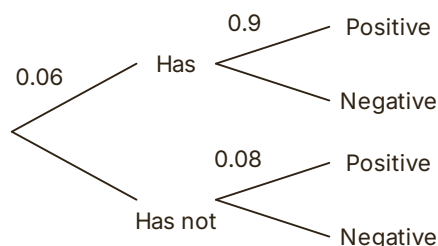
Answer

D Exam-style questions

- D1** In a large batch, 4% of light bulbs are faulty. Two bulbs are chosen at random. Tom says, "The probability that exactly one is faulty is $0.04 \times 0.96 = 0.0384$." [2 marks]

Is Tom correct? You must show your working.

- D2** At a clinic, 6% of the people tested have a condition. A test is positive for 90% of the people who have the condition and for 8% of the people who do not.



- (a) Complete the tree diagram. [2 marks]
- (b) Work out the probability that a person tested at random tests positive. [2 marks]

Answer

- (c) The clinic tests 2500 people. A manager says, "More than 250 of them will test positive." Is the manager right? Show how you decide. [2 marks]

Total for D2: 6 marks

- D3** A team of 3 is chosen at random from 6 boys and 4 girls. Work out the probability that the team has at least one girl. [3 marks]

Answer

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** A bag has n red counters and 4 blue counters. Two counters are taken at random without replacement. The probability that both are blue is $\frac{2}{15}$. Work out n . [3 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Write the probability of two blue counters in terms of n .
Hint 2 $\frac{4}{n+4} \times \frac{3}{n+3} = \frac{2}{15}$.
Hint 3 So $(n+4)(n+3) = 90 = 10 \times 9$, which gives $n = 6$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can multiply probabilities of independent events and find "at least one" as one minus "none". ☐ ☐ ☒

I can complete a tree diagram and add the routes for "exactly one" in both orders. ☐ ☐ ☒

I can draw a tree when the second probabilities change: without replacement, or when one event depends on another. ☐ ☐ ☒