



KS3.M-P7 Tree Diagrams for Independent Events

AQA KS3.M-P7 · Calculators not allowed · about 60 minutes

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** A fair coin is tossed once. State the probability of getting a head.

(1)

- 2** A 6-sided fair die is rolled once. State the probability of rolling an even number.

(1)

- 3** Two fair coins are tossed. Use a two-branch tree diagram idea to find the probability of getting two heads.

(2)

- 4** A bag contains a red and a blue counter. A counter is chosen, its colour noted, then it is replaced and the bag is shaken. A second counter is chosen. Find the probability the first is red and the second is blue.

(2)

- 5** A spinner has three equal regions labelled A, B and C. The spinner is spun twice. List all possible outcomes for the two spins and give the probability of outcome AB (first A then B).

(2)

- 6** A gardener has a 60% chance of watering her plants in the morning and a 30% chance of watering them in the evening. The two actions are independent. Find the probability she waters them both morning and evening on a given day.

(2)

- 7** A two-stage experiment has probabilities: Stage 1 gives success (S) with probability $\frac{2}{5}$ and failure (F) with probability $\frac{3}{5}$. If S occurs, Stage 2 has success with probability $\frac{1}{3}$ and failure with probability $\frac{2}{3}$. If F occurs, Stage 2 has success with probability $\frac{1}{4}$ and failure with probability $\frac{3}{4}$. Complete the tree probabilities and find the probability of success on both stages.

(3)

- 8** Two fair coins are tossed. Work out the probability of getting at least one tail.

(2)

- 9** A factory machine has a 0.1 chance of producing a faulty widget each time and 0.9 chance of a good widget. Two widgets are produced independently. Find the probability that exactly one of the two widgets is faulty.

(3)

- 10** Three independent events each have probability $\frac{2}{3}$ of happening. Find the probability that none of them happens.

(2)

- 11** A bag contains 2 red, 3 blue and 5 green counters. A counter is drawn, its colour noted and then replaced. This is repeated twice in total (two independent draws with replacement). Find the probability both draws give green.

(3)

- 12** An experiment has two independent stages. Stage 1 succeeds with probability 0.7 and fails with probability 0.3. Stage 2 succeeds with probability 0.5 and fails with probability 0.5, regardless of Stage 1. Find the probability that exactly one of the two stages succeeds.

(3)

- 13** Three independent tests each have probability 0.8 of passing. Find the probability that at least one test fails.

(3)

- 14** Three independent events each have probability 0.6 of happening. Find the probability that exactly two of them happen.

(3)

- 15** A bag contains 4 white and 1 black ball. A ball is drawn, colour noted, then replaced and the bag shaken. This is done twice. Construct a tree diagram and find the probability both draws are white.

(4)

- 16** A two-stage device works as follows. Stage A works with probability 0.25 independently of Stage B. Stage B works with probability 0.5. Find the probability that at least one of the two stages works.

(4)

- 17** A fair coin is tossed and a fair 6-sided die is rolled independently. Find the probability that the coin shows Heads or the die shows an even number (or both).

(4)

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- 18** Two biased coins are tossed independently. The first coin shows Heads with probability 0.6 and Tails with probability 0.4. The second coin shows Heads with probability 0.7 and Tails with probability 0.3.

Part a: Find the probability both coins show Heads.

Part b: Find the probability exactly one coin shows Heads.

- (a)** Find the probability both coins show Heads.

(2)

- (b)** Find the probability exactly one coin shows Heads.

(1)

Mark scheme · KS3.M-P7 Tree Diagrams for Independent Events

Question 1

- **B1** $\frac{1}{2}$ or 0.5 or 50% cao
- Answer: **$\frac{1}{2}$**

Question 2

- **B1** $\frac{3}{6} = \frac{1}{2}$ cao
- Answer: **$\frac{1}{2}$**

Question 3

- **M1** method: multiply probabilities for one branch, $\frac{1}{2} \times \frac{1}{2}$ or equivalent
- **A1** $\frac{1}{4}$ cao
- Answer: **$\frac{1}{4}$**

Question 4

- **M1** method: $\frac{1}{2} \times \frac{1}{2}$ or equivalent for independent draws with replacement
- **A1** $\frac{1}{4}$ cao
- Answer: **$\frac{1}{4}$**

Question 5

- **M1** list of 9 outcomes or recognition of all pairs: AA, AB, AC, BA, BB, BC, CA, CB, CC oe
- **A1** probability of AB = $\frac{1}{9}$ cao
- Answer: **Outcomes: AA, AB, AC, BA, BB, BC, CA, CB, CC; AB = $\frac{1}{9}$**

Question 6

- **M1** method: multiply 0.6×0.3 or 60% $\times$ 30%
- **A1** 0.18 or 18% cao
- Answer: **0.18**

Question 7

- **M1** correct completion of branch probabilities, e.g. S→S $\frac{2}{5} \times \frac{1}{3}$, S→F $\frac{2}{5} \times \frac{2}{3}$, F→S $\frac{3}{5} \times \frac{1}{4}$, F→F $\frac{3}{5} \times \frac{3}{4}$
- **M1** method: multiply for S then S branch: $\frac{2}{5} \times \frac{1}{3}$
- **A1** $\frac{2}{15}$ cao
- Answer: **$\frac{2}{15}$**

Question 8

- **M1** method: $1 - P(\text{no tails})$ or count branches: $1 - \frac{1}{4}$ or $\frac{3}{4}$
- **A1** $\frac{3}{4}$ cao
- Answer: **$\frac{3}{4}$**

Question 9

- **M1** method: two branches: faulty-good and good-faulty probabilities 0.1×0.9 and 0.9×0.1
- **M1** add the two branch probabilities
- **A1** 0.18 or 18% cao
- Answer: **0.18**

Question 10

- **M1** method: probability of not happening is $1 - \frac{2}{3} = \frac{1}{3}$; multiply three times: $(\frac{1}{3})^3$
- **A1** $\frac{1}{27}$ cao
- Answer: **$\frac{1}{27}$**

Question 11

- **M1** identify probability of green on one draw: $5/10 = 1/2$
- **M1** method: multiply probabilities for two independent draws: $1/2 \times 1/2$
- **A1** $1/4$ cao
- **Answer: $1/4$**

Question 12

- **M1** method: calculate probabilities for S then F and F then S: 0.7×0.5 and 0.3×0.5
- **M1** add the two branch probabilities
- **A1** 0.5 cao
- **Answer: 0.5**

Question 13

- **M1** method: find probability all three pass = 0.8^3
- **M1** method: subtract from 1 to get at least one fail: $1 - 0.8^3$
- **A1** 0.488 cao
- **Answer: 0.488**

Question 14

- **M1** method: probability of a given two happening and one not = $0.6^2 \times 0.4$
- **M1** multiply by 3 for the three possible choices of the single failure
- **A1** 0.432 cao
- **Answer: 0.432**

Question 15

- **M1** identify probabilities on branches: white $4/5$, black $1/5$ for each draw
- **M1** method: multiply for white-white branch: $4/5 \times 4/5$
- **M1** correct calculation to $16/25$ or decimal equivalent
- **A1** $16/25$ or 0.64 cao
- **Answer: $16/25$**

Question 16

- **M1** method: find probability neither works = $(1 - 0.25) \times (1 - 0.5) = 0.75 \times 0.5$
- **M1** method: calculate neither works = 0.375
- **M1** method: subtract from 1 to get at least one works: $1 - 0.375$
- **A1** 0.625 cao
- **Answer: 0.625**

Question 17

- **M1** identify $P(\text{Heads}) = 1/2$ and $P(\text{even}) = 1/2$
- **M1** identify $P(\text{Heads and even}) = 1/2 \times 1/2 = 1/4$
- **M1** use union formula: $P(\text{Heads or even}) = 1/2 + 1/2 - 1/4$
- **A1** $3/4$ or 0.75 cao
- **Answer: $3/4$**

Question 18

- (a) **M1** method: multiply probabilities for independent coins: 0.6×0.7
- (a) **A1** 0.42 cao
- (a) **Answer: 0.42**
- (b) **B1** $0.6 \times 0.3 + 0.4 \times 0.7 = 0.18 + 0.28 = 0.46$ cao
- (b) **Answer: 0.46**