

Systematic Listing

Solutions

For AQA GCSE Mathematics (8300) • 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 (2 marks)

Amy (A), Ben (B) and Cara (C) stand in a line for a photo.

List all the possible orders.

One has been done for you.

Work systematically: fix the person on the left, then swap the other two.

Two orders start with A, two with B and two with C:

Left	Middle	Right
A	B	C
A	C	B
B	A	C
B	C	A
C	A	B
C	B	A

Answer: ABC, ACB, BAC, BCA, CAB, CBA

Tip: ABC has already been done for you, so you need to find 5 more orders. Do not write ABC again: repeats count as extras.

Marks: 2 marks for all 6 orders and no extras. 1 mark for at least 4 correct.

2 (3 marks)

Priya decorates a mug.

She chooses one colour

yellow (Y) or green (G)

and one pattern

spots (S) or stripes (T) or zigzags (Z)

- (a) List all the possible mugs Priya could make.

One has been done for you.

Take each colour in turn, and pair it with each pattern.

Yellow (Y): YS, YT, YZ

Green (G): GS, GT, GZ

That is $2 \times 3 = 6$ mugs.

Answer: YS, YT, YZ, GS, GT, GZ

Tip: Each mug has one colour and one pattern. Do not list mugs with two patterns, like ST.

Marks: 2 marks for all 6 and no extras. 1 mark for at least 4 correct.

- (b) What fraction of the possible mugs do **not** have spots?

There are 6 mugs altogether.

2 of them have spots: YS and GS.

So $6 - 2 = 4$ do not have spots.

Fraction: $\frac{4}{6} = \frac{2}{3}$

Answer: $\frac{4}{6}$ (or $\frac{2}{3}$)

Tip: Read the question carefully: it asks for the mugs that do **not** have spots.

3 (2 marks)

A pizza has two **different** toppings.

The toppings are chosen from

ham (H) olives (O) peppers (P) sweetcorn (S)

List all the possible pairs of toppings.

Start with H and pair it with each of the others: HO, HP, HS

Then O with the ones after it: OP, OS

Then P: PS

There are no new pairs starting with S.

Answer: HO, HP, HS, OP, OS, PS

Tip: HO and OH are the same pair of toppings. Only write each pair once.

Marks: 2 marks for all 6 and no repeats. 1 mark for at least 4 correct with no repeats.

4 (2 marks)

A garden centre sells plant pots in three sizes.

small £3 medium £5 large £8

Freya buys two pots.

The two pots can be the same size or different sizes.

Work out all the possible total costs.

Two pots the same size: $3 + 3 = 6$, $5 + 5 = 10$, $8 + 8 = 16$

Two different sizes: $3 + 5 = 8$, $3 + 8 = 11$, $5 + 8 = 13$

A small and a medium pot is the same as a medium and a small pot, so each pair is only counted once.

Answer: £6, £8, £10, £11, £13, £16

Tip: Remember the pots can be the same size. Students often forget pairs like small and small.

Marks: 2 marks for all 6 totals and no extras. 1 mark for at least 4 correct totals.

5 (2 marks)

Ria answers three true-or-false questions in a quiz.
She answers each question True (T) or False (F).

List all the possible ways she could answer the three questions.

Start with the answers that begin with T, then those that begin with F.

T first: TTT, TTF, TFT, TFF

F first: FTT, FTF, FFT, FFF

There are $2 \times 2 \times 2 = 8$ ways.

Answer: TTT, TTF, TFT, TFF, FTT, FTF, FFT, FFF

Tip: Order matters here: TTF, TFT and FTT are three different ways, because a different question gets the F each time.

Marks: 2 marks for all 8 and no repeats. 1 mark for at least 6 correct.

6 (3 marks)

Sam has three number cards.

3

5

8

He uses all three cards to make a 3-digit number.

(a) How many different numbers can Sam make?

List them in order, starting with the smallest first digit.

Starting with 3: 358, 385

Starting with 5: 538, 583

Starting with 8: 835, 853

That is 6 numbers.

Answer: 6

Marks: 1 mark for a systematic list. 1 mark for 6.

(b) How many of these numbers are even?

A number is even if its last digit is even.

The only even digit is 8.

Numbers ending in 8: 358 and 538

Answer: 2

7 (1 mark)

Two spinners are spun.

One spinner is labelled Red and Blue.

The other spinner is labelled 1, 2, 3 and 4

Pip says,

‘There are 6 possible outcomes.’

Is Pip correct? Tick a box.

Give a reason for your answer.

List the outcomes:

Red 1, Red 2, Red 3, Red 4

Blue 1, Blue 2, Blue 3, Blue 4

There are $2 \times 4 = 8$ outcomes, not 6.

Answer: No, there are 8 outcomes

8 (2 marks)

Zak has three coins: 5p, 10p and 20p

He picks two of the coins.

Write down all the possible total amounts of money.

List the pairs of coins:

5p and 10p: $5 + 10 = 15\text{p}$

5p and 20p: $5 + 20 = 25\text{p}$

10p and 20p: $10 + 20 = 30p$

Answer: 15p, 25p, 30p

Marks: 1 mark for at least 2 correct totals. 1 mark for all three and no extras.

9 (2 marks)

Chloe makes a fruit salad.

She chooses three **different** fruits from

apple (A) banana (B) cherries (C) grapes (G)

List all the possible options for the three fruits.

The first one has been done for you.

Choosing 3 of the 4 fruits is the same as leaving 1 out.

Leave out G: ABC

Leave out C: ABG

Leave out B: ACG

Leave out A: BCG

So there are only 4 options.

Answer: ABC, ABG, ACG, BCG

Marks: 2 marks for all 4 and no extras or repeats. 1 mark for 2 or 3 more correct.

10 (2 marks)

Dev (D), Erin (E), Fay (F) and Gus (G) run a relay race as a team.

Each of them runs one leg of the race.

Gus will run the **last** leg.

List all the possible orders in which they could run.

G is always last.

Then list the orders of D, E and F systematically.

D first: DEFG, DFEG

E first: EDFG, EFDG

F first: FDEG, FEDG

That is 6 orders.

Answer: DEFG, DFEG, EDFG, EFDG, FDEG, FEDG

Tip: Every order must end with G. With G fixed you are only putting three people in order, so there are $3 \times 2 \times 1 = 6$ orders.

Marks: 2 marks for all 6 and no extras. 1 mark for at least 4 correct.

11 (2 marks)

Ben is thinking of a 2-digit number.

Both digits are odd.

The two digits are different.

The number is greater than 50

The number is a multiple of 3

List all the possible numbers.

The odd digits are 1, 3, 5, 7, 9.

The number is greater than 50, so the first digit is 5, 7 or 9.

The digits must be different.

Starting with 5: 51, 53, 57, 59

Starting with 7: 71, 73, 75, 79

Starting with 9: 91, 93, 95, 97

A number is a multiple of 3 if its digits add up to a multiple of 3.

$5 + 1 = 6$, $5 + 7 = 12$, $7 + 5 = 12$, $9 + 3 = 12$

So the numbers are 51, 57, 75 and 93.

Answer: 51, 57, 75, 93

Tip: Check every condition for each number. Many students find numbers that meet some of the conditions but not all of them.

Marks: 1 mark for a systematic list of numbers above 50 with two different odd digits. 1 mark for all four answers and no extras.
