



## KS3.M-P8 Mixed Probability Problem Set

AQA KS3.M-P8 · Calculators not allowed · about 70 minutes

Name: \_\_\_\_\_ Date: \_\_\_\_ / \_\_\_\_ / \_\_\_\_

**Answer ALL questions. Show all your working.**

- 1** A bag contains 5 red counters and 3 blue counters. A counter is chosen at random. Write down the probability that the counter is red.

(1)

- 2** A fair six-sided die is rolled once. What is the probability of rolling an even number?

(2)

- 3** A spinner is split into 8 equal sectors. Two adjacent sectors are shaded. Write down the probability of landing on a shaded sector.

(2)

- 4** A bag contains 4 green, 2 yellow and 4 black counters. One counter is chosen at random. Calculate the probability that the counter is not yellow.

(2)

- 5** A coin is flipped twice. List all possible outcomes and find the probability of getting exactly one head.

(3)

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- 6** Two dice are rolled. What is the probability that the total is 7?

(2)

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- 7** A bag contains 3 red, 3 white and 4 blue counters. Two counters are drawn at random without replacement. Calculate the probability that the first is red and the second is blue.

(3)

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- 8** A box contains 6 white and 2 black balls. A ball is drawn, its colour noted, then it is replaced. This experiment is repeated twice. Calculate the probability of drawing black then white in that order.

(2)

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- 9** A card is drawn at random from a set of 12 cards numbered 1 to 12. What is the probability the number is a multiple of 3?

(2)

- 10** A spinner has three equal sectors labelled A, B and C. The spinner is spun twice. Find the probability of getting A at least once.

(3)

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- 11** A bag contains 7 beads: 3 gold, 2 silver and 2 copper. One bead is picked at random. Give the probability that the bead is metal-coloured (silver or copper).

(2)

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- 12** A school has 40 students in a class. 25 students take music, 18 take art and 10 take both music and art. A student is chosen at random. Calculate the probability the student takes music or art.

(3)

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- 13** A fair 10-sided spinner is numbered 0 to 9. Two independent spins are made. What is the probability that the sum of the two numbers is 10?

(2)

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- 14** A jar contains 5 orange sweets and 7 lemon sweets. Two sweets are eaten at random without replacement. Find the probability both sweets are the same flavour.

(3)

- 15** A box contains slips labelled A, B, C, D, E. One slip is chosen at random and then replaced. This is repeated three times. Calculate the probability that letter A appears exactly once in the three draws.

(3)

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- 16** A fair coin is flipped until heads appears. What is the probability that heads appears for the first time on the third flip?

(4)

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- 17** A fair six-sided die is rolled. Given the result is an even number, what is the probability that it is a 6?

(3)

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- 18** Stretch question. A game uses two fair coins and one six-sided die. A player wins the prize if they get at least two heads from the two coins and roll a number greater than 4 on the die. Find the probability of winning.

(4)

## Mark scheme · KS3.M-P8 Mixed Probability Problem Set

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### Question 1

- **B1**  $\frac{5}{8}$  cao
- Answer:  **$\frac{5}{8}$**

### Question 2

- **M1** correct identification of 3 favourable outcomes (2,4,6) out of 6 or equivalent method
- **A1**  $\frac{1}{2}$  or  $\frac{3}{6}$  cao
- Answer:  **$\frac{1}{2}$**

### Question 3

- **M1** recognition that probability = shaded sectors / total sectors
- **A1**  $\frac{2}{8} = \frac{1}{4}$  cao
- Answer:  **$\frac{1}{4}$**

### Question 4

- **M1** correct total count 10 and recognition of non-yellow count 8
- **A1**  $\frac{8}{10} = \frac{4}{5}$  cao
- Answer:  **$\frac{4}{5}$**

### Question 5

- **M1** correct list of outcomes: HH, HT, TH, TT or equivalent
- **M1** identification of favourable outcomes HT and TH
- **A1**  $\frac{2}{4} = \frac{1}{2}$  cao
- Answer:  **$\frac{1}{2}$**

### Question 6

- **M1** recognition of 6 favourable outcomes out of 36
- **A1**  $\frac{6}{36} = \frac{1}{6}$  cao
- Answer:  **$\frac{1}{6}$**

### Question 7

- **M1** probability first red =  $\frac{3}{10}$  and then blue =  $\frac{4}{9}$  or equivalent
- **M1** product method used:  $(\frac{3}{10}) * (\frac{4}{9})$
- **A1**  $\frac{12}{90} = \frac{2}{15}$  cao
- Answer:  **$\frac{2}{15}$**

### Question 8

- **M1** recognition that replacement keeps probabilities the same: black  $\frac{2}{8}$ , white  $\frac{6}{8}$
- **A1**  $(\frac{2}{8}) * (\frac{6}{8}) = \frac{12}{64} = \frac{3}{16}$  cao
- Answer:  **$\frac{3}{16}$**

### Question 9

- **M1** identification of multiples of 3: 3,6,9,12 gives 4 favourable out of 12
- **A1**  $\frac{4}{12} = \frac{1}{3}$  cao
- Answer:  **$\frac{1}{3}$**

### Question 10

- **M1** recognition that easier to use complement: probability no A in two spins =  $(\frac{2}{3}) * (\frac{2}{3})$
- **M1** calculate  $(\frac{2}{3})^2 = \frac{4}{9}$
- **A1**  $1 - \frac{4}{9} = \frac{5}{9}$  cao
- Answer:  **$\frac{5}{9}$**

### Question 11

- **M1** recognition silver or copper count = 4 out of 7
- **A1**  $\frac{4}{7}$  cao
- **Answer:  $\frac{4}{7}$**

### Question 12

- **M1** use of inclusion-exclusion:  $25 + 18 - 10 = 33$  students take music or art
- **M1** recognition total 40 and forming probability  $\frac{33}{40}$
- **A1**  $\frac{33}{40}$  cao
- **Answer:  $\frac{33}{40}$**

### Question 13

- **M1** count pairs (0,10) invalid so valid ordered pairs are (1,9),(2,8),(3,7),(4,6),(5,5),(6,4),(7,3),(8,2),(9,1) = 9 pairs out of 100
- **A1**  $\frac{9}{100}$  cao
- **Answer:  $\frac{9}{100}$**

### Question 14

- **M1** probability both orange =  $(\frac{5}{12}) * (\frac{4}{11})$  and both lemon =  $(\frac{7}{12}) * (\frac{6}{11})$  recognised
- **M1** sum of probabilities computed:  $(\frac{20}{132}) + (\frac{42}{132}) = \frac{62}{132}$
- **A1**  $\frac{62}{132} = \frac{31}{66}$  cao
- **Answer:  $\frac{31}{66}$**

### Question 15

- **M1** probability of A on one draw =  $\frac{1}{5}$  and not A =  $\frac{4}{5}$  used and recognition of binomial count 3 positions
- **M1** compute  $3 * (\frac{1}{5}) * (\frac{4}{5})^2$
- **A1**  $3 * (\frac{1}{5}) * (\frac{16}{25}) = \frac{48}{125}$  cao
- **Answer:  $\frac{48}{125}$**

### Question 16

- **M1** recognition that first two flips must be tails with probability  $(\frac{1}{2}) * (\frac{1}{2})$
- **M1** recognition third flip must be heads with probability  $\frac{1}{2}$
- **M1** product method used:  $(\frac{1}{2})^3$
- **A1**  $\frac{1}{8}$  cao
- **Answer:  $\frac{1}{8}$**

### Question 17

- **M1** recognition conditional sample space of even numbers {2,4,6} size 3
- **M1** favourable outcome 6 is one of these
- **A1**  $\frac{1}{3}$  cao
- **Answer:  $\frac{1}{3}$**

### Question 18

- **M1** calculate probability of at least two heads from two coins: outcomes HH, HT, TH, TT so  $P(\text{at least two heads}) = P(HH) = \frac{1}{4}$
- **M1** calculate probability die > 4: favourable 5 or 6 gives  $\frac{2}{6} = \frac{1}{3}$
- **M1** recognition of independence and multiplication of probabilities
- **A1**  $(\frac{1}{4}) * (\frac{1}{3}) = \frac{1}{12}$  cao
- **Answer:  $\frac{1}{12}$**