

Probabilities Summing to 1

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

The probability that Amir is late for school is 0.08

Work out the probability that Amir is **not** late for school.

Amir is either late or not late, so the probabilities add up to 1.

$$P(\text{not late}) = 1 - 0.08$$

Answer: 0.92

2 (1 mark)

A shop sells phone cases that are either plastic or leather.

The probability that a phone case chosen at random is leather is $\frac{4}{11}$

Work out the probability that the phone case is plastic.

Each case is either plastic or leather, so $P(\text{plastic}) + P(\text{leather}) = 1$.

$$P(\text{plastic}) = 1 - \frac{4}{11}$$

$$= \frac{11}{11} - \frac{4}{11} = \frac{7}{11}$$

Answer: $\frac{7}{11}$

3 (4 marks)

Here is a 4-sided spinner.

The table shows the probabilities that the spinner lands on 1, 2 and 3

Number	1	2	3	4
Probability	0.12	0.25	0.31	x

- (a) Work out the value of x .

The four probabilities add up to 1.

Add the ones you know: $0.12 + 0.25 + 0.31 = 0.68$

$$x = 1 - 0.68 = 0.32$$

Answer: 0.32

Marks: 1 mark for $1 - (0.12 + 0.25 + 0.31)$. 1 mark for 0.32.

- (b) Mia spins the spinner 200 times.

Work out an estimate for the number of times the spinner lands on 3

Estimate = probability $\times$ number of spins

$$0.31 \times 200 = 62$$

Answer: 62

Tip: Multiply the probability by the number of spins. Dividing $(200 \div 0.31)$ gives an answer bigger than 200, which cannot be right.

Marks: 1 mark for 0.31×200 . 1 mark for 62.

4 (3 marks)

A bag contains red, blue, yellow and white counters.

A counter is taken at random.

The probability that it is yellow is the same as the probability that it is blue.

Colour	Red	Blue	Yellow	White
Probability		0.15		0.1

Work out the probability that the counter is red.

Yellow has the same probability as blue, so yellow = 0.15.

Blue, yellow and white: $0.15 + 0.15 + 0.1 = 0.4$

The probabilities add up to 1.

Red: $1 - 0.4 = 0.6$

Answer: 0.6

Tip: Fill in the yellow probability first. Then there is only one gap left in the table.

Marks: 1 mark for yellow = 0.15. 1 mark for $1 - (0.15 + 0.15 + 0.1)$. 1 mark for 0.6.

5 (3 marks)

There are only red, green and blue pens in a box.

The probability that a pen taken at random is red is $\frac{1}{4}$

The probability that it is green is $\frac{1}{3}$

There are 60 pens in the box.

Work out the number of blue pens.

Red pens: $\frac{1}{4}$ of 60 = 15

Green pens: $\frac{1}{3}$ of 60 = 20

Blue pens: $60 - 15 - 20 = 25$

(Or: $P(\text{blue}) = 1 - \frac{1}{4} - \frac{1}{3} = \frac{5}{12}$, and $\frac{5}{12} \times 60 = 25$.)

Answer: 25

Marks: 1 mark for $\frac{5}{12}$, or for 15 and 20. 1 mark for a full method, e.g. $60 - 15 - 20$. 1 mark for 25.

6 (4 marks)

A box of crisps contains only ready salted, cheese, vinegar and prawn flavour packets. A packet is taken at random from the box.

The table shows the probability that the packet is ready salted.

Flavour	ready salted	cheese	vinegar	prawn
Probability	0.28			

The numbers of cheese, vinegar and prawn packets are in the ratio 3 : 2 : 1
Complete the table.

Cheese, vinegar and prawn together: $1 - 0.28 = 0.72$

Share 0.72 in the ratio 3 : 2 : 1.

Total parts: $3 + 2 + 1 = 6$

One part: $0.72 \div 6 = 0.12$

Cheese: $3 \times 0.12 = 0.36$

Vinegar: $2 \times 0.12 = 0.24$

Prawn: $1 \times 0.12 = 0.12$

Flavour	ready salted	cheese	vinegar	prawn
Probability	0.28	0.36	0.24	0.12

Answer: cheese 0.36, vinegar 0.24, prawn 0.12

Tip: Take away the ready salted probability before you share in the ratio. Check at the end: the four probabilities add up to 1.

Marks: 1 mark for 0.72. 1 mark for $0.72 \div 6$. 1 mark for two correct values. 1 mark for all three correct.

7 (4 marks)

A café sells only four types of sandwich: chicken, tuna, egg and cheese. The table shows the probability that the next sandwich it sells is chicken and the probability that it is tuna.

Sandwich	chicken	tuna	egg	cheese
Probability	0.32	0.2		

- (a) The probability that the next sandwich sold is egg is 3 times the probability that it is cheese.

Complete the table.

$$\text{Egg and cheese together: } 1 - 0.32 - 0.2 = 0.48$$

Egg is 3 times cheese, so cheese is 1 part and egg is 3 parts: $1 + 3 = 4$ parts.

$$\text{Cheese} = 0.48 \div 4 = 0.12$$

$$\text{Egg} = 3 \times 0.12 = 0.36$$

Sandwich	chicken	tuna	egg	cheese
Probability	0.32	0.2	0.36	0.12

Answer: egg 0.36, cheese 0.12

Tip: Check both facts: $0.36 + 0.12 = 0.48$ **and** $0.36 = 3 \times 0.12$. Dividing 0.48 by 3 (instead of by 4 parts) is a common mistake.

Marks: 1 mark for 0.48 or $0.48 \div 4$. 1 mark for both correct.

- (b) On Monday the café sells 45 cheese sandwiches.
Work out an estimate for the number of chicken sandwiches it sells on Monday.

$P(\text{cheese}) = 0.12$, so 0.12 of the sandwiches sold is 45.

Total sandwiches = $45 \div 0.12 = 375$

Chicken = $0.32 \times 375 = 120$

Answer: 120

Tip: Find the total number of sandwiches first by **dividing** 45 by 0.12. Then multiply by the chicken probability. 0.32×45 uses the wrong total.

Marks: 1 mark for $45 \div 0.12$ (375). 1 mark for 120.

8 (3 marks)

There are 72 chocolates in a box.

Each chocolate is milk, dark or white.

There are twice as many milk chocolates as dark chocolates.

A chocolate is taken at random from the box.

The probability that it is white is $\frac{1}{6}$

Work out the number of dark chocolates in the box.

White: $\frac{1}{6}$ of 72 = 12 chocolates

Milk and dark together: $72 - 12 = 60$

Twice as many milk as dark, so milk : dark = 2 : 1

$$60 \div 3 = 20$$

Dark = 20 (milk = 40)

Answer: 20

Tip: "Twice as many milk as dark" means 3 equal parts altogether. Do not just halve 60.

Marks: 1 mark for 12 white (or $\frac{5}{6}$). 1 mark for $60 \div 3$ or for sharing in the ratio 2:1. 1 mark for 20.

9 (3 marks)

There are only red buttons, white buttons and blue buttons in a jar.

A button is taken at random from the jar.

The table shows the probabilities of getting a red button or a white button.

Colour	red	white	blue
Probability	0.35	0.4	

- (a) Work out the probability that the button is blue.

$$0.35 + 0.4 = 0.75$$

$$P(\text{blue}) = 1 - 0.75 = 0.25$$

Answer: 0.25

- (b) There are more than 50 buttons and fewer than 70 buttons in the jar.

Work out the number of buttons in the jar.

You must give a reason for your answer.

Write each probability as a fraction:

$$0.35 = \frac{7}{20}, \quad 0.4 = \frac{8}{20}, \quad 0.25 = \frac{5}{20}$$

So the number of buttons must be a multiple of 20 (or each number of buttons would not be a whole number).

The only multiple of 20 between 50 and 70 is 60.

Check: red $0.35 \times 60 = 21$, white $0.4 \times 60 = 24$, blue $0.25 \times 60 = 15$, all whole numbers ✓

Answer: 60

Tip: The number of buttons of each colour must be a whole number. Test your answer: $0.25 \times 65 = 16.25$, so 65 is not possible.

Marks: 1 mark for $\frac{7}{20}$ (or seeing that the total must be a multiple of 20). 1 mark for 60 with a correct reason.

10 (4 marks)

There are only green balloons, orange balloons and purple balloons in a bag.

The number of green balloons : the number of orange balloons = 3 : 5

There are 36 green balloons in the bag.

Rosa is going to take at random a balloon from the bag.

The probability that the balloon will be purple is 0.2

Work out the total number of balloons in the bag.

Green : orange = 3 : 5 and there are 36 green balloons.

One part: $36 \div 3 = 12$

Orange: $5 \times 12 = 60$

Green and orange together: $36 + 60 = 96$

$P(\text{purple}) = 0.2$, so green and orange are $1 - 0.2 = 0.8$ of the balloons.

Total = $96 \div 0.8 = 120$

Answer: 120

Tip: 96 balloons is 0.8 of the total, not 0.2. Divide by 0.8 to find the total.

Marks: 1 mark for 60 orange. 1 mark for 96. 1 mark for 0.8 or $96 \div 0.8$. 1 mark for 120.
