

# Additional training papers

## Illustrated worked solutions

Complete solutions to all 48 additional training questions. Each question has its own page with a labelled visual, worked explanation, final answer and 5-mark guide. Solutions are separate from the question papers.

### Set A / Foundation

Pages 2-17

Foundation: build confidence with short hints and visual models.

### Set B / Practice

Pages 18-33

Practice: work independently, then explain and check your method.

### Set C / Challenge

Pages 34-49

Challenge: repair mistakes, find possibilities and justify conclusions.

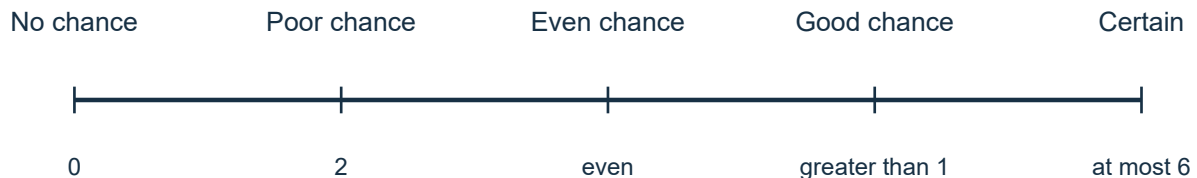
Accept equivalent correct methods and valid alternative designs. The guides explain where each of the 5 marks is earned. Sample experimental records are invented practice data, clearly identified in the questions; blank investigation tables should contain only real results if the learner performs the experiment.

Based on the supplied 27971797.pdf: Cambridge Primary Mathematics, Learner's Book 4, second edition (2021), Mary Wood and Emma Low. Scope: 4.1 Likelihood; 5.1 Tables, multiples and factors; 5.2 Multiplication; 6.1 2D shapes and tessellation; 6.2 Symmetry; 7.1 Understanding fractions; 7.2 Fractions as operators. Printed pages 54-60, 61-73, 75-86 and 88-98. These are original supplementary papers, independently prepared; they are not official Cambridge examinations.

# Probability

Question A4.1 | 5 marks | Worked explanation and marking guide

## A4.1 Choose a chance word



From impossible to certain

### 1. List the outcomes

The possible results are 1, 2, 3, 4, 5 and 6. Each face has the same chance.

### 2. Compare matching and non-matching results

a) 0 is absent: no chance. b) Only one face is 2: poor chance. c) 2, 4 and 6 are even; three other faces are odd: even chance. d) Five faces are greater than 1: good chance. e) Every face is at most 6: certain.

### 3. Check the wording

At most 6 means 6 or less. Good chance still allows the event not to happen.

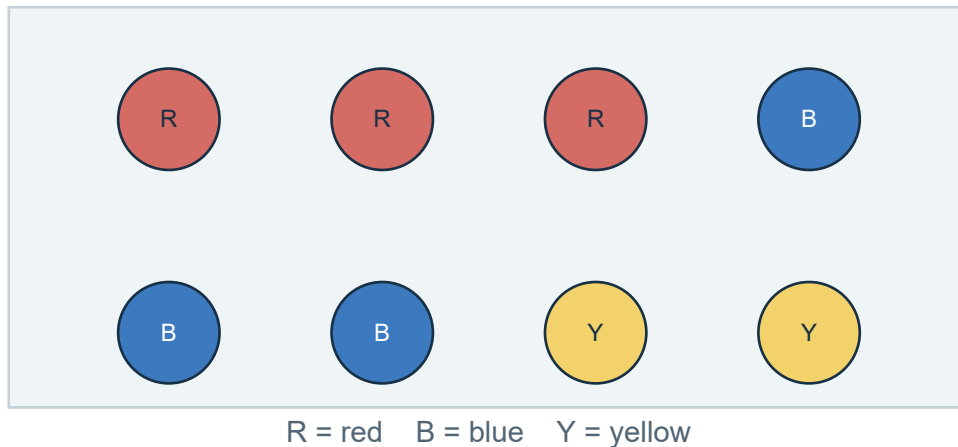
a) No chance; b) poor chance; c) even chance; d) good chance; e) certain.

Marking (5 marks): 1 mark per correct phrase. Accept impossible, unlikely and likely where appropriate.

# Probability

Question A4.2 | 5 marks | Worked explanation and marking guide

## A4.2 Read a bag of counters



### 1. Count the counters

There are 3 red, 3 blue and 2 yellow counters: 8 altogether.

### 2. Compare the groups

a) Red and blue are equally likely because each has 3 counters. b) Yellow is least likely among the colours present, with 2 counters.

### 3. Consider combined outcomes

c) Red or blue has a good chance: 6 counters fit, while only 2 do not. d) Green has no chance because none is present. e) Yes, R, B or Y is certain; every counter has one of those colours.

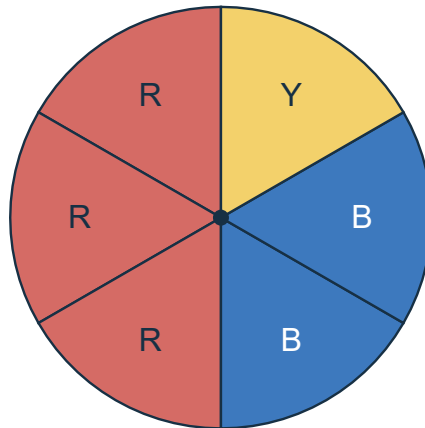
a) Red and blue; b) yellow; c) good chance; d) no chance; e) yes, certain.

Marking (5 marks): 1 mark for each part.

# Probability

Question A4.3 | 5 marks | Worked explanation and marking guide

## A4.3 A six-section spinner



Six equal sections

### 1. Count equal sections

There are 3 red sections, 2 blue sections and 1 yellow section. All 6 sections have the same size.

### 2. Compare with the rest

a) Red: even chance, since 3 sections are red and 3 are not. b) Blue: poor chance, since 2 are blue and 4 are not. c) Yellow: poor chance, since only 1 is yellow.

### 3. Finish the remaining events

d) Green: no chance, because no section is green. e) Red or blue: good chance, because 5 of the 6 sections match. The yellow section means this is not certain.

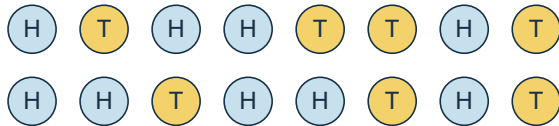
a) Even chance; b) poor chance; c) poor chance; d) no chance; e) good chance.

Marking (5 marks): 1 mark per correct phrase.

# Probability

Question A4.4 | 5 marks | Worked explanation and marking guide

## A4.4 Tally sixteen coin flips



Read the top row first.

| Result | Tally           | Total |
|--------|-----------------|-------|
| H      | <del>    </del> | 9     |
| T      | <del>    </del> | 7     |

### 1. Tally and check

The sample has 9 heads and 7 tails. Count each symbol once. Check:  $9 + 7 = 16$ .

### 2. Compare the totals

b) Heads occurred more often. The difference is  $9 - 7 = 2$ .

### 3. Predict without making a guarantee

c) The next head has an even chance because the coin is fair. d) No. Eight heads is a reasonable prediction for 16 flips, but a short experiment can give more or fewer heads.

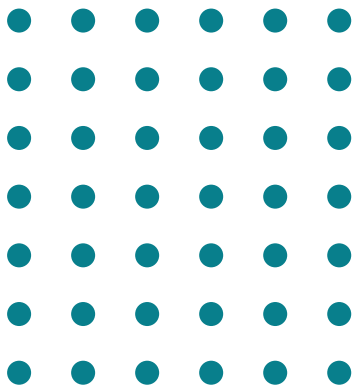
a) H: 9, T: 7; b) heads by 2; c) even chance; d) no, totals can vary.

Marking (5 marks): a) 1 for each correct tally and total row; b), c), d) 1 each. Part d needs a reason.

# Multiplication, multiples and factors

Question A5.1 | 5 marks | Worked explanation and marking guide

## A5.1 Build your seven-times table



7 equal rows

6 in each row

$$7 \times 6 = 42$$

### 1. Multiply in groups

a)  $7 \times 6 = 42$ . The array has 7 rows of 6. b)  $7 \times 9 = 63$ ; you can use  $7 \times 10 - 7 = 70 - 7$ . c)  $8 \times 7 = 56$ .

### 2. Use inverse facts

d)  $42 \div 7 = 6$  because  $7 \times 6 = 42$ . e)  $5 \times 7 = 35$ , so the missing number is 5.

### 3. Check

Multiplying the division answer by 7 returns 42. Every number in the table is reached by adding 7 again.

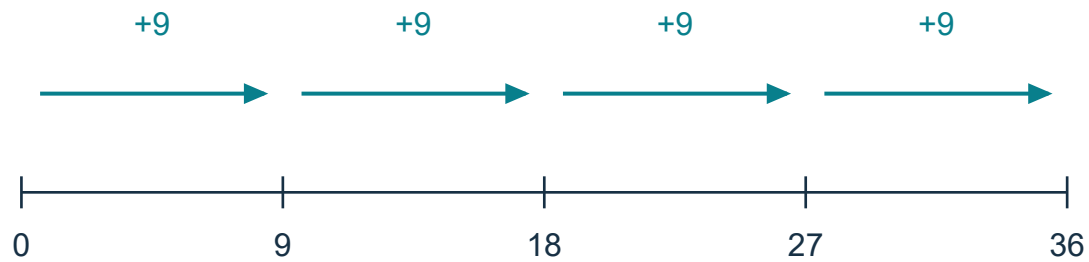
a) 42; b) 63; c) 56; d) 6; e) 5.

Marking (5 marks): 1 mark per correct answer.

# Multiplication, multiples and factors

Question A5.2 | 5 marks | Worked explanation and marking guide

## A5.2 Recognise multiples



### 1. Count in nines

a) 9, 18, 27, 36. These are  $1 \times 9$ ,  $2 \times 9$ ,  $3 \times 9$  and  $4 \times 9$ .

### 2. Use the six-times table

b) Circle 18, 24, 30 and 36: they are  $3 \times 6$ ,  $4 \times 6$ ,  $5 \times 6$  and  $6 \times 6$ .

### 3. Locate the non-multiple

c) The consecutive multiples around 35 are 30 and 36. There is no whole-number multiple of 6 equal to 35.

a) 9, 18, 27, 36; b) 18, 24, 30, 36; c) 35 lies between 30 and 36.

Marking (5 marks): a) 2 for all four in order, 1 for three correct; b) 2 for exactly the correct selections, 1 for one selection error; c) 1 for a valid reason.

# Multiplication, multiples and factors

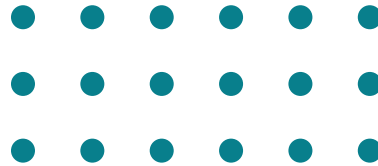
Question A5.3 | 5 marks | Worked explanation and marking guide

## A5.3 Factor pairs of eighteen

$$1 \times 18 = 18$$

$$2 \times 9 = 18$$

$$3 \times 6 = 18$$



3 rows × 6 columns

### 1. Find pairs

$1 \times 18 = 18$ ,  $2 \times 9 = 18$  and  $3 \times 6 = 18$ . Four and five do not divide 18 exactly. At  $6 \times 3$ , a pair repeats.

### 2. List the factors once

The factors are 1, 2, 3, 6, 9, 18. Both numbers in each pair belong in the list.

### 3. Draw and check

The model array has 3 rows of 6 dots, giving  $3 \times 6 = 18$ . Other correct arrays include  $2 \times 9$  and  $1 \times 18$ .

Pairs: (1,18), (2,9), (3,6). Factors: 1, 2, 3, 6, 9, 18.

Marking (5 marks): a) 2 for all pairs, 1 for two; b) 2 for the complete ordered list, 1 for one omission or extra; c) 1 for a labelled 18-dot rectangle.

# Multiplication, multiples and factors

Question A5.4 | 5 marks | Worked explanation and marking guide

## A5.4 A multiplication grid

|   |     |    |
|---|-----|----|
| × | 30  | 4  |
| 6 | 180 | 24 |

$$180 + 24 = 204$$

### 1. Estimate

34 rounds to 30. The estimate is  $30 \times 6 = 180$ .

### 2. Split and multiply

$34 = 30 + 4$ . Then  $30 \times 6 = 180$  and  $4 \times 6 = 24$ .

### 3. Add and check

$180 + 24 = 204$ . This is 24 above the estimate because the estimate left out 4 groups of 6.

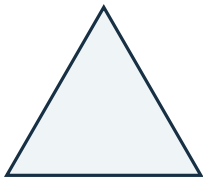
Estimate: 180. Exact answer: 204.

Marking (5 marks): a) 1; b) 1 for  $30 + 4$ , 1 for 180, 1 for 24 and 1 for 204.

## 2D shapes

Question A6.1 | 5 marks | Worked explanation and marking guide

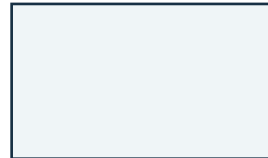
### A6.1 Sides, vertices and boundaries



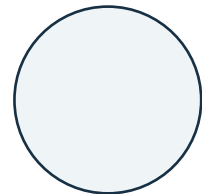
A: triangle



B: regular hexagon



C: rectangle



D: circle

#### 1. Count the corners and sides

A is an equilateral triangle: 3 sides and 3 vertices. B is a regular hexagon: 6 sides and 6 vertices.

#### 2. Describe the boundaries

C is a rectangle with 2 pairs of parallel opposite sides. D is a circle, whose curved boundary means it is not a polygon.

#### 3. Explain regular

B has all sides equal in length and all interior angles equal. A regular polygon needs both properties.

a) 3 and 3; b) 6 and 6; c) 2 pairs; d) curved boundary; e) equal sides and equal angles.

Marking (5 marks): 1 per part. Require both counts in a and b and both regularity properties in e.

## 2D shapes

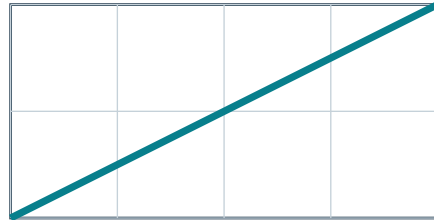
Question A6.2 | 5 marks | Worked explanation and marking guide

### A6.2 Two different cuts

a) Two squares



b) Two triangles



#### 1. Make two squares

Draw a vertical cut halfway along the left rectangle. Each piece is 2 grid squares long and 2 high, so both pieces are squares.

#### 2. Make two triangles

Draw a diagonal from one corner of the right rectangle to the opposite corner. Each piece has three straight sides.

#### 3. Keep the outline separate

Before cutting, the outside shape is a rectangle. The internal cut changes the pieces, not the original outside outline.

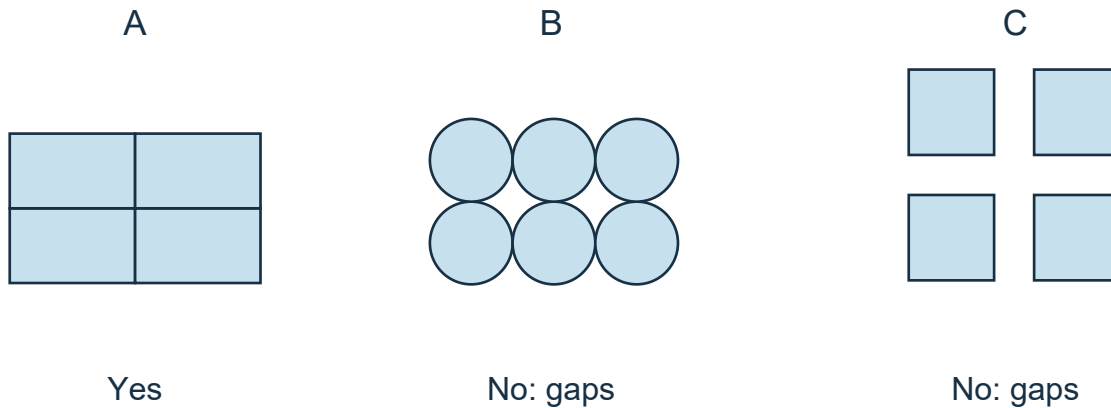
a) A vertical halfway cut; b) a corner-to-opposite-corner diagonal; c) rectangle.

Marking (5 marks): a) 1 for the cut and 1 for two squares; b) 1 for a full diagonal and 1 for two triangles; c) 1 for rectangle.

## 2D shapes

Question A6.3 | 5 marks | Worked explanation and marking guide

### A6.3 Look for gaps



#### 1. Check patch A

A tessellates. Its rectangles meet edge to edge with no gaps or overlaps; the rows can continue.

#### 2. Check patch B

B does not tessellate in this arrangement. The circles leave uncovered spaces between them.

#### 3. Check patch C

C does not tessellate in this arrangement. The separated squares leave gaps. A tessellation must cover the surface completely without overlapping.

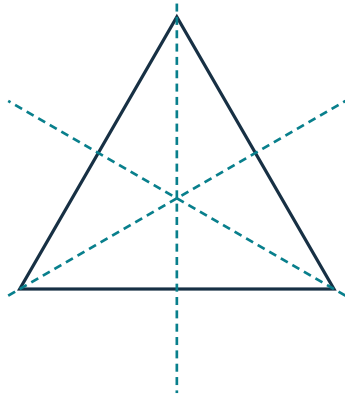
a) A: yes, B: no, C: no. b) Rectangles fit without gaps or overlaps. c) Circles leave gaps.

Marking (5 marks): a) 1 per decision; b) 1 for both no gaps and no overlaps; c) 1 for gaps between circles.

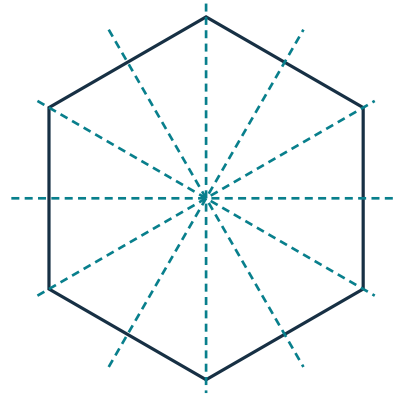
## 2D shapes

Question A6.4 | 5 marks | Worked explanation and marking guide

### A6.4 Fold lines in regular shapes



3 sides: 3 lines



6 sides: 6 lines

#### 1. Triangle

An equilateral triangle has 3 lines of symmetry. Each goes from a vertex to the middle of the opposite side.

#### 2. Hexagon

A regular hexagon has 6 lines: 3 join opposite vertices and 3 join the midpoints of opposite sides.

#### 3. Fold test

Fold along a proposed line. One half must match the other exactly. The line may be vertical, horizontal or slanted.

a) 3 lines; b) 6 lines; c) the two halves match exactly when folded.

Marking (5 marks): a) 1 for the count and 1 for all lines; b) the same; c) 1 for an exact-match explanation.

# Fractions

Question A7.1 | 5 marks | Worked explanation and marking guide

## A7.1 Name the shaded fractions



Equal-sized whole strips

### 1. Count all equal parts

A has 3 of its 6 equal parts shaded:  $\frac{3}{6}$ . B has 5 of its 8 equal parts shaded:  $\frac{5}{8}$ .

### 2. Read the numbers

In  $\frac{5}{8}$ , 5 is the numerator and 8 is the denominator. The numerator counts selected parts; the denominator counts all equal parts.

### 3. Find unit fractions

Circle  $\frac{1}{4}$  and  $\frac{1}{6}$ . Unit fractions have numerator 1.

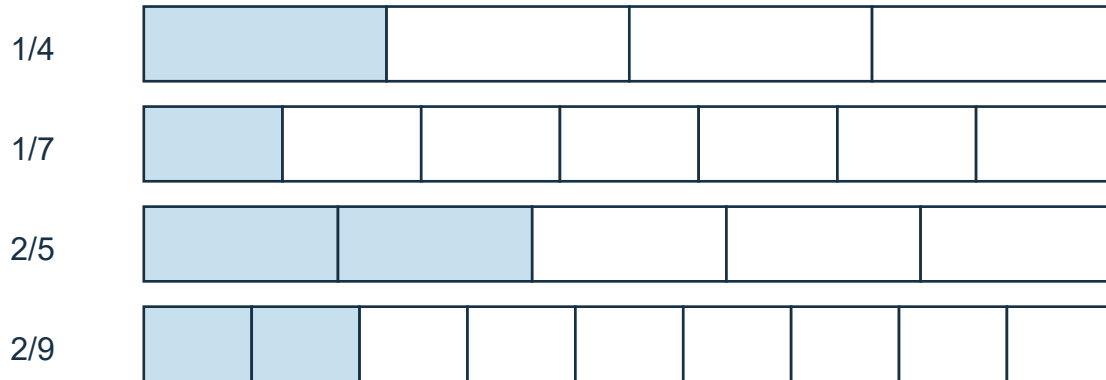
a) A:  $\frac{3}{6}$ , B:  $\frac{5}{8}$ ; b) numerator 5, denominator 8; c)  $\frac{1}{4}$  and  $\frac{1}{6}$ .

Marking (5 marks): a)  $1 + 1$ ; b)  $1 + 1$ ; c) 1 for exactly the two unit fractions. Accept  $\frac{1}{2}$  for strip A.

# Fractions

Question A7.2 | 5 marks | Worked explanation and marking guide

## A7.2 Compare equal-sized wholes



Equal-sized whole strips

### 1. Compare one part

One quarter is larger than one seventh. Dividing the same whole into 4 pieces makes larger pieces than dividing it into 7.

### 2. Compare two parts

Two fifths is larger than two ninths. Both select two pieces, but fifth-pieces are larger.

### 3. Order and explain

$1/10 < 1/5 < 1/2$ . With the same positive numerator and the same-sized whole, a larger denominator gives smaller pieces and a smaller fraction.

a)  $1/4$ ; b)  $2/5$ ; c)  $1/10 < 1/5 < 1/2$ .

Marking (5 marks): a) 1; b) 1; c) 2 for the complete order, 1 for one neighbouring pair reversed; d) 1 for the equal-parts explanation.

# Fractions

Question A7.3 | 5 marks | Worked explanation and marking guide

## A7.3 Find one equal share

Whole quantity: 52



$$52 \div 4 = 13; 1 \text{ selected part} = 13$$

### 1. Divide by the denominator

a)  $46 \div 2 = 23$ . b)  $27 \div 3 = 9$ . c)  $52 \div 4 = 13$ .

### 2. Continue the same method

d)  $60 \div 5 = 12$ . e)  $80 \div 10 = 8$ .

### 3. Use the bar to check

The illustrated whole 52 is split into 4 equal groups of 13. One group is  $\frac{1}{4}$  of the whole. Check:  $4 \times 13 = 52$ .

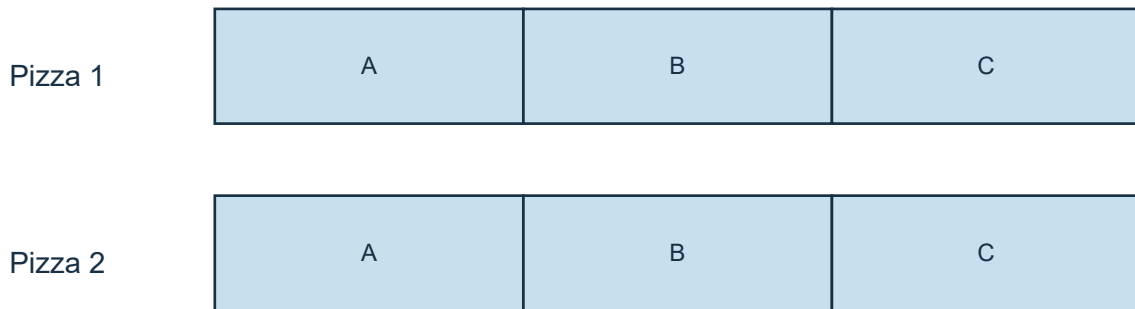
a) 23; b) 9; c) 13; d) 12; e) 8.

Marking (5 marks): 1 mark per correct answer with its division.

# Fractions

Question A7.4 | 5 marks | Worked explanation and marking guide

## A7.4 Share two pizzas



Each letter gets one piece from each pizza.

### 1. Write the division

Two pizzas shared among three friends is  $2 \div 3$ .

### 2. Divide and distribute

Cut each pizza into 3 equal pieces. Give each friend one piece from each pizza. Each friend receives two thirds of one pizza:  $2/3$ .

### 3. Check all the pieces

There are 6 third-pieces altogether. Each of the 3 friends gets 2. No pizza is left over and everyone receives the same amount. The rectangular bars are models of whole pizzas.

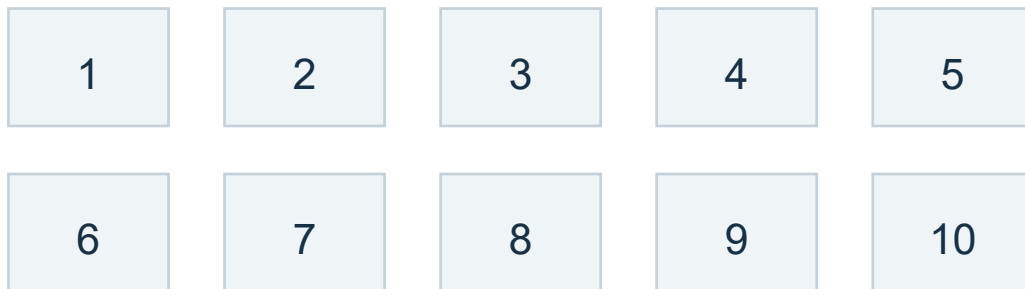
$2 \div 3 = 2/3$ . Each friend receives two thirds of one pizza.

Marking (5 marks): a) 1; b) 1; c) 1 for equal partitions and 1 for equal allocation; d) 1 for checking that all pizza is shared equally.

# Probability

Question B4.1 | 5 marks | Worked explanation and marking guide

## B4.1 Number cards and chance



### 1. List matching cards

a) Odd cards are 1, 3, 5, 7 and 9: 5 matching and 5 not matching. b) Greater than 7 means 8, 9 and 10: only 3 matches.

### 2. Compare with the rest

c) Cards 1 to 8 are less than 9: 8 matches and 2 non-matches. d) Only one card is 10. e) There is no card numbered 11.

### 3. Choose precise words

Use even chance for a, poor chance for b, good chance for c, poor chance for d and no chance for e. Possible does not mean certain.

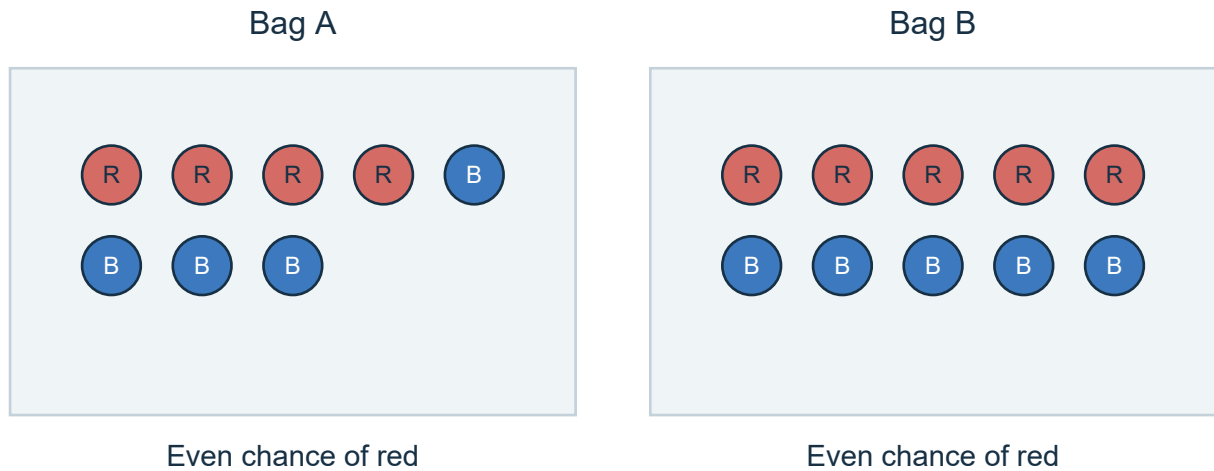
a) Even chance; b) poor chance; c) good chance; d) poor chance; e) no chance.

Marking (5 marks): 1 mark per correct chance phrase.

# Probability

Question B4.2 | 5 marks | Worked explanation and marking guide

## B4.2 Does a bigger bag help?



### 1. Compare red with non-red in each bag

A has 4 red and 4 non-red counters, so red has an even chance. B has 5 red and 5 non-red counters, so red also has an even chance.

### 2. Compare the bags

No, B does not give a better chance. Both bags have half red and half blue. B has more red counters, but it also has proportionally more blue counters.

### 3. Keep possibility and certainty separate

Neither bag guarantees red. A blue counter can be selected from either one.

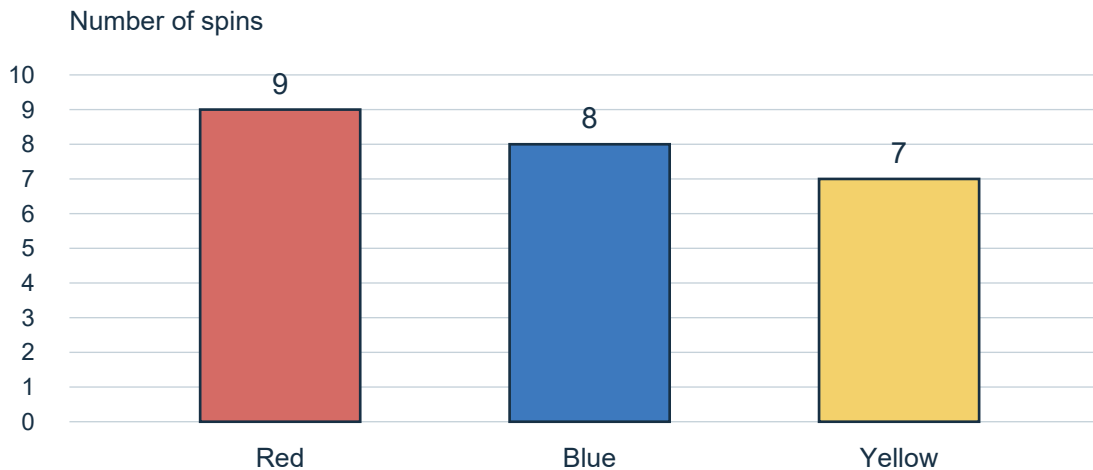
a) Even chance; b) even chance; c) equal chances; d) no.

Marking (5 marks): a) 1; b) 1; c) 1 for equal chances and 1 for equal red/non-red shares; d) 1.

# Probability

Question B4.3 | 5 marks | Worked explanation and marking guide

## B4.3 Read a spinner record



### 1. Add the counts

a)  $9 + 8 + 7 = 24$  spins. Each spin contributes exactly one recorded result.

### 2. Compare the record

b) Red appeared most often, with 9. c) The difference between red and yellow is  $9 - 7 = 2$ .

### 3. Do not turn a record into a guarantee

d) No. Another set can have different counts. These observations alone do not prove the hidden spinner's exact section sizes, and random outcomes can vary.

a) 24 spins; b) red; c) 2; d) no, a new sample can differ.

Marking (5 marks): a), b), c) 1 each; d) 1 for no and 1 for explaining variation or the limited evidence.

# Probability

Question B4.4 | 5 marks | Worked explanation and marking guide

## B4.4 Plan eighteen die rolls

| Face | Tally | Total |
|------|-------|-------|
| 1    |       |       |
| 2    |       |       |
| 3    |       |       |
| 4    |       |       |
| 5    |       |       |
| 6    |       |       |

### 1. Predict and prepare

a) Odd has an even chance because three faces are odd and three are even. b) Use six rows labelled 1 to 6, with tally and total columns.

### 2. Record one roll at a time

c) Roll, read the face and add one tally before the next roll. Stop at 18 rolls. Add the final totals and check that they sum to 18.

### 3. Interpret correctly

d) No. Eighteen divided by six is 3, but an even spread is not guaranteed in a short experiment. e) A 7 is impossible because it is not on this die. No actual results have been invented for this plan.

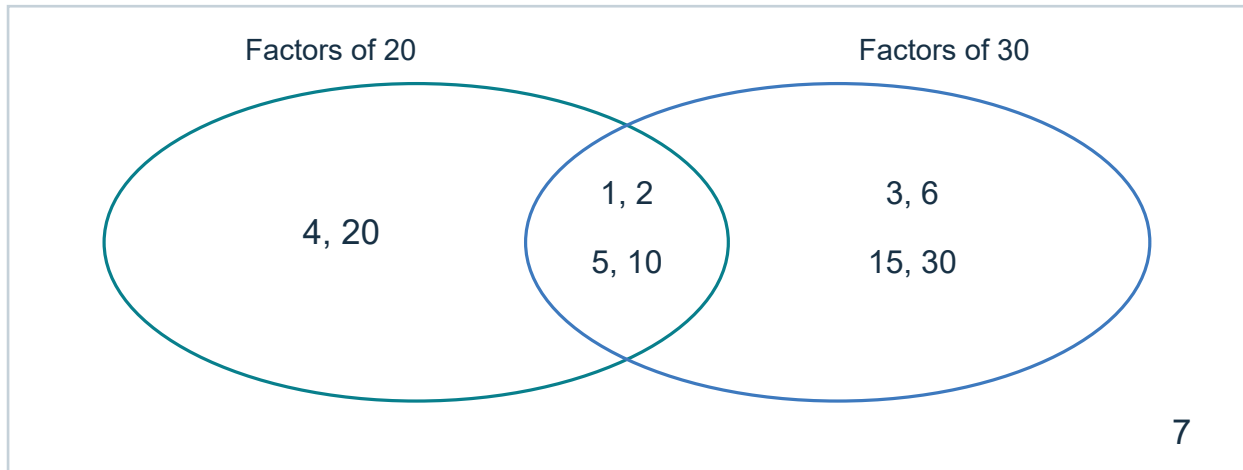
Even chance for odd; six tally rows; record each roll once; exact equal totals are not required; 7 is impossible.

Marking (5 marks): 1 mark per part. Require reasons for d and e; part c needs a clear recording/checking procedure.

# Multiplication, multiples and factors

Question B5.1 | 5 marks | Worked explanation and marking guide

## B5.1 Factor sorting



### 1. Find the factors

20 has factors 1, 2, 4, 5, 10, 20. 30 has factors 1, 2, 3, 5, 6, 10, 15, 30.

### 2. Sort the selected numbers

20 only: 4, 20. Both: 1, 2, 5, 10. 30 only: 3, 6, 15, 30. Neither: 7.

### 3. Read the overlap

The greatest number in both sets is 10. Check:  $20 \div 10 = 2$  and  $30 \div 10 = 3$ .

20 only: 4, 20. Both: 1, 2, 5, 10. 30 only: 3, 6, 15, 30. Neither: 7. Greatest overlap: 10.

Marking (5 marks): a) 1 per completely correct region; b) 1 for 10.

# Multiplication, multiples and factors

Question B5.2 | 5 marks | Worked explanation and marking guide

## B5.2 Regroup to make easy facts

$$9 \times (2 \times 5)$$



$$9 \times 10 = 90$$

$$(4 \times 25) \times 7$$



$$100 \times 7 = 700$$

### 1. Make a ten

a)  $18 \times 5 = (9 \times 2) \times 5 = 9 \times (2 \times 5) = 9 \times 10 = 90$ . Grouping 2 and 5 produces an easy multiplication by 10.

### 2. Make a hundred

b)  $(4 \times 25) \times 7 = 100 \times 7 = 700$ .

### 3. Explain the law

The associative law changes the grouping of factors without changing the answer. The order stays the same in these two worked examples.

a) 90; b) 700.

Marking (5 marks): a) 1 for substituting  $9 \times 2$ , 1 for useful regrouping with explanation, 1 for 90; b) 1 for grouping and 1 for 700.

# Multiplication, multiples and factors

Question B5.3 | 5 marks | Worked explanation and marking guide

## B5.3 A larger written multiplication

| × | 400  | 20  | 7  |
|---|------|-----|----|
| 6 | 2400 | 120 | 42 |

$$2400 + 120 + 42 = 2562$$

### 1. Estimate

427 rounds to 400. Estimate:  $400 \times 6 = 2400$ .

### 2. Multiply each place-value part

$427 = 400 + 20 + 7$ . The partial products are  $400 \times 6 = 2400$ ,  $20 \times 6 = 120$ , and  $7 \times 6 = 42$ . Add:  $2400 + 120 + 42 = 2562$ .

### 3. Check the direction

The exact result is above 2400 because the rounded number 400 is smaller than 427. The omitted 27 contributes  $27 \times 6 = 162$ , and  $2400 + 162 = 2562$ .

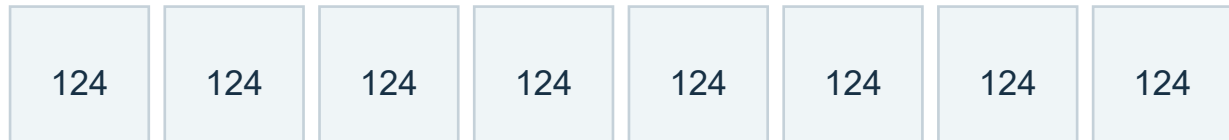
Estimate: 2400. Exact answer: 2562, above the estimate.

Marking (5 marks): a) 1; b) 2 for correct partial products or valid column stages and 1 for 2562; c) 1 for a correct reason.

# Multiplication, multiples and factors

Question B5.4 | 5 marks | Worked explanation and marking guide

## B5.4 Tickets in packets



Target: 1200 tickets

$$8 \times 124 = 992; \text{ shortage} = 208$$

### 1. Estimate

124 rounds to 120. Estimate:  $8 \times 120 = 960$  tickets.

### 2. Calculate the stock

$8 \times 124 = 8 \times (100 + 20 + 4) = 800 + 160 + 32 = 992$  tickets.

### 3. Compare with the target

There are not enough tickets. The shortage is  $1200 - 992 = 208$  tickets. Check by adding:  $992 + 208 = 1200$ .

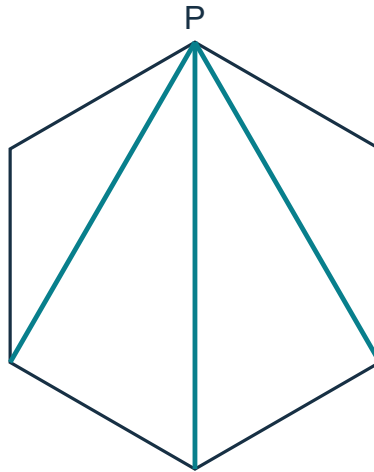
a) About 960; b) exactly 992; c) not enough, 208 more tickets are needed.

Marking (5 marks): a) 1; b) 1 for method and 1 for 992; c) 1 for shortage and 1 for 208 tickets.

## 2D shapes

Question B6.1 | 5 marks | Worked explanation and marking guide

### B6.1 Divide a hexagon into triangles



#### 1. Choose diagonals

Join P to the three vertices that are neither P itself nor its two immediate neighbours. A line to a neighbour would only follow an existing side.

#### 2. Count the pieces

The three diagonals form four triangles. The lines meet only at P, so no extra crossing creates another piece.

#### 3. Check the boundary

The outside still has 6 straight sides. The new internal lines are not extra outside sides.

Three diagonals from P create 4 triangles. The outer boundary still has 6 sides.

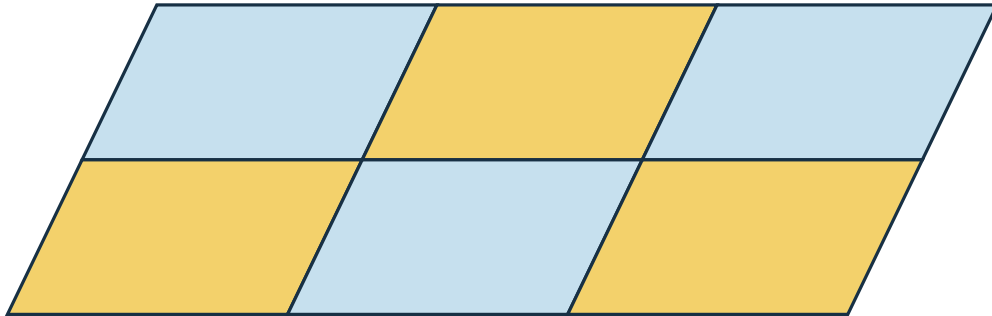
Marking (5 marks): a) 1 per correct diagonal; b) 1 for 4; c) 1 for 6.

## 2D shapes

Question B6.2 | 5 marks | Worked explanation and marking guide

### B6.2 Tessellate a parallelogram

Six matching parallelograms



#### 1. Make a row

Place copies side by side so the slanted edges coincide. All copies must keep the same size and shape.

#### 2. Add another row

Shift the next row to match the top edges of the first row. The model has three tiles in each of two rows. Every shared edge is fully covered.

#### 3. Continue the rule

Repeat the same sideways and upward shifts. Matching opposite parallel edges lets the patch grow with no internal gaps or overlaps.

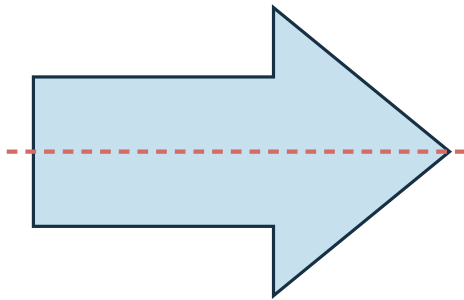
One valid answer is two offset rows of three identical parallelograms.

Marking (5 marks): a) 1 for six or more tiles, 1 for identical parallelograms, 1 for no gaps, 1 for no overlaps with visible boundaries; b) 1 for a valid repeat rule.

## 2D shapes

Question B6.3 | 5 marks | Worked explanation and marking guide

### B6.3 An arrow and a parallelogram



Arrow: 1 line



Parallelogram: 0 lines

#### 1. Fold the arrow

The arrow has 1 horizontal line through its middle. The top folds onto the bottom. A vertical fold would put the arrowhead onto the flat tail, so that does not match.

#### 2. Test the parallelogram

The illustrated parallelogram has 0 lines of symmetry. It is neither a rectangle nor a rhombus; each proposed reflection mismatches its corners or sides.

#### 3. Use the counterexample

The claim is false. This parallelogram is a four-sided polygon but has no reflection symmetry. Turning it half a turn is not the fold test.

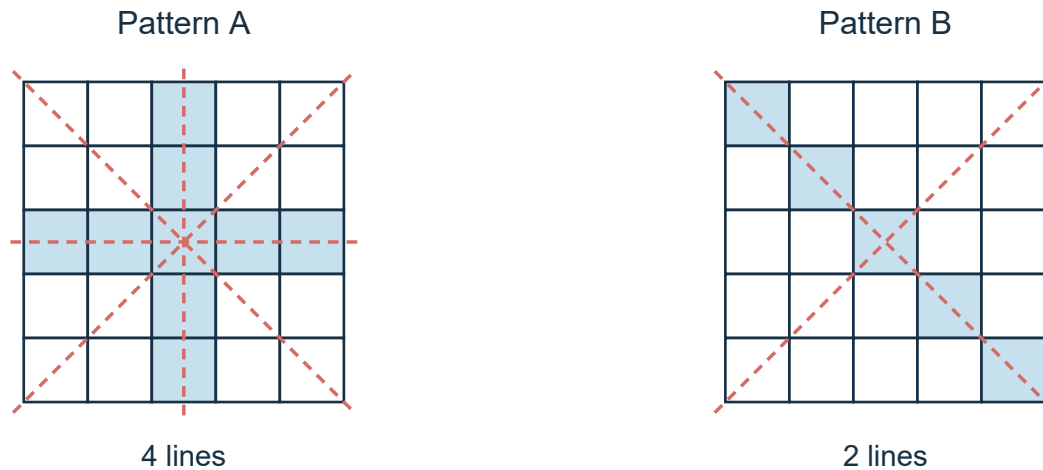
a) 1 horizontal line; b) 0 lines; c) false.

Marking (5 marks): a) 1 for the line and 1 for the count; b) 1 for zero and 1 for a valid mismatch explanation; c) 1 for false.

## 2D shapes

Question B6.4 | 5 marks | Worked explanation and marking guide

### B6.4 Look for diagonal symmetry



#### 1. Pattern A

The cross has 4 symmetry lines: vertical, horizontal and the two diagonals. All reflected shaded cells land on shaded cells.

#### 2. Pattern B

The diagonal stripe has 2 symmetry lines, both diagonals of the outside square. Reflecting along either diagonal preserves the stripe.

#### 3. Reject the vertical line

The shaded top-left square would reflect to the unshaded top-right square. Because those cells do not match, the vertical centre line is not a symmetry line.

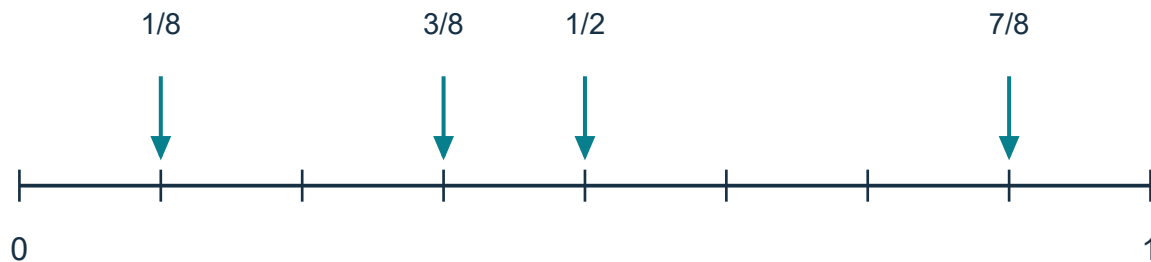
A: 4 lines. B: 2 diagonal lines. A vertical fold mismatches B's top corner cells.

Marking (5 marks): a) 1 for count and 1 for all lines; b) 1 for count and 1 for both diagonals; c) 1 for a specific mismatched pair.

# Fractions

Question B7.1 | 5 marks | Worked explanation and marking guide

## B7.1 Eighths on a number line



$$\text{Halfway} = 4/8 = 1/2$$

### 1. Count equal spaces

Each interval has length  $1/8$ . Begin at 0 and count spaces, not the number of tick marks.

### 2. Place the labels

$1/8$  is one interval after 0;  $3/8$  is three intervals after 0;  $1/2$  is four intervals after 0;  $7/8$  is one interval before 1.

### 3. Name the halfway point

Half of eight equal intervals is four intervals. Therefore  $1/2 = 4/8$ .

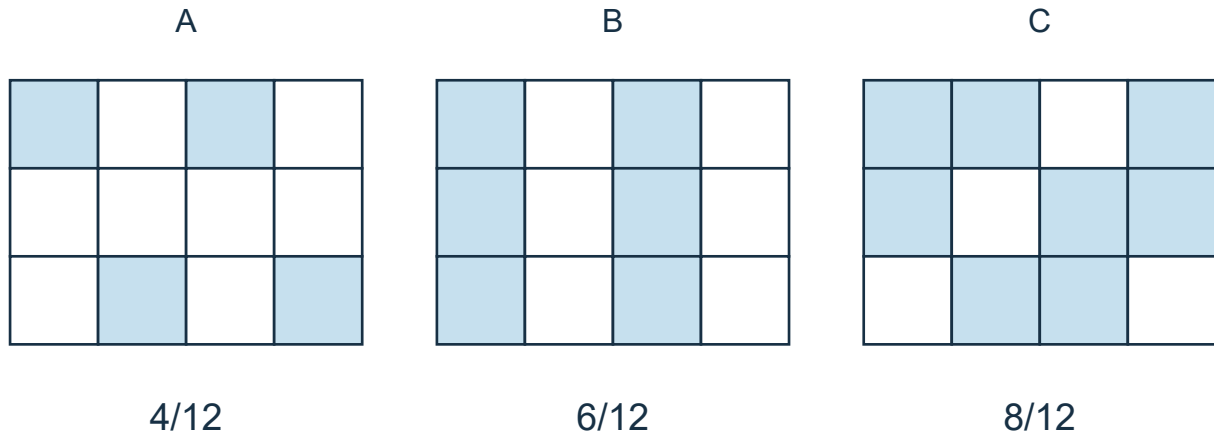
a) Ticks 1, 3, 4 and 7 after 0; b)  $4/8$ .

Marking (5 marks): a) 1 per correctly placed label; b) 1 for  $4/8$ .

# Fractions

Question B7.2 | 5 marks | Worked explanation and marking guide

## B7.2 Fractions need not be in one block



### 1. Count equal squares

A has 4 shaded squares, B has 6, and C has 8. Each whole contains 12 equal squares. Their fractions are  $4/12$ ,  $6/12$  and  $8/12$ .

### 2. Identify half

B has half shaded because 6 of its 12 squares are shaded and 6 are unshaded.

### 3. Ignore position when counting area

Yes. Shaded parts need not touch. Add the areas of all shaded equal squares; the selected amount is the same wherever those squares lie.

a) A:  $4/12$ , B:  $6/12$ , C:  $8/12$ ; b) B; c) yes, count all selected equal parts.

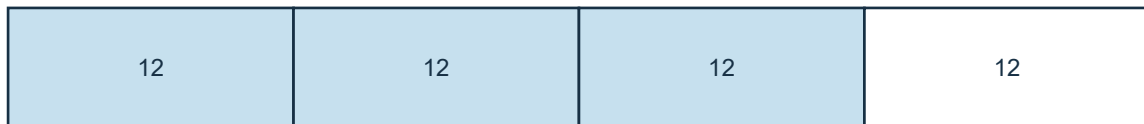
Marking (5 marks): a) 1 per fraction; b) 1; c) 1 for yes with a correct equal-area explanation.

# Fractions

Question B7.3 | 5 marks | Worked explanation and marking guide

## B7.3 One part, then three parts

Whole quantity: 48



$$48 \div 4 = 12; 3 \text{ selected parts} = 36$$

### 1. Find unit fractions

a)  $54 \div 6 = 9$ . b)  $72 \div 8 = 9$ . c)  $130 \div 10 = 13$ .

### 2. Find one quarter

For d,  $48 \div 4 = 12$ . So each quarter contains 12.

### 3. Select three quarters

$3 \times 12 = 36$ . In the bar, three of the four equal parts are selected. Check: the selected 36 and remaining 12 add to 48.

a) 9; b) 9; c) 13; d) 36.

Marking (5 marks): a), b), c) 1 each with division; d) 1 for finding 12 and 1 for multiplying by 3 to get 36.

# Fractions

Question B7.4 | 5 marks | Worked explanation and marking guide

## B7.4 A quarter-sized recipe

| Ingredient | For 20 | For 5 |
|------------|--------|-------|
| Flour      | 320 g  | 80 g  |
| Butter     | 160 g  | 40 g  |
| Sugar      | 80 g   | 20 g  |
| Milk       | 200 ml | 50 ml |

Divide every amount by 4.

### 1. Find the fraction

Five is one quarter of twenty. Divide every ingredient amount by 4 to make one quarter of the recipe.

### 2. Calculate

Flour:  $320 \div 4 = 80$  g. Butter:  $160 \div 4 = 40$  g. Sugar:  $80 \div 4 = 20$  g. Milk:  $200 \div 4 = 50$  ml.

### 3. Check the recipe stays balanced

All ingredients use the same fraction so the recipe keeps its proportions. Multiplying the new amounts by 4 returns the original amounts.

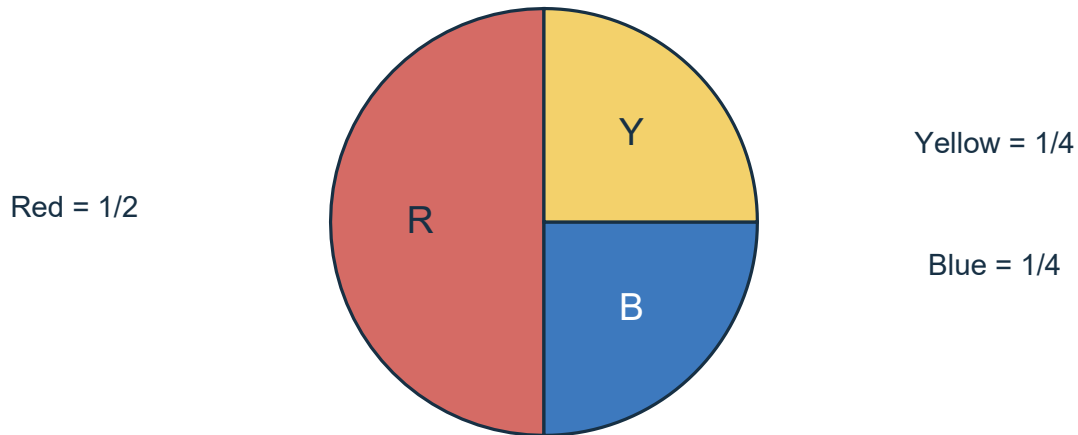
80 g flour, 40 g butter, 20 g sugar and 50 ml milk; use one quarter.

Marking (5 marks): a) 1 per correct amount and unit; b) 1 for one quarter with a reason.

# Probability

Question C4.1 | 5 marks | Worked explanation and marking guide

## C4.1 Unequal spinner sections



### 1. Compare areas

Red fills half the circle and the other colours together fill the other half. Red therefore has an even chance. Blue and yellow have equal chances because their sections have the same area.

### 2. Test the claim

The learner is incorrect. The number of colour names does not decide the chance: the sizes of the sections matter. Red covers twice as much of the circle as either blue or yellow.

### 3. Check certainty

Red is not certain. A spin can still land in either the blue or yellow section.

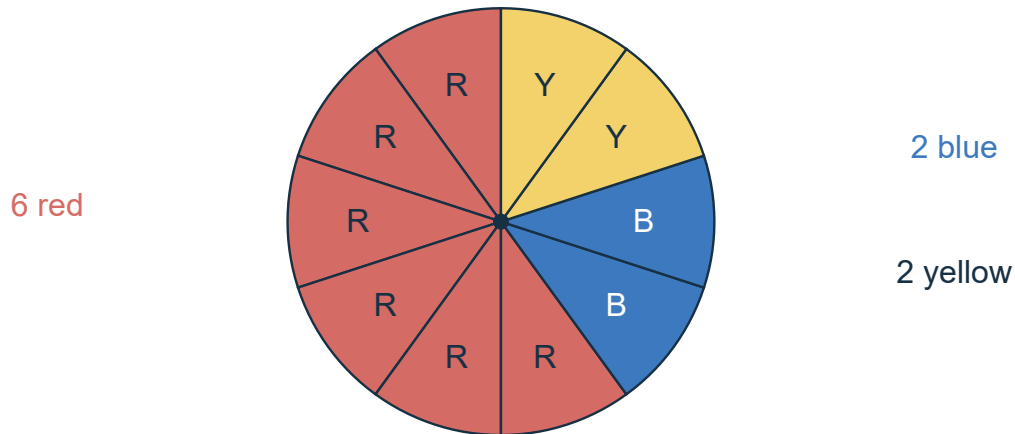
a) Even chance; b) equally likely; c) incorrect, section sizes differ; d) no.

Marking (5 marks): a) 1; b) 1; c) 1 for rejecting the claim and 1 for comparing areas; d) 1.

# Probability

Question C4.2 | 5 marks | Worked explanation and marking guide

## C4.2 Find every possible red count



### 1. Build a valid example

One design has 6 red, 2 blue and 2 yellow sections. Red occupies more than half; each other colour occupies less than half.

### 2. Find the lower and upper limits

Red must occupy more than 5 sections to have a good chance. At least one blue and one yellow must remain, so red can occupy no more than 8.

### 3. List and check all possibilities

The red counts are 6, 7 and 8. Examples are 6R-2B-2Y, 7R-1B-2Y and 8R-1B-1Y. With each of these red counts, the remaining positive blue and yellow counts are each below 5.

Example: 6 red, 2 blue, 2 yellow. All possible red counts: 6, 7, 8.

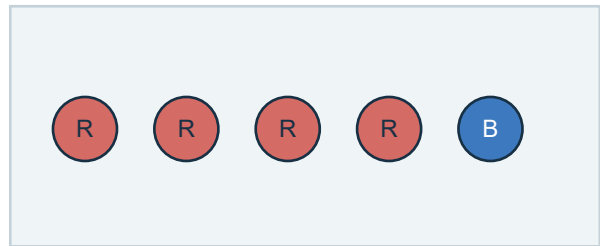
Marking (5 marks): a) 1 for a labelled ten-section design using every colour and 1 for meeting all chances; b) 1 for exactly 6,7,8, 1 for the lower limit and 1 for the upper limit.

# Probability

Question C4.3 | 5 marks | Worked explanation and marking guide

## C4.3 A hidden bag: evidence or proof?

| Colour | Sample count |
|--------|--------------|
| Red    | 32           |
| Blue   | 8            |
| Green  | 0            |



One plausible model

### 1. Suggest a model

A plausible bag has 4 red counters and 1 blue counter. Red appeared about four times as often as blue in the sample, so this model fits the observed balance.

### 2. Separate evidence from proof

The record does not prove those exact contents. Random samples can differ from the makeup of a bag. No observed green also does not prove that green is absent; a green counter might not have been selected.

### 3. Predict cautiously

The next pick could be blue. Replacing each counter keeps the bag contents the same, and previous red results do not force the next result to be red.

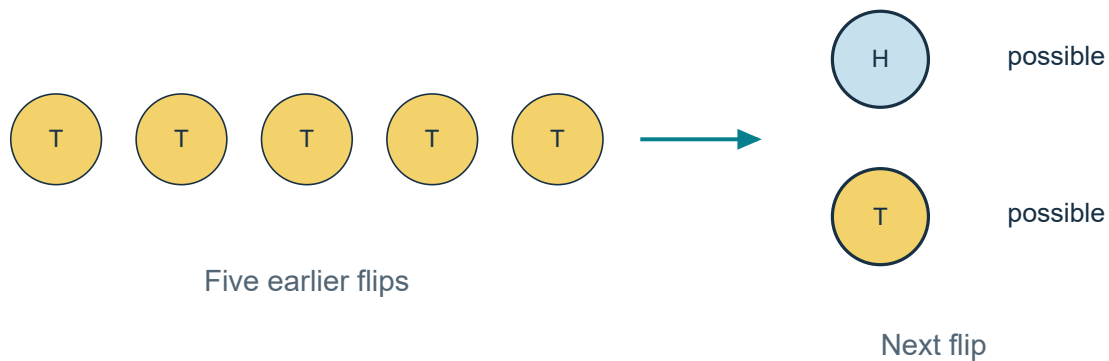
a) A plausible model is 4 red and 1 blue. b) No. c) No. d) Yes.

Marking (5 marks): a) 1 for a plausible five-counter model and 1 for linking it to the sample; b), c), d) 1 each. Accept justified alternatives.

# Probability

Question C4.4 | 5 marks | Worked explanation and marking guide

## C4.4 Is a head due?



### 1. Use the fair-coin model

a) A head still has an even chance on the next flip. A tail has an even chance too.

### 2. Reject the balancing claim

b) Earlier flips do not force the next result. The coin does not remember or repair the record, so either side can appear next.

### 3. Distinguish unlikely from impossible

c) Five tails is possible, although a particular long run may be uncommon. d) No. Ten further flips can contain more or fewer than five heads. Equal chance does not guarantee equal counts in a short run.

a) Even chance; b) either side can occur, regardless of previous flips; c) no; d) no.

Marking (5 marks): a) 1; b) 1 for rejecting a forced head and 1 for explaining that earlier flips do not determine the next; c) 1; d) 1.

# Multiplication, multiples and factors

Question C5.1 | 5 marks | Worked explanation and marking guide

## C5.1 Why does thirty-six have an odd count?

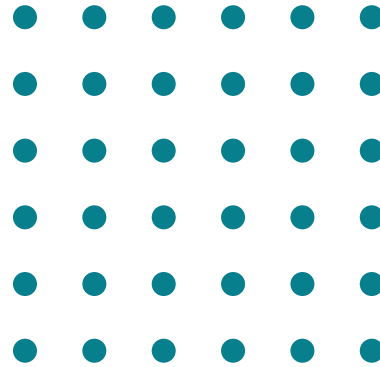
$$1 \times 36 = 36$$

$$2 \times 18 = 36$$

$$3 \times 12 = 36$$

$$4 \times 9 = 36$$

$$6 \times 6 = 36$$



6 rows  $\times$  6 columns

### 1. Find every pair

The pairs are  $1 \times 36$ ,  $2 \times 18$ ,  $3 \times 12$ ,  $4 \times 9$  and  $6 \times 6$ . Five does not divide 36 exactly; later pairs reverse ones already found.

### 2. List distinct factors

1, 2, 3, 4, 6, 9, 12, 18, 36. There are 9 distinct positive factors.

### 3. Explain the odd count

Most pairs contribute two different factors. The square pair  $6 \times 6$  contributes just one distinct factor, 6. Thus four ordinary pairs give 8 factors and the square pair adds 1: 9 altogether.

Pairs: (1,36), (2,18), (3,12), (4,9), (6,6). Factors: 1,2,3,4,6,9,12,18,36.

Marking (5 marks): a) 2 for all pairs, 1 for three or four; b) 2 for the full ordered list, 1 for one error; c) 1 for explaining the repeated 6 in the square pair.

# Multiplication, multiples and factors

Question C5.2 | 5 marks | Worked explanation and marking guide

## C5.2 Repair a multiplication mistake

|   |     |    |
|---|-----|----|
| × | 50  | 7  |
| 8 | 400 | 56 |

Correct:  $400 + 56 = 456$

### 1. Locate the first error

a) The error is  $7 \times 8 = 54$ . The place-value split  $57 = 50 + 7$  and  $50 \times 8 = 400$  are correct.

### 2. Repair the calculation

b)  $7 \times 8 = 56$ . c) The correct total is  $400 + 56 = 456$ .

### 3. Estimate and explain

d) Round 57 to 60:  $60 \times 8 = 480$ . e) This is above the exact result because 60 is 3 more than 57; the estimate adds  $3 \times 8 = 24$ . Check:  $480 - 24 = 456$ .

a)  $7 \times 8$  was wrong; b) 56; c) 456; d) 480; e) rounding up makes the product larger.

Marking (5 marks): 1 mark per part. Part e needs a reason.

# Multiplication, multiples and factors

Question C5.3 | 5 marks | Worked explanation and marking guide

## C5.3 Make the greatest product

| Calculation   | Product |
|---------------|---------|
| $24 \times 7$ | 168     |
| $27 \times 4$ | 108     |
| $42 \times 7$ | 294     |
| $47 \times 2$ | 94      |
| $72 \times 4$ | 288     |
| $74 \times 2$ | 148     |

### 1. Organise by the one-digit multiplier

With multiplier 7:  $24 \times 7$  and  $42 \times 7$ . With multiplier 4:  $27 \times 4$  and  $72 \times 4$ . With multiplier 2:  $47 \times 2$  and  $74 \times 2$ . These cover every choice and both orders of the remaining digits.

### 2. Calculate all six

$24 \times 7 = 168$ ;  $42 \times 7 = 294$ ;  $27 \times 4 = 108$ ;  $72 \times 4 = 288$ ;  $47 \times 2 = 94$ ;  $74 \times 2 = 148$ .

### 3. Compare systematically

The greatest is 294, from  $42 \times 7$ . Every digit has been tried as the multiplier, with both arrangements of the other two digits, so no possible calculation has been omitted.

Greatest product:  $42 \times 7 = 294$ .

Marking (5 marks): a) 2 for all six possibilities, 1 for four or five distinct valid ones; b) 1 for 294; c) 1 for comparing all products and 1 for explaining complete coverage.

# Multiplication, multiples and factors

Question C5.4 | 5 marks | Worked explanation and marking guide

## C5.4 Two missing-digit solutions

| Middle digit | Calculation    | Product |
|--------------|----------------|---------|
| 1            | $316 \times 4$ | 1264    |
| 6            | $366 \times 4$ | 1464    |

### 1. Start in the ones column

$6 \times 4 = 24$ . Write 4 ones and carry 2 tens.

### 2. Test the middle digit

The tens multiplication plus the carried 2 must end in 6. A middle digit of 1 gives  $1 \times 4 + 2 = 6$ . A middle digit of 6 gives  $6 \times 4 + 2 = 26$ . Testing digits 0 to 9 gives no other tens result ending in 6.

### 3. Finish and check

$316 \times 4 = 1264$ . For 366, carry the 2 hundreds from 26 tens:  $3 \times 4 + 2 = 14$  hundreds, so  $366 \times 4 = 1464$ . Both match 1?64.

$316 \times 4 = 1264$  and  $366 \times 4 = 1464$ .

Marking (5 marks): a) 2 per complete correct calculation; b) 1 for restricting the middle digit to 1 or 6 using the carried 2.

## 2D shapes

Question C6.1 | 5 marks | Worked explanation and marking guide

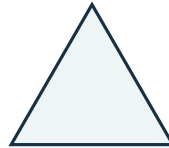
### C6.1 Always, sometimes or never?



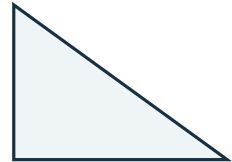
Rectangle



Parallelogram



Equilateral



Scalene

Examples and counterexamples test the claims.

#### 1. Quadrilaterals

a) Sometimes. A rectangle has four right angles, but the slanted parallelogram does not. A quadrilateral only has to have four straight sides.

#### 2. Regular polygons

b) Always. An equilateral triangle has 3, a square 4 and a regular hexagon 6. For a regular polygon, equal sides and equal angles give the corresponding symmetry pattern.

#### 3. Triangles

c) Sometimes. An equilateral triangle has 3 lines of symmetry. A scalene triangle, with all side lengths different, has 0.

a) Sometimes; b) always; c) sometimes.

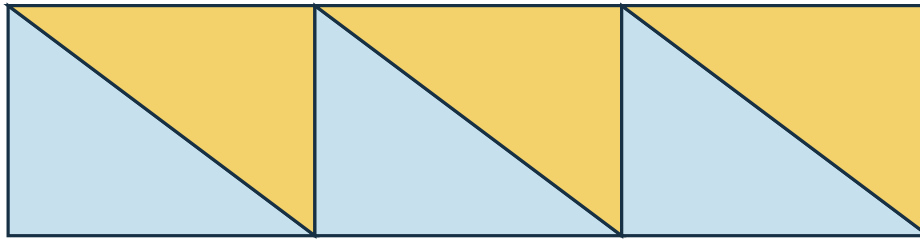
Marking (5 marks): a) 1 for sometimes and 1 for suitable example/counterexample reasoning; b) 1 for always with the regular-polygon rule; c) 1 for sometimes and 1 for distinguishing triangle types.

## 2D shapes

Question C6.2 | 5 marks | Worked explanation and marking guide

### C6.2 An irregular triangle can tile

Six identical scalene right-angled triangles



#### 1. Join two copies

Yes. Turn a second copy and join the long sides to make a rectangle. The two triangles fill the rectangle exactly.

#### 2. Repeat the rectangles

Three such rectangles in a row use six identical triangles. The rectangles share full edges, so the entire patch has no gaps or overlaps.

#### 3. State the conclusion

A triangle need not be regular to tessellate. This scalene right-angled triangle is one example. The outside rows can be extended to continue the pattern.

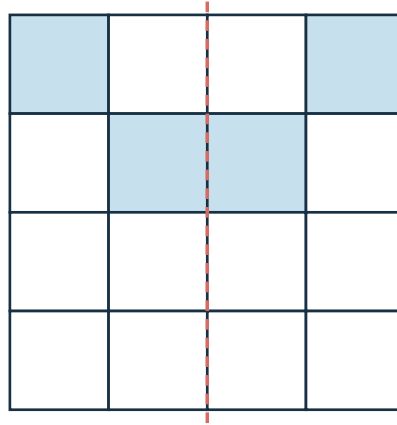
a) Yes; b) three rectangles, each split into two copies; c) matching edges fill the patch; d) no.

Marking (5 marks): a) 1; b) 1 for at least six identical triangle tiles and 1 for a correct patch with boundaries; c) 1 for a valid gap/overlap explanation; d) 1.

## 2D shapes

Question C6.3 | 5 marks | Worked explanation and marking guide

### C6.3 Design exactly one symmetry line



#### 1. Build matching left and right halves

The model shades the two top corner cells and the two middle cells in the second row. The bottom two rows stay unshaded. Left and right halves reflect exactly.

#### 2. Reject the horizontal line

The top corner cells would reflect to the unshaded bottom corner cells. They do not match.

#### 3. Reject both diagonals

For the top-left to bottom-right diagonal, the shaded top-right cell reflects to the unshaded bottom-left. For the other diagonal, the shaded top-left reflects to the unshaded bottom-right. The vertical line is the only one.

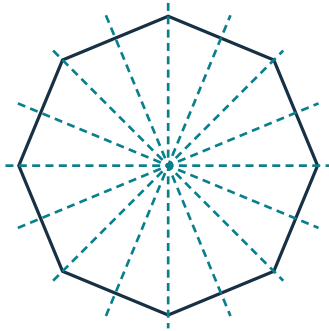
Many designs work. The model has one vertical symmetry line and no horizontal or diagonal symmetry.

Marking (5 marks): a) 1 for a non-empty pattern symmetric vertically and 1 for having no additional symmetry lines; b) 1; c) 1 for a mismatched pair; d) 1 for ruling out both diagonals with valid evidence.

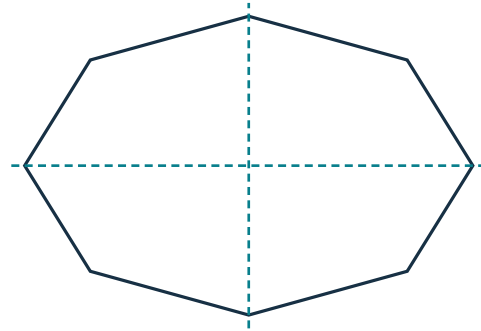
## 2D shapes

Question C6.4 | 5 marks | Worked explanation and marking guide

### C6.4 Same side count, different symmetry



A: regular - 8 lines



B: stretched - 2 lines

#### 1. Count the boundary corners

Both shapes have 8 vertices. Stretching changes lengths and angles but does not add or remove vertices.

#### 2. Test the reflection lines

A has 8 lines of symmetry. B has only 2: vertical and horizontal through its centre. The other original reflection lines fail after the horizontal stretch.

#### 3. Use the rule only when its condition holds

The missing word is sides. The rule needs a regular polygon. B is irregular, so having eight sides does not guarantee eight symmetry lines.

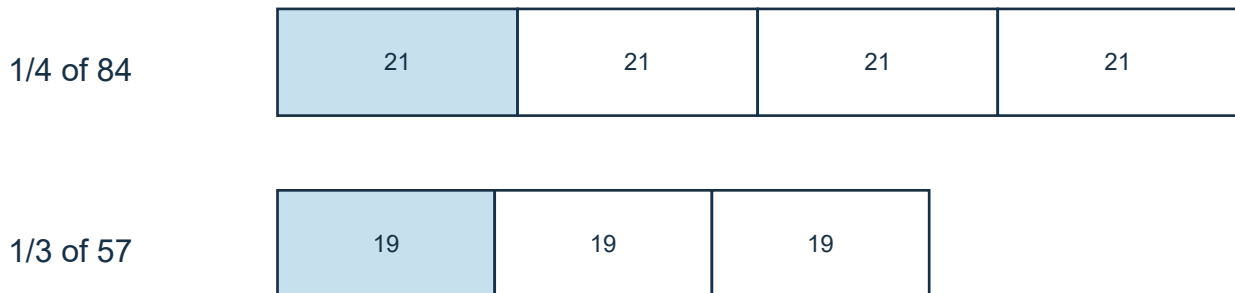
a) 8 each; b) A: 8, B: 2; c) sides; d) irregular polygons need not follow the rule.

Marking (5 marks): a) 1 for both counts; b) 1 per shape for its count and all lines; c) 1; d) 1 for the regular/irregular distinction.

# Fractions

Question C7.1 | 5 marks | Worked explanation and marking guide

## C7.1 Compare shares of different amounts



Both whole bars use the same scale.

### 1. Find the amounts

$\frac{1}{4}$  of 84 =  $84 \div 4 = 21$ .  $\frac{1}{3}$  of 57 =  $57 \div 3 = 19$ .

### 2. Compare

The quarter of 84 is greater by  $21 - 19 = 2$ . The diagram uses the same scale for both whole bars, so the selected quarter is visibly longer.

### 3. Explain the changing whole

Here the whole amounts are different, so the fraction alone does not decide the selected quantity. For equal-sized wholes,  $\frac{1}{3}$  would be greater than  $\frac{1}{4}$ .

a) 21 and 19; b)  $\frac{1}{4}$  of 84 is greater by 2; c) different whole amounts; d)  $\frac{1}{3}$ .

Marking (5 marks): a) 1 + 1; b) 1 for choice and difference; c) 1 for different wholes; d) 1.

# Fractions

Question C7.2 | 5 marks | Worked explanation and marking guide

## C7.2 Recover the whole amount

One fifth = 11

|    |    |    |    |    |
|----|----|----|----|----|
| 11 | 11 | 11 | 11 | 11 |
|----|----|----|----|----|

$$5 \times 11 = 55$$

### 1. Reverse the sharing

a) One fifth is 11, so all five fifths contain  $5 \times 11 = 55$ . b) One eighth is 7, so the whole is  $8 \times 7 = 56$ .

### 2. Finish and check

c) One third is 16, so the whole is  $3 \times 16 = 48$ . For d, a valid check is  $55 \div 5 = 11$ , or the corresponding check for another part.

### 3. Compare the wholes

56 is greater than 55 and 48. It is the whole in part b, even though its known single share, 7, is the smallest of the three given shares.

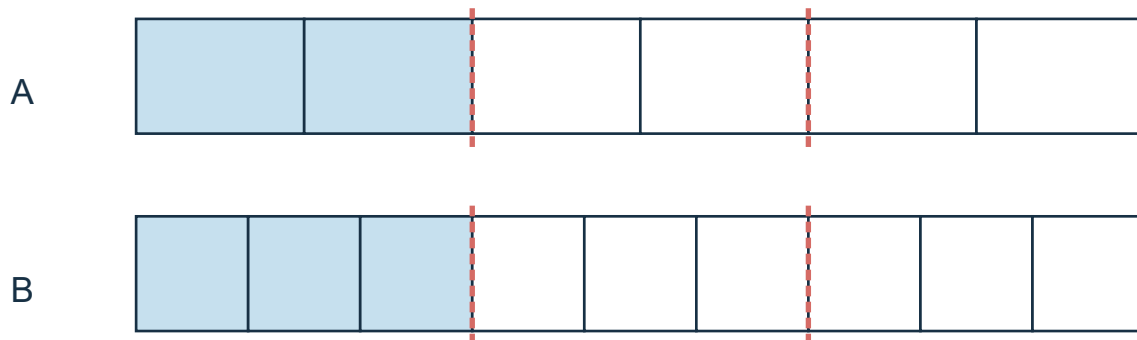
a) 55; b) 56; c) 48; d) for example,  $5 \times 11 = 55$  and  $55 \div 5 = 11$ ; e) 56.

Marking (5 marks): 1 per part. Part d needs the multiplication and a valid inverse check.

# Fractions

Question C7.3 | 5 marks | Worked explanation and marking guide

## C7.3 Different partitions, same amount



One of three equal larger groups is shaded in each.

### 1. Read the displayed fractions

A has 2 of 6 equal parts shaded:  $\frac{2}{6}$ . B has 3 of 9 equal parts shaded:  $\frac{3}{9}$ .

### 2. Make three larger equal groups

In A, combine each pair of sixths:  $6 \div 2 = 3$  equal groups. In B, combine each group of three ninths:  $9 \div 3 = 3$  equal groups.

### 3. Compare the selected amount

In each strip, exactly one of the three larger groups is shaded. Both therefore show  $\frac{1}{3}$  of equal-sized wholes. The fractions are equal in value even though the partitions differ.

A:  $\frac{2}{6}$ ; B:  $\frac{3}{9}$ . They are equal: both show  $\frac{1}{3}$ .

Marking (5 marks): a) 1 + 1; b) 1 for equal; c) 1 for correctly grouping both strips into thirds and 1 for explaining one shaded third in each.

# Fractions

Question C7.4 | 5 marks | Worked explanation and marking guide

## C7.4 Two ways to make equal shares

| Solution | A  | B  | C  | Share |
|----------|----|----|----|-------|
| 1        | 12 | 18 | 24 | 6     |
| 2        | 24 | 36 | 48 | 12    |

$$\frac{1}{2} \text{ of } A = \frac{1}{3} \text{ of } B = \frac{1}{4} \text{ of } C$$

### 1. Choose a common share of 6

For a half to equal 6, A must be  $2 \times 6 = 12$ . For a third to equal 6, B must be  $3 \times 6 = 18$ . For a quarter to equal 6, C must be  $4 \times 6 = 24$ .

### 2. Choose a common share of 12

$A = 2 \times 12 = 24$ ,  $B = 3 \times 12 = 36$ ,  $C = 4 \times 12 = 48$ . All three numbers are available and are different within this solution.

### 3. Check both rows

$12 \div 2 = 18 \div 3 = 24 \div 4 = 6$ . Also,  $24 \div 2 = 36 \div 3 = 48 \div 4 = 12$ . The card 24 can appear in both rows because reuse between solutions is allowed.

Solution 1: A=12, B=18, C=24. Solution 2: A=24, B=36, C=48.

Marking (5 marks): a) 2 for a correct distinct-card triple, 1 for two correctly linked entries; b) same for a different triple; c) 1 for checking both rows by division.