Answers

Solving mathematical problems

12 in the middle (p.8)

Challenge

Many answers are possible, for example:

10, 11, **12**, 13, 14 (on in steps of 1)

14, 13, **12**, 11, 10 (back in steps of 1)

8, 10, **12**, 14, 16 (on in steps of 2)

16, 14, **12**, 10, 8 (back in steps of 2)

What if?

For example:

10, 20, **30**, 40, 50 (on in steps of 10)

50, 40, **30**, 20, 10 (back in steps of 10)

20, 25, **30**, 35, 40 (on in steps of 5)

40, 35, **30**, 25, 20 (back in steps of 5)

Showing numbers (p.9)

Challenge

The following numbers are possible:

1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 15, 20, 21, 22, 23, 24, 25, 30, 31, 32, 33, 34, 35

What if?

5, 14, 23, 32, 41, 50

Ladybird counting (p.10)

Challenge

Any even number of counters works and any odd number of counters does not work.

What if?

Multiples of 4 work, i.e. 4, 8, 12, 16, 20 …

2-digit numbers (p.11)

Challenge

20 different two-digit numbers are possible:

12, 13, 14, 16, 21, 23, 24, 26, 31, 32, 34, 36, 41, 42, 43, 46, 61, 62, 63, 64

What if?

10 different numbers between 14 and 34 are possible:

15, 20, 21, 22, 23, 25, 30, 31, 32, 33

Scoring 12 (p.12)

Challenge

2 pins: 2 + 10, 3 + 9, 4 + 8, 5 + 7

3 pins: 1 + 2 + 9, 1 + 3 + 8, 1 + 4 + 7, 1 + 5 + 6, 2 + 6 + 4, 2 + 7 + 3, 3 + 4 + 5

4 pins: 1 + 2 + 3 + 6, 1 + 2 + 4 + 5

What if?

Largest score from two pins: 19 (10 + 9)

Smallest score from two pins: 3 (1 + 2)

Differences (p.13)

Challenge

Difference of 3:

6 spot dominoes: 0 and 3, 1 and 4, 2 and 5, 3 and 6

9 spot dominoes: as for 6 spot dominoes as well as 4 and 7, 5 and 8, 6 and 9

Difference of 2:

6 spot dominoes: 0 and 2, 1 and 3, 2 and 4, 3 and 5, 4 and 6

9 spot dominoes: as for 6 spot dominoes as well as 5 and 7, 6 and 8, 7 and 9

Difference of 4:

6 spot dominoes: 0 and 4, 1 and 5, 2 and 6

9 spot dominoes: as for 6 spot dominoes as well as 3 and 7, 4 and 8, 5 and 9

What if?

1–6 dice with a difference of 2: 1 and 3, 2 and 4, 3 and 5, 4 and 6

0–9 dice with a difference of 2: 0 and 2, 1 and 3, 2 and 4, 3 and 5, 4 and 6, 5 and 7, 6 and 8, 7 and 9

3-card number sentence (p.14)

Challenge

16 addition number sentences are possible:

1 + 2 = 3, 1 + 3 = 4, 1 + 4 = 5, 1 + 5 = 6, 1 + 6 = 7, 1 + 7 = 8, 1 + 8 = 9,

2 + 3 = 5, 2 + 4 = 6, 2 + 5 = 7, 2 + 6 = 8, 2 + 7 = 9,

3 + 4 = 7, 3 + 5 = 8, 3 + 6 = 9,

4 + 5 = 9

What if?

32 subtraction number sentences are possible:

9 – 8 = 1, 9 – 7 = 2, 9 – 6 = 3, 9 – 5 = 4, 9 – 4 = 5, 9 – 3 = 6, 9 – 2 = 7, 9 – 1 = 8,

8 – 7 = 1, 8 – 6 = 2, 8 – 5 = 3, 8 – 3 = 5, 8 – 2 = 6, 8 – 1 = 7,

7 – 6 = 1, 7 – 5 = 2, 7 – 4 = 3, 7 – 3 = 4, 7 – 2 = 5, 7 – 1 = 6,

6 – 5 = 1, 6 – 4 = 2, 6 – 2 = 4, 6 – 1 = 5,

5 – 4 = 1, 5 – 3 = 2, 5 – 2 = 3, 5 – 1 = 4,

4 – 3 = 1, 4 – 1 = 3,

3 – 2 = 1, 3 – 1 = 2

Making 20 (p.15)

Challenge

11 models are possible:

20 + 0, 19 + 1, 18 + 2, 17 + 3, 16 + 4, 15 + 5, 14 + 6, 13 + 7, 12 + 8, 11 + 9, 10 + 10

What if?

36 models are possible:

20 + 0 + 0,

19 + 1 + 0,

18 + 2 + 0, 18 + 1 + 1,

17 + 3 + 0, 17 + 2 + 1,

16 + 4 + 0, 16 + 3 + 1, 16 + 2 + 2,

15 + 5 + 0, 15 + 4 + 1, 15 + 3 + 2,

14 + 6 + 0, 14 + 5 + 1, 14 + 4 + 2, 14 + 3 + 3,

13 + 7 + 0, 13 + 6 + 1, 13 + 5 + 2, 13 + 4 + 3,

12 + 8 + 0, 12 + 7 + 1, 12 + 6 + 2, 12 + 5 + 3, 12 + 4 + 4

11 + 9 + 0, 11 + 8 + 1, 11 + 7 + 2, 11 + 6 + 3, 11 + 5 + 4

10 + 10 + 0, 10 + 9 + 1, 10 + 8 + 2, 10 + 7 + 3, 10 + 6 + 4, 10 + 5 + 5

Doubling (p.16)

Challenge

Children's explanations will vary depending on their depth of understanding. However, accept any explanation that refers to one or more of the following generalisations.

Doubling each of the numbers 1 to 10 results in an answer that:

- is an even number
- is one of the numbers you say when you count on in steps of 2 from 0
- can be split into pairs
- can be divided by 2
- is divisible by 2
- is a multiple of 2

What if?

The same applies as above for the numbers 11 to 20.

24 cubes (p.17)

Challenge

24 cubes can be shared into the following groups:

2 groups of 12, 12 groups of 2,

3 groups of 8, 8 groups of 3,

4 groups of 6, 6 groups of 4.

What if?

12 cubes can be shared into the following groups:

2 groups of 6, 6 groups of 2,

3 groups of 4, 4 groups of 3.

36 cubes can be shared into the following groups:

2 groups of 18, 18 groups of 2,

3 groups of 12, 12 groups of 3,

4 groups of 9, 9 groups of 4,

6 groups of 6.

Children's explanations will vary depending on their depth of understanding. However, accept any explanation that refers to the following generalisations:

- Any even number of cubes can be shared into equal groups. (The number of groups and the number of cubes in each group will depend on the number chosen by the child.)
- An odd number of cubes cannot be divided into equal groups.

Steps of 2, 5 and 10 (p.18)

Challenge

2, 4, 6, 8, (10), 12, 14, 16, 18, (20)

5, (10), 15, (20), 25, (30), 35, (40), 45, (50)

(10), (20), (30), (40), (50), 60, 70, 80, 90, 100

The numbers 10 and 20 appear on all three number lines.

The numbers 30, 40 and 50 appear on the fives and tens number lines.

Children's explanations will vary depending on their depth of understanding. However, accept any explanation that refers to the following generalisations:

- All multiples of 2 (a number you say when you count on in steps of 2 from 0) are even numbers, and every other multiple of 5 when you count on in steps of 5 from 0 is also an even number, and all multiples of 10 (a number you say when you count on in steps of 10 from 0) are even numbers.

- All multiples of 10 (a number you say when you count on in steps of 10 from 0) are also multiples of 2 (a number you say when you count on in steps of 2 from 0) and multiples of 5 (a number you say when you count on in steps of 5 from 0).

What if?

Children's explanations will vary depending on their depth of understanding. However, accept any explanation that refers to the fact that any multiple of 10 will appear on all three number lines.

Describing rectangles (p.19)

Challenge

Children should see the rectangles as arrays and use them to describe two related multiplication number sentences, thereby showing evidence of an understanding of the commutative law as it applies to multiplication.

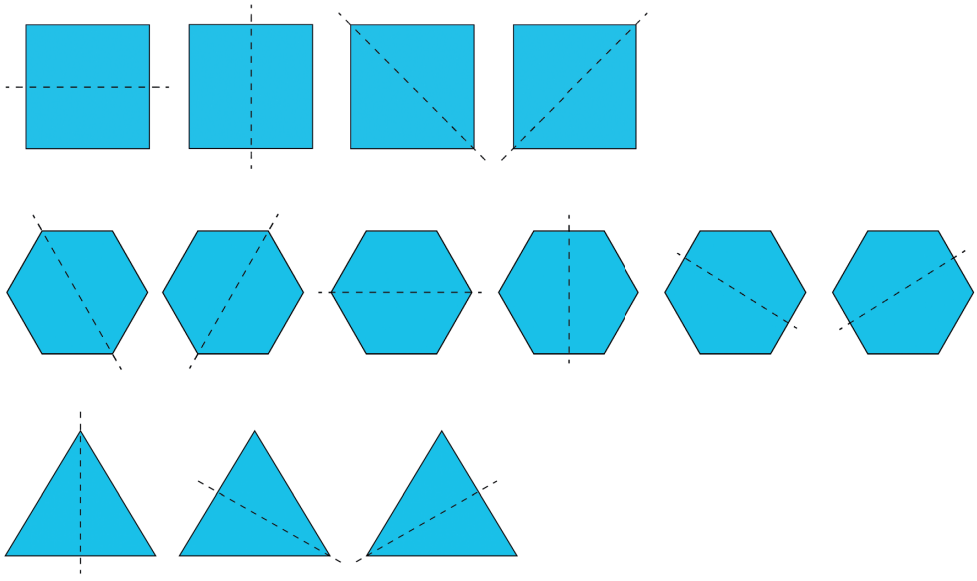
Some children may also describe the rectangles using the language of division, e.g. 8 shared between 2 is 4, and/or 8 shared between 4 is 2.

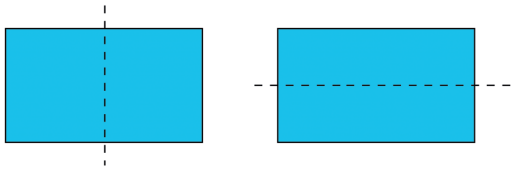
What if?

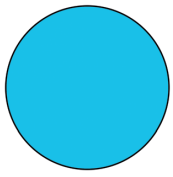
A large square will result in an array with the same number of rows as columns, e.g. 3 × 3 / 4 × 4. The total number of counters in a square array, e.g. 9 or 16, is referred to as a 'square number.' For such arrays there is only one multiplication number sentence, e.g. 3 × 3 = 9 / 4 × 4 = 16, and one division number sentence, e.g. 9 ÷ 3 = 3 / 16 ÷ 4 = 4.

Divide a shape (p.20)

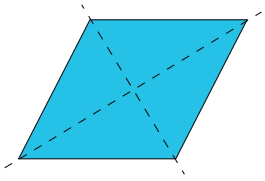
Challenge

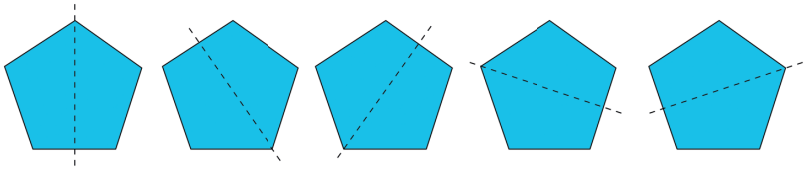




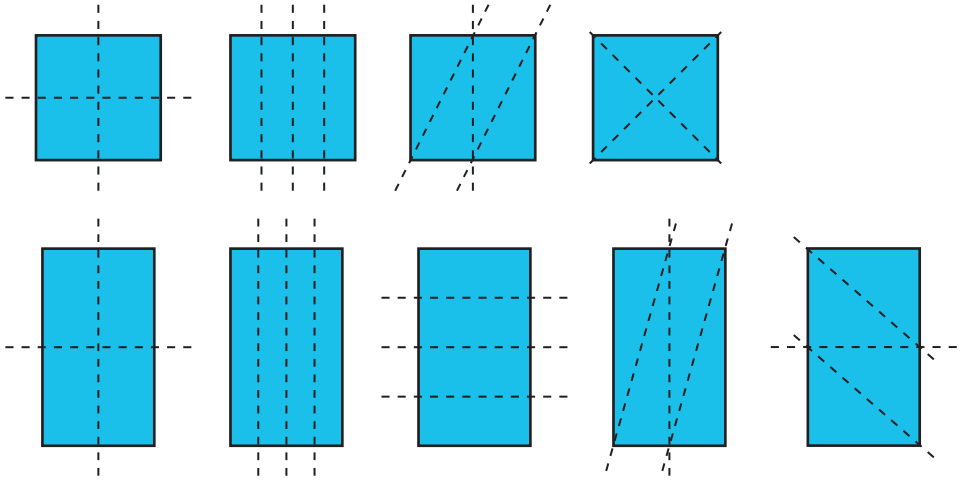


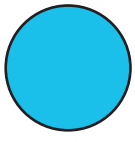
Accept any straight line that divides the circle through its centre.





What if?





Accept any two straight lines that divide the circle through its centre into four equal sectors.

Fraction counters (p.21)

Challenge

Children's explanations will vary depending on their depth of understanding. However, accept any explanation that refers to the following generalisations:

- Any even number of counters can be halved.
- Any odd number of counters cannot be halved.

What if?

Handfuls of 4, 8, 12, 16, … counters work. Any other handful of counters does not work.

Children's explanations will vary depending on their depth of understanding. However, accept any explanation that refers to the fact that only a number that is a multiple of 4 (a number you say when you count on in steps of 4 from 0) can be divided into four equal groups.

Showing halves and quarters (p.22)

Challenge

Accept any models using concrete, pictorial and/or abstract representations of half of 12.

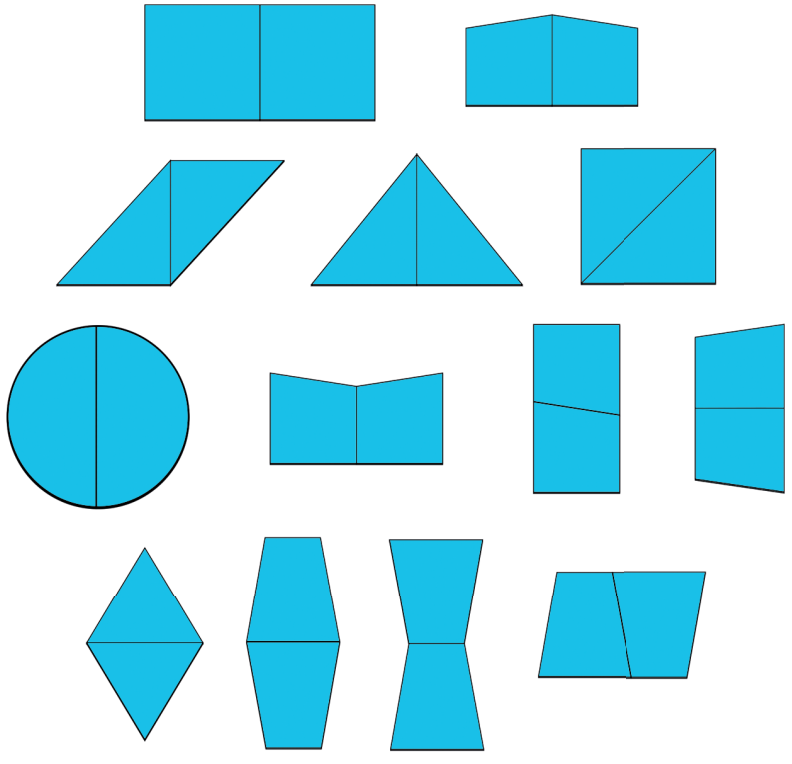
What if?

Accept any models using concrete, pictorial and/or abstract representations of a quarter of 12.

What's the whole shape? (p.23)

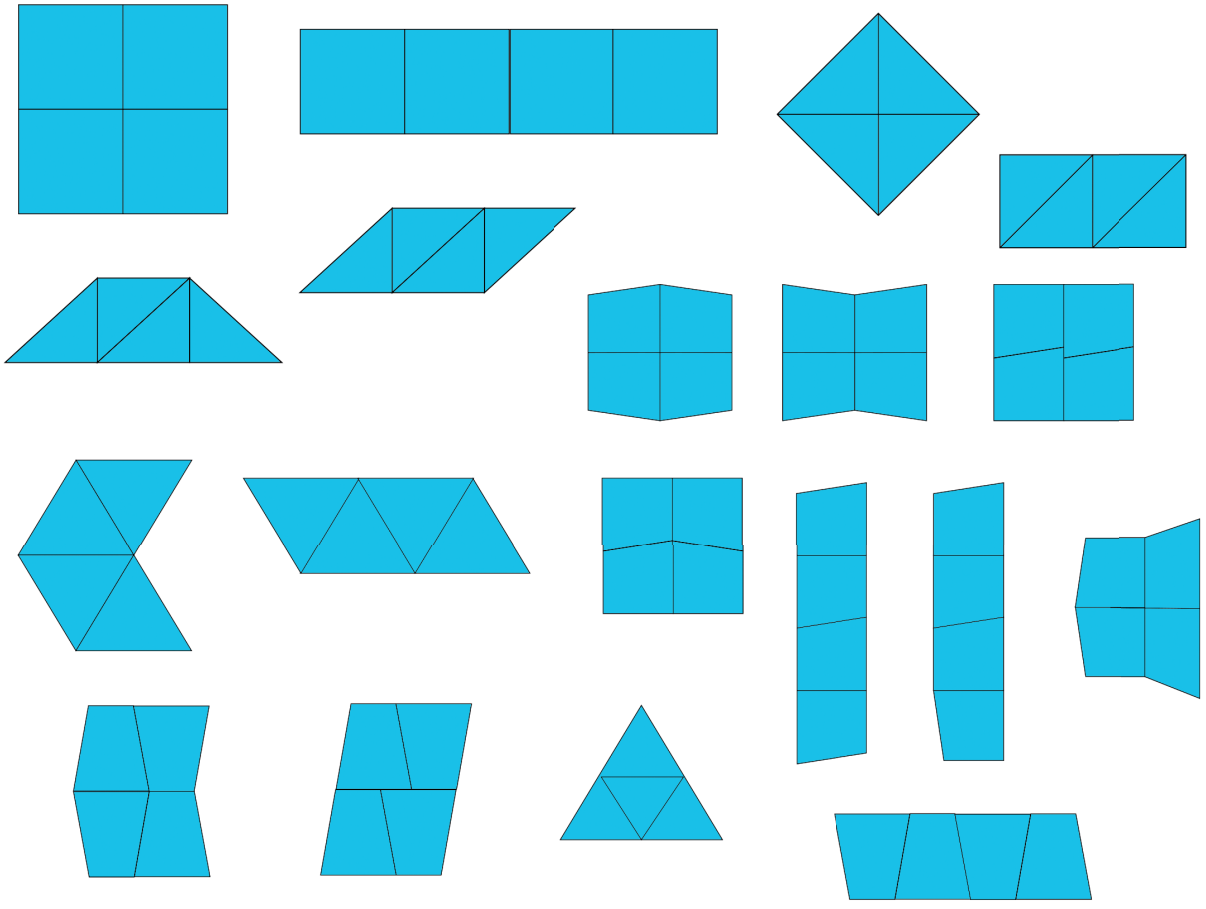
Challenge

Accept rotations of any of the shapes below.



What if?

Accept reflections and rotations of any of the shapes below.



Make a metre (p.24)

Challenge

Answers will vary depending on the uniform non-standard measuring objects used.

What if?

Answers will vary depending on the uniform non-standard measuring objects used.

Comparing objects (p.25)

Challenge

Statements may include those similar to the following:

- The fire engine and the aeroplane weigh the same.
- The fire engine is heavier than the car. The car is lighter than the fire engine.

- The train is heavier than the aeroplane. The aeroplane is lighter than the train.
- Two cars weigh the same as one train.
- The car is the lightest of the four toys.
- The train is the heaviest of the four toys.

What if?

- 4 building blocks weigh the same as the aeroplane.
- 6 building blocks weigh the same as the train.

Jugs, bottles and glasses (p.26)

Challenge

1 jug = 3 bottles

= 2 bottles and 4 cups

= 1 bottle and 8 cups

= 12 cups

What if?

2 jugs = 6 bottles

= 5 bottles and 4 cups

= 4 bottles and 8 cups

= 3 bottles and 12 cups

= 2 bottles and 16 cups

= 1 bottle and 20 cups

= 24 cups

Meru's diary (p.27)

Challenge

Statements will vary.

What if?

Statements will vary.

Making totals (p.28)

Challenge

Two coins:

1p + 1p = 2p

1p + 2p = 3p

1p + 5p = 6p

1p + 10p = 11p

2p + 2p = 4p

2p + 5p = 7p

2p + 10p = 12p

5p + 5p = 10p

5p + 10p = 15p

What if?

Three coins:

1p + 1p + 2p = 4p

1p + 1p + 5p = 7p

1p + 1p + 10p = 12p

1p + 2p + 2p = 5p

1p + 2p + 5p = 8p

1p + 2p + 10p = 13p

1p + 5p + 5p = 11p

1p + 5p + 10p = 16p

2p + 2p + 5p = 9p

2p + 2p + 10p = 14p

2p + 5p + 5p = 12p

2p + 5p + 10p = 17p

5p + 5p + 10p = 20p

Four coins:

1p + 1p + 2p + 2p = 6p

1p + 1p + 2p + 5p = 9p

1p + 1p + 2p + 10p = 14p

1p + 1p + 5p + 5p = 12p

1p + 1p + 5p + 10p = 17p

1p + 2p + 2p + 5p = 10p

1p + 2p + 2p + 10p = 15p

1p + 2p + 5p + 5p = 13p

1p + 2p + 5p + 10p = 18p

1p + 5p + 5p + 10p = 21p

2p + 2p + 5p + 5p = 14p

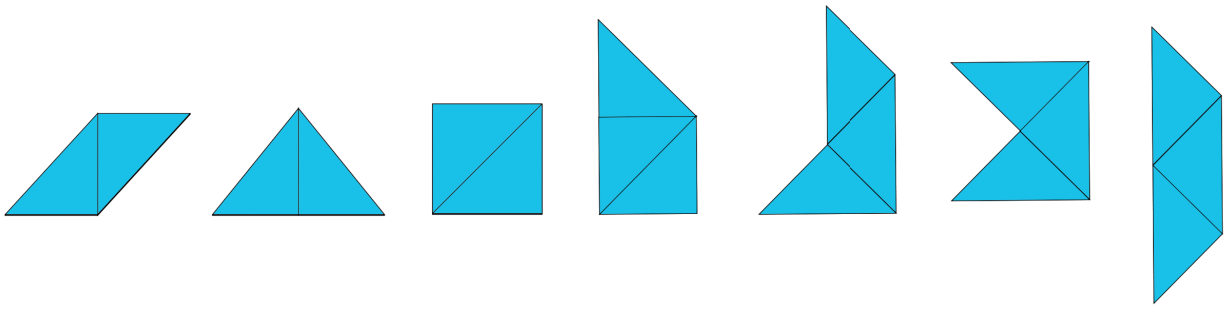
10p + 2p + 2p + 5p = 19p

10p + 2p + 5p + 5p = 22p

Triangular shapes (p.29)

Challenge

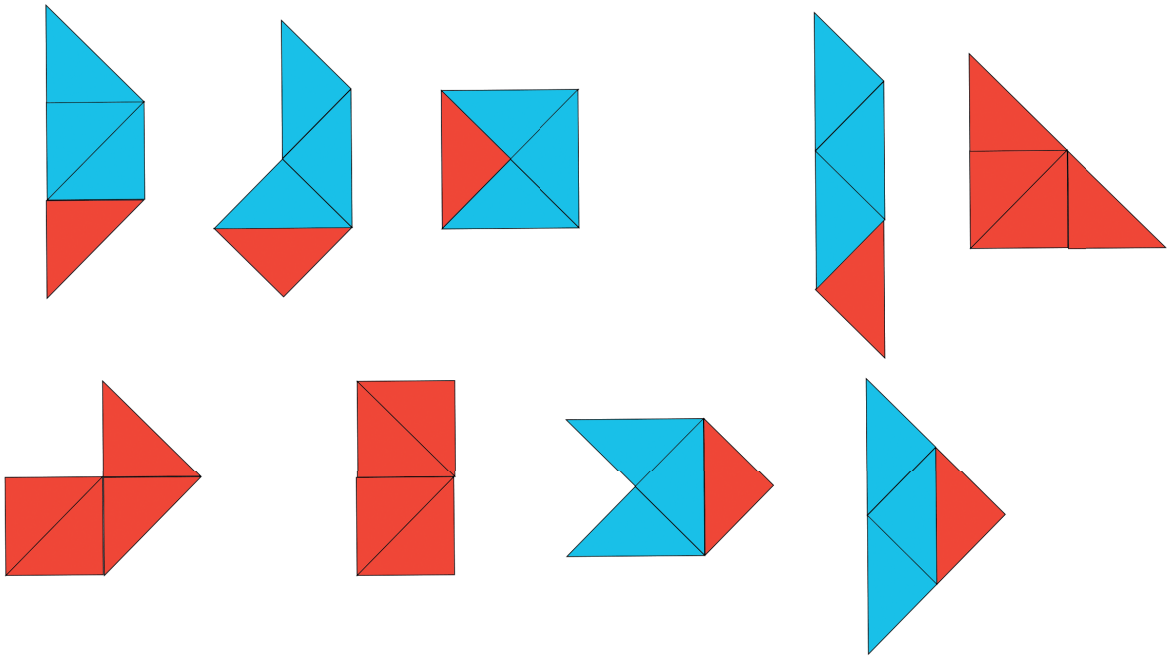
Using three triangles, four different shapes are possible.



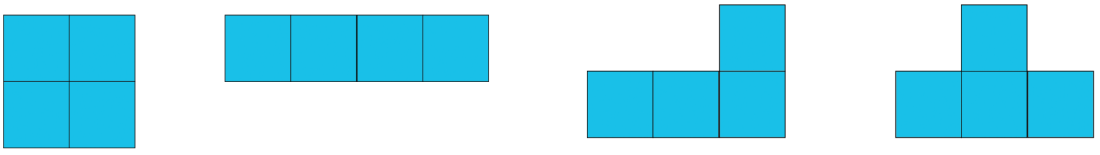
Accept reflections and rotations of any of the above shapes.

What if?

Four triangles:



Four squares:



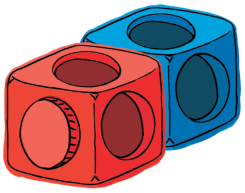
Accept reflections and rotations of any of the above shapes.

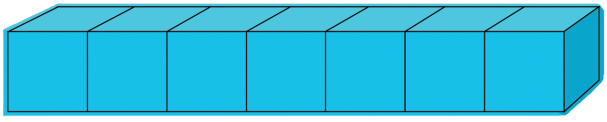
Making cuboids from cubes (p.30)

Challenge

Using 9 interlocking cubes, one-layer cuboids include:

Set of 2 cuboids: 2 interlocking cubes + 7 interlocking cubes, i.e.





3 cubes + 6 cubes

4 cubes + 5 cubes

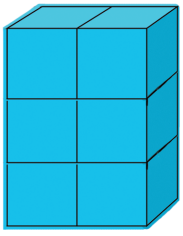
Set of 3 cuboids: 2 cubes + 3 cubes + 4 cubes

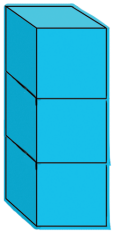
3 cubes + 3 cubes + 3 cubes

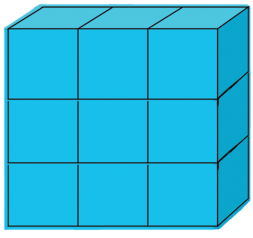
5 cubes + 2 cubes + 2 cubes

Set of 4 cuboids: 2 cubes + 2 cubes + 2 cubes + 3 cubes

Using 9 interlocking cubes, multiple-layer cuboids include:



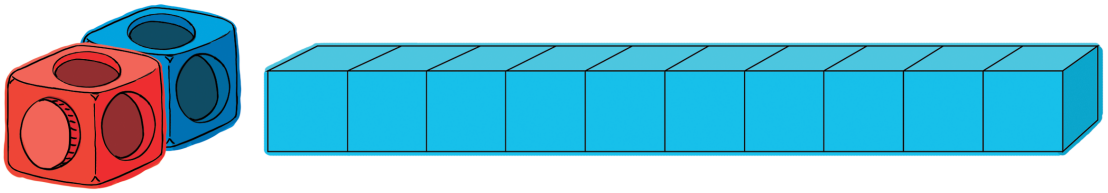




What if?

Using 12 interlocking cubes, one-layer cuboids include:

Set of 2 cuboids: 2 interlocking cubes + 10 interlocking cubes, i.e.



3 cubes + 9 cubes

4 cubes + 8 cubes

5 cubes + 7 cubes

Set of 3 cuboids: 2 cubes + 2 cubes + 8 cubes

2 cubes + 3 cubes + 7 cubes

2 cubes + 4 cubes + 6 cubes

2 cubes + 5 cubes + 5 cubes

3 cubes + 5 cubes + 4 cubes

3 cubes + 6 cubes + 3 cubes

Set of 4 cuboids: 2 cubes + 2 cubes + 2 cubes + 6 cubes

2 cubes + 2 cubes + 3 cubes + 5 cubes

2 cubes + 2 cubes + 4 cubes + 4 cubes

2 cubes + 3 cubes + 3 cubes + 4 cubes

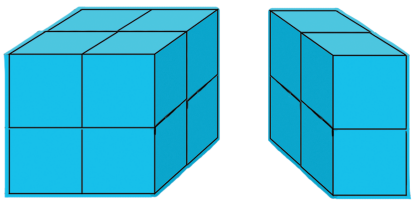
3 cubes + 3 cubes + 3 cubes + 3 cubes

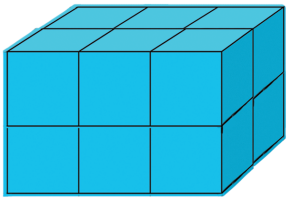
Set of 5 cuboids: 2 cubes + 2 cubes + 2 cubes + 2 cubes + 4 cubes

2 cubes + 2 cubes + 2 cubes + 3 cubes + 3 cubes

Set of 6 cuboids: 2 cubes + 2 cubes + 2 cubes + 2 cubes + 2 cubes + 2 cubes

Using 12 interlocking cubes, multiple-layer cuboids include:





The faces of an interlocking cube are predominately flat and the edges predominately straight. Interlocking cubes also have vertices (corners). Therefore, it is not possible to use interlocking cubes to make the curved faces and edges required for a sphere, cylinder or cone.

Route (p.31)

Challenge

R2, D2

D2, R2

D1, R2, D1

R1, D2, R1

R1, D1, R1, D1

D1, R1, D1, R1

What if?

Various movements are possible, e.g.

L2, D1

D1, L2

L3, D1, R1

D2, L2, U1

D2, L3, U1, R1

D2, L1, U1, L1

D2, L3, U2, R1, D1

Reasoning mathematically

Which is larger? (p.32)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Ruby's statement is sometimes true. The size of a number depends on the value of its most significant digit. So, for example, while 8 is larger than 5 and 18 is larger than 15, 18 is smaller than 25 and 28 is smaller than 35.

What if?

For any two-digit number, a number with 1 ten is always smaller than a number with 2 tens. However, this is not always the case for numbers larger than 100. For example, 110 is larger than 20 and 210 is larger than 120. The same applies as above – the size of the number depends on the value of its most significant digit.

1 more and 1 less (p.33)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Jake is correct.

1 more than 5 is 6, which can be expressed as 5 + 1 = 6.

1 less than 5 is 4, which can be expressed as 5 – 1 = 4.

What if?

2 more is the same as adding 2: 2 more than 5 is 7, which can be expressed as 5 + 2 = 7

2 less is the same as subtracting 2: 2 less than 5 is 3, which can be expressed as 5 – 2 = 3

10 more is the same as adding 10: 10 more than 5 is 15, which can be expressed as 5 + 10 = 15

10 less is the same as subtracting 10: 10 less than 17 is 7, which can be expressed as 17 – 10 = 7

4, 14 and 24 (p.34)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

4, 14 and 24

The same:

- All have 4 ones (units).
- All are even numbers.
- All are more than 3.
- All are less than 25.
- Consecutive numbers have a difference of 10, i.e. 14 is 10 more than 4, 24 is 10 more than 14.

Different:

- Each has a different number of tens.
- One number is a one-digit number; the other two numbers are two-digit numbers.

What if?

12 and 21

The same:

- Both are two-digit numbers.
- Both contain the same two digits: 1 and 2.
- Both are more than 10.
- Both are less than 25.

Different:

- One number is even; the other number is odd.
- The values of the ones (units) and tens digits are different.

4 and 14

The same:

- Both numbers have 4 ones (units).
- Both numbers are even.

- Both are more than 3.
- Both are less than 15.

Different:

- One number is a one-digit number; the other number is a two-digit number.
- The values of the tens digits are different.

5 and 16

The same:

- Both are more than 3.
- Both are less than 20.

Different:

- One number is a one-digit number; the other number is a two-digit number.
- One number is odd; the other number is even.
- The values of the ones (units) digits are different.

Wrong patterns (p.35)

Challenge

15, 16, 18, 19, 20

Mistake: The number 17 is missing.

Correct pattern: 15, 16, 17, 18, 19, 20

13, 12, 11, 9, 8

Mistake: The number 10 is missing.

Correct pattern: 13, 12, 11, 10, 9, 8

50, 40, 35, 30, 25

Mistake: The number 45 is missing.

Correct pattern: 50, 45, 40, 35, 30, 25

6, 8, 9, 12, 14

Mistake: The number 9 should be the number 10.

Correct pattern: 6, 8, 10, 12, 14

What if?

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

If you count on from 16, you will not say the number 12 because 12 is less than 16 and when counting on from 16 the numbers will become larger, e.g. 16, 17, 18, 19, … / 16, 18, 20, 22, …

If you count on in twos from 6, you will say the number 20 because 20 is larger than 6 (counting on) and when counting on in twos from 6 (an even number), all numbers in the count will also be even numbers, i.e. 6, 8, 10, 12, 14, 16, 18, 20, …

Who's right? (p.36)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Holly is correct: you can use the three numbers 3, 5 and 8 to make four number sentences. The four digits can be used to make two addition and two subtraction number sentences:

$3 + 5 = 8$ $\quad 5 + 3 = 8$
$8 - 3 = 5$ $\quad 8 - 5 = 3$.

What if?

Children's answers will vary.

Number sentence patterns (p.37)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

$0 + 8 = 8$ In the first column the numbers increase by 1 each time as you move down the list.

$1 + 7 = 8$ In the second column the numbers decrease by 1 each time as you move down the list.

$2 + \boxed{6} = 8$ The third column of numbers contains only the number 8.

$3 + \boxed{5} = 8$

$\boxed{4} + 4 = 8$

$\boxed{5} + 3 = 8$

$6 + \boxed{2} = 8$

$\boxed{7} + 1 = 8$

$\boxed{8} + \boxed{0} = 8$

0 + 10 = 10

1 + 9 = 10

2 + 8 = 10

3 + 7 = 10

4 + 6 = 10

5 + 5 = 10

6 + 4 = 10

7 + 3 = 10

8 + 2 = 10

9 + 1 = 10

10 + 0 = 10

What if?

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

8 – 8 = 0	The first column of numbers contains only the number 8.
8 – 7 = 1	In the second column the numbers decrease by 1 each time as you move down the list.
8 – 6 = 2	In the third column the numbers increase by 1 each time as you move down the list.

8 – 5 = 3

8 – 4 = 4

8 – 3 = 5

8 – 2 = 6

8 – 1 = 7

8 – 0 = 8

or:

8 – 0 = 8	The first column of numbers contains only the number 8.
8 – 1 = 7	In the second column the numbers increase by 1 each time as you move down the list.
8 – 2 = 6	In the third column the numbers decrease by 1 each time as you move down the list.

8 – 3 = 5

8 – 4 = 4

8 – 5 = 3

8 – 6 = 2

8 – 7 = 1

8 – 8 = 0

Subtraction patterns for a number from 9 to 12 will be similar to the subtraction pattern for 8.

Using known facts (p.38)

Challenge

Children's answers will vary. Some sample answers are provided below for guidance. Use your professional judgement when assessing children's responses to open-ended questions and their reasoning.

Related addition facts may include:

4 + 2 = 6

20 + 40 = 60 / 40 + 20 = 60

12 + 4 = 16 / 14 + 2 = 16

12 + 14 = 26 / 14 + 12 = 26

Related subtraction facts may include:

6 – 4 = 2 / 6 – 2 = 4

60 – 40 = 20 / 60 – 20 = 40

16 – 4 = 12 / 16 – 12 = 4

16 – 14 = 2 / 16 – 2 = 14

Knowledge of place value, the commutative law, and the inverse relationship between addition and subtraction, all help in working out related facts.

What if?

Children's answers will vary.

True statements (p.39)

Challenge

Children's answers will vary. Some sample answers are provided below for guidance. Use your professional judgement when assessing children's responses to open-ended questions and their reasoning.

$6 + \boxed{4} = \boxed{1} + 9$

The given number (6) and the missing number (4) to the left of the equals sign must have the same total as the total of the missing number (1) and the given number (9) to the right of the equals sign, e.g. 10.

Other possible calculations include: $6 + \boxed{5} = \boxed{2} + 9$ or $6 + \boxed{6} = \boxed{3} + 9$

What if?

$\boxed{3} + 7 = \boxed{13} - 3$

The missing number (3) and the given number (7) to the left of the equals sign must have the same total as the difference between the missing number (13) and the given number (3) to the right of the equals sign, e.g. 10.

Other possible calculations include: $\boxed{2} + 7 = \boxed{12} - 3$ or $\boxed{1} + 7 = \boxed{11} - 3$

Are they right? (p.40)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Ruby is right. If you start at 0 and count on in twos you will say the number 24 because all numbers in the count must be consecutive (increasing) even numbers, i.e. 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, …

Jake is right. If you start at 0 and count on in tens you will say the number 50 because all numbers in the count must have 0 ones (units), and the tens digit must increase by 1 each time, i.e. 0, 10, 20, 30, 40, 50, 60, …

Holly is not right. If you start at 0 and count on in fives you will not say the number 32 because all numbers in the count must alternate between 0 and 5 ones (units), i.e. 0, 5, 10, 15, 20, 25, 30, 35, …

What if?

Children's answers will vary.

Numbers that Ruby, Jake and Holly might say:

- Ruby: Accept any five multiples of 2.

- Jake: Accept any five multiples of 10.
- Holly: Accept any five multiples of 5.

Numbers that Ruby, Jake and Holly will not each say:

- Ruby: Accept any five numbers that are not a multiple of 2.
- Jake: Accept any five numbers that are not a multiple of 10.
- Holly: Accept any five numbers that are not a multiple of 5.

20p (p.41)

Challenge

2p + 2p + 2p + 2p + 2p + 2p + 2p + 2p + 2p + 2p / (2p × 10)

5p + 5p + 5p + 5p / (5p × 4)

10p + 10p / (10p × 2)

2p + 2p + 2p + 2p + 2p + 10p / (2p × 5) + 10p

5p + 5p + 10p / (5p × 2) + 10p

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Using knowledge of counting on in steps of 2, 5 and 10 / multiplication facts for the 2, 5 and 10 times tables.

What if?

Children's answers will vary. Some sample answers are provided below for guidance. You should use your professional judgement when assessing children's responses to open-ended questions.

2p × 25

5p × 10

10p × 5

(2p × 5) + (5p × 8)

(5p × 6) + (10p × 2)

Biscuit tray (p.42)

Challenge

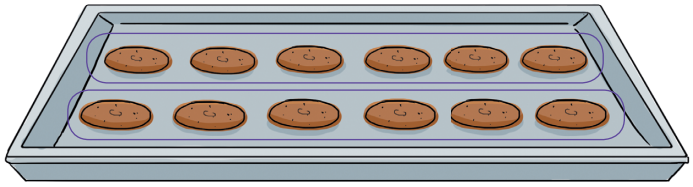
Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

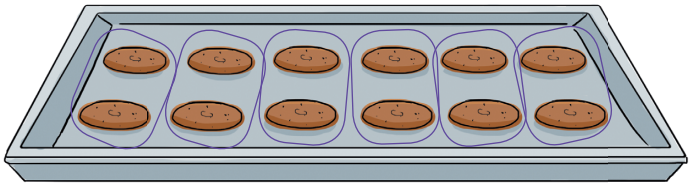
Jake is correct: the array shows two multiplication and two division number sentences, i.e.

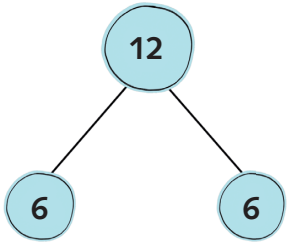
$2 \times 6 = 12$ / $6 \times 2 = 12$, $12 \div 6 = 2$ / $12 \div 2 = 6$

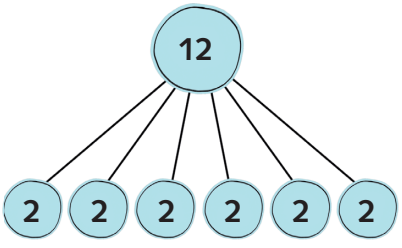
What if?

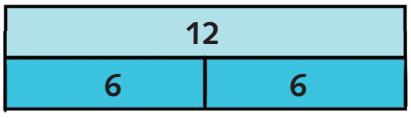
Children's answers will vary. Some sample answers are provided below for guidance.

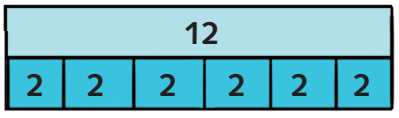












$2 \times 6 = 12$ / $6 \times 2 = 12$, $12 \div 6 = 2$ / $12 \div 2 = 6$

Doubling and halving (p.43)

Challenge

Children's explanations will vary depending on their depth of understanding of fractions.

Some children may agree with Holly's statement and think that you can double any number (e.g. double 4 is 8 and double 5 is 10) but that only even numbers can be halved (e.g. half of 6 is 3).

However, other children may have a greater depth of understanding and know that any number can be doubled or halved, and that halving an odd number does not produce a whole number (e.g. half of 7 is $3\frac{1}{2}$).

What if?

Holly's statement is true, as doubling (multiplication) and halving (division) are inverse operations.

Recognising halves and quarters (p.44)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Shapes that show a half shaded	Shapes that show a quarter shaded	Shapes that do not show a half or a quarter shaded
A, B, F, H, K	E, I, L, M	C, D, G, J

Each of the shapes that show a half have either 1 of 2 equal parts, or 2 of 4 equal parts shaded.

Each of the shapes that show a quarter have 1 of 4 equal parts shaded.

What if?

Shape C: 2 of 6 (or 1 of 3) equal parts are shaded ($\frac{1}{3}$ shaded)

Shape D: 3 of 4 equal parts are shaded ($\frac{3}{4}$ shaded)

Shape G: 1 of 3 equal parts is shaded ($\frac{1}{3}$ shaded)

Shape J: Less than a half of Shape J is shaded.

Children's other shapes will vary.

Finding halves and quarters (p.45)

Challenge

A more accurate description for finding half would refer to the fact that a half is one of two *equal parts* of an object, shape or quantity.

What if?

A more accurate description for finding a quarter would refer to the fact that a quarter is one of four *equal parts* of an object, shape or quantity.

Halves and quarters of numbers (p.46)

Challenge

Children's answers will vary. Some sample answers are provided below for guidance. Use your professional judgement when assessing children's responses to open-ended questions and their reasoning.

1 is half of 2, 2 is half of 4, 3 is half of 6, …

In all cases, the second number is double the first number, i.e. 2 is double 1, 4 is double 2, 6 is double 3.

What if?

Children's answers will vary. Some sample answers are provided below for guidance. Use your professional judgement when assessing children's responses to open-ended questions and their reasoning.

1 is a quarter of 4, 3 is a quarter 12, 4 is a quarter of 16, …

In all cases, the second number is four times the first number, i.e.

$1 \times 4 = 4$, $2 \times 4 = 8$, $3 \times 4 = 12$, $4 \times 4 = 16$.

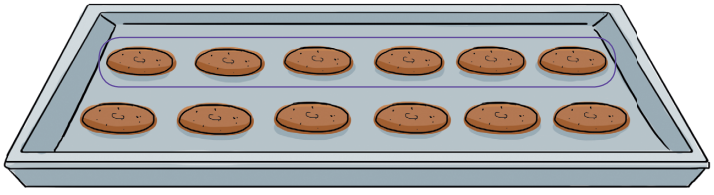
Using half (p.47)

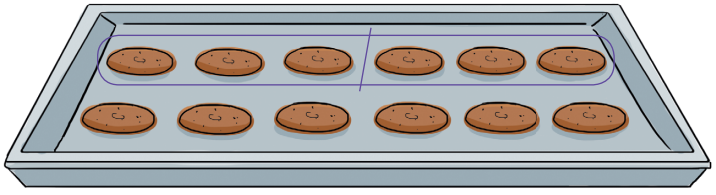
Challenge

Jake's statement is sometimes true.

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Finding half of a number, then finding half of the result, will give the same answer as finding a quarter of a number. For example, $\frac{1}{2}$ of 12 is 6, and $\frac{1}{2}$ of 6 is 3; and $\frac{1}{4}$ of 12 is 3.



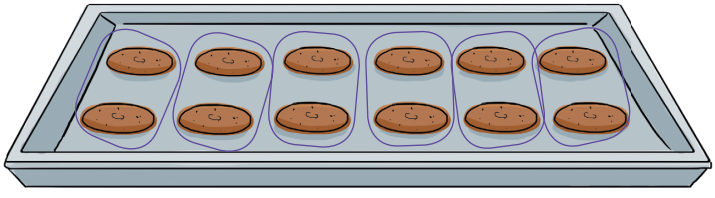


However, this strategy only works with numbers that are multiples of 4, i.e. 4, 8, 12, 16, …

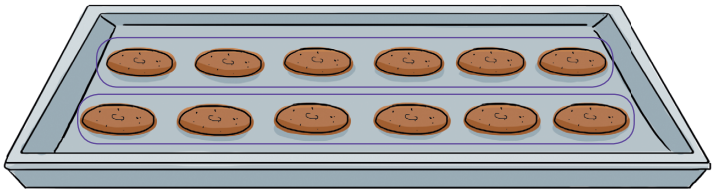
What if?

Jake's statement is not true.

Finding half of a number does not involve sharing objects into *groups of 2*, i.e.



Finding half of a number involves sharing the objects into *two equal groups*, i.e.



Which is better? (p.48)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

The cubes are better for measuring the length of the table as all the cubes are the same size (a uniform non-standard measure), whereas the cars are different sizes (a non-uniform non-standard measure).

Children should suggest other uniform non-standard measures, e.g. paper clips, or an appropriate measuring instrument, e.g. a centimetre ruler or metre rule.

What if?

The length of blue wool is longer as it is not taut. Once the piece of blue wool is stretched out, it will be longer than the piece of yellow wool.

Which is heavier? (p.49)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

The car is heavier than the giraffe as the giraffe weighs the same as 3 bricks whereas the car weighs the same as 4 bricks.

What if?

The apple is the lightest object and the orange is the heaviest.

We know from the first and second balances that the apple is lighter than the banana as the apple weighs the same as 3 bricks, whereas the banana weighs the same as 4 bricks.

We also know from the third balance that the orange is heavier than the banana.

So the apple is the lightest, then the banana, and the orange is the heaviest.

Is it fair? (p.50)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Jake is incorrect. All three children have received the same amount of juice. Although the three glasses vary in height, and Jake has the tallest glass, the width of all three glasses is the same, and the level of juice in each glass is identical.

What if?

This is not fair. Although the three glasses are identical in height and show the same height of juice within the glass, the width of all three glasses is different. Therefore, Jake has the least juice and Meru has the most.

Who's wearing which watch? (p.51)

Challenge/What if?

Children's answers may vary. Some sample answers are provided below for guidance. Use your professional judgement when assessing children's responses to open-ended questions and their reasoning.

- 8 o'clock – Ruby: It's my bedtime.
- $\frac{1}{2}$ past 8 – Meru: It's time for me to walk to school.
- 4 o'clock – Jake: It's time for my swimming lesson.
- $\frac{1}{2}$ past 12 – Holly: It's lunchtime.

Or:

- 8 o'clock – Meru: It's time for me to walk to school.
- $\frac{1}{2}$ past 8 – Ruby: It's my bedtime.
- 4 o'clock – Jake: It's time for my swimming lesson.
- $\frac{1}{2}$ past 12 – Holly: It's lunchtime.

Whose coins? (p.52)

Challenge

Children's explanations will vary depending on their depth of understanding, however they should refer to the following. Use your professional judgement when assessing children's reasoning.

Assuming that children would prefer to have the most money, then children would rather have the coins chosen by Jake that make a total of £3.18 (based on the 'old' round £1 coin). However, if the decision is based on the 'new' 12-sided £1 coin then Ruby with £3.03 has the most money.

Holly: I'd like to have all the silver coins – Total 85p

Jake: I wish I had all the round coins – Total £3.18 (based on the old round £1 coin) or £2.18 (based on the new 12-sided £1 coin)

Ruby: I'd like to have all the coins that aren't silver – Total £3.03

Meru: I wish I could have the two gold coins – Total £3

What if?

Once again, assuming that children would prefer to have the most money, then children would rather have the £5 note chosen by Mr Lewis.

Jake: On second thoughts, I'd like one of each coin – Total £3.88

Mr Lewis: I think I'd rather have a £5 note – Total £5

Sorting 2-D shapes (p.53)

Challenge

Children's criteria for sorting will vary. Some sample criteria are provided below for guidance. Use your professional judgement when assessing children's responses to open-ended questions and their reasoning.

Criteria may include:

- the number of sides
- the number of vertices (corners)
- straight sides or curved sides.

What if?

A better definition of a square would be: a square has 4 sides *of equal length*.

Same and different 3-D shapes (p.54)

Challenge/What if?

Children's answers will vary. Some sample answers are provided below for guidance. Use your professional judgement when assessing children's responses to open-ended questions and their reasoning.

Similarities and differences may be based on:

- the number of faces

- the number of edges
- the number of vertices (corners)
- flat faces or curved faces
- straight edges or curved edges.

Finding food (p.55)

Challenge/What if?

Children's answers will vary. Use your professional judgement when assessing children's responses to open-ended questions and their reasoning.

Using and applying mathematics in real-world contexts

Finding numbers (p.56)

Challenge/What if?

Results of the challenge will vary.

List of numbers (p.57)

Challenge/What if?

Results of the challenge will vary.

Card patterns (p.58)

Challenge/What if?

Results of the challenge will vary.

Types of shoes (p.59)

Challenge/What if?

Results of the challenge will vary.

Jelly beans (p.60)

Challenge/What if?

Results of the challenge will vary.

Favourite bear (p.61)

Challenge

Results of the challenge will vary.

What if?

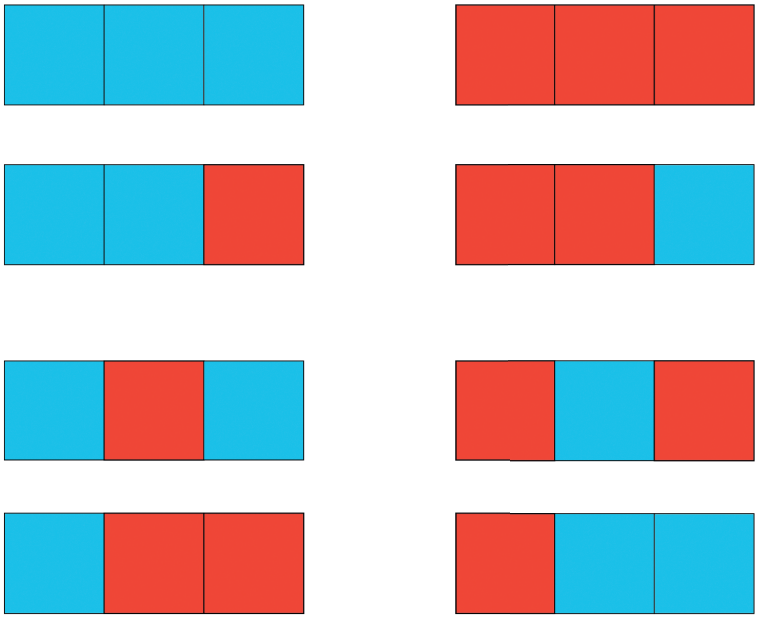
There are eight different possible combinations:

- orange hat, red shirt, green shorts
- orange hat, red shirt, yellow shorts
- orange hat, blue shirt, green shorts
- orange hat, blue shirt, yellow shorts
- purple hat, red shirt, green shorts
- purple hat, red shirt, yellow shorts
- purple hat, blue shirt, green shorts
- purple hat, blue shirt, yellow shorts

Flags (p.62)

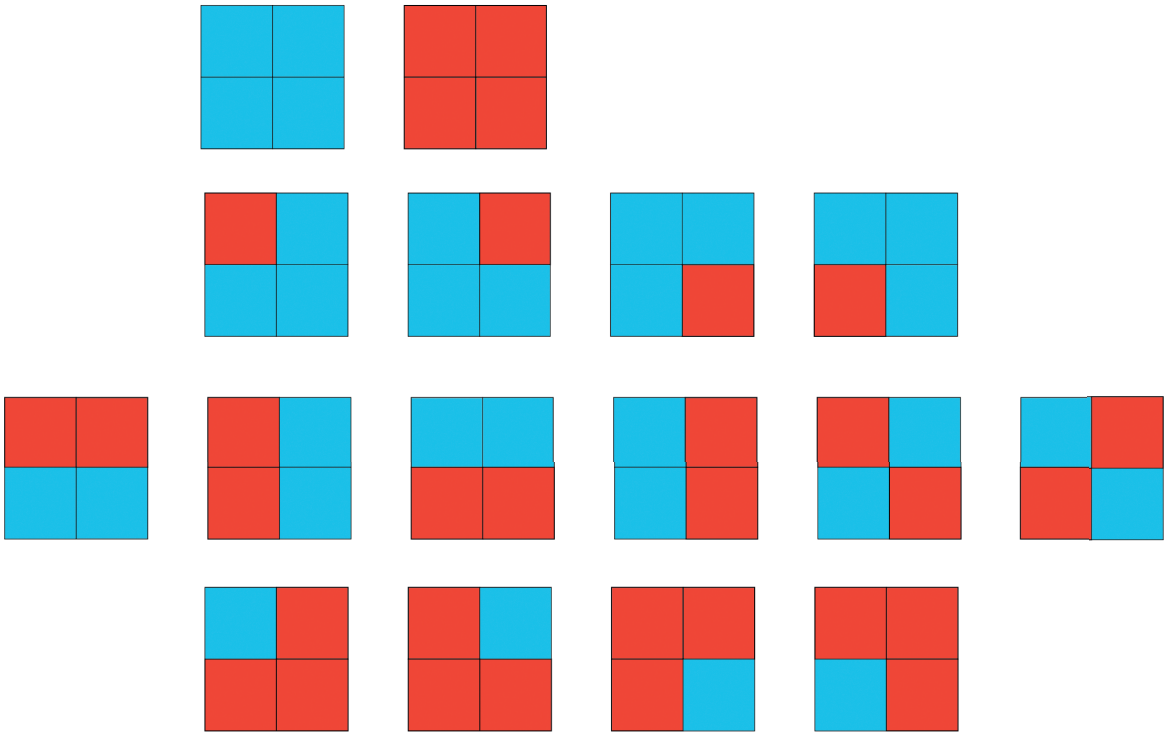
Challenge

There are eight different possible combinations:



What if?

There are 16 different possible combinations:



Letters in a name (p.63)

Challenge/What if?

Results of the challenge will vary.

Greg's garage (p.64)

Challenge

6 cars

12 motorbikes

5 cars and 2 motorbikes

4 cars and 4 motorbikes

3 cars and 6 motorbikes

2 cars and 8 motorbikes

1 car and 10 motorbikes

What if?

7 cars and 1 two-wheeled motorbike

6 cars and 3 two-wheeled motorbikes

5 cars and 5 two-wheeled motorbikes

4 cars and 7 two-wheeled motorbikes

3 cars and 9 two-wheeled motorbikes

2 cars and 11 two-wheeled motorbikes

1 car and 13 two-wheeled motorbikes

6 cars and 2 three-wheeled motorbikes

3 cars and 6 three-wheeled motorbikes

12 two-wheeled and 2 three-wheeled motorbikes

9 two-wheeled and 4 three-wheeled motorbikes

6 two-wheeled and 6 three-wheeled motorbikes

3 two-wheeled and 8 three-wheeled motorbikes

5 cars, 2 two-wheeled and 2 three-wheeled motorbikes

4 cars, 4 two-wheeled and 2 three-wheeled motorbikes

4 cars, 1 two-wheeled and 4 three-wheeled motorbikes

3 cars, 6 two-wheeled and 2 three-wheeled motorbikes

3 cars, 3 two-wheeled and 4 three-wheeled motorbikes

2 cars, 8 two-wheeled and 2 three-wheeled motorbikes

2 cars, 5 two-wheeled and 4 three-wheeled motorbikes

2 cars, 2 two-wheeled and 6 three-wheeled motorbikes

1 car, 10 two-wheeled and 2 three-wheeled motorbikes

1 car, 7 two-wheeled and 4 three-wheeled motorbikes

1 car, 4 two-wheeled and 6 three-wheeled motorbikes

15 two-wheeled motorbikes

10 three-wheeled motorbikes

Takeaway food (p.65)

Challenge

There are 15 different possible combinations:

- peas and chips
- peas and salad
- peas and pasta
- peas and fish fingers
- peas and pizza
- chips and salad
- chips and pasta
- chips and fish fingers
- chips and pizza
- salad and pasta
- salad and fish fingers
- salad and pizza
- pasta and fish fingers
- pasta and pizza
- fish fingers and pizza

What if?

There are 15 different possible combinations:

- peas, chips, salad and pasta
- peas, chips, salad and fish fingers
- peas, chips, salad and pizza
- peas, chips, pasta and fish fingers
- peas, chips, pasta and pizza
- peas, chips, fish fingers and pizza
- peas, salad, pasta and fish fingers
- peas, salad, pasta and pizza

- peas, salad, fish fingers and pizza
- peas, pasta, fish fingers and pizza
- chips, salad, pasta and fish fingers
- chips, salad, pasta and pizza
- chips, salad, fish fingers and pizza
- chips, pasta, fish fingers and pizza
- salad, pasta, fish fingers and pizza

Recycling (p.66)

Challenge/What if?

Results of the challenge will vary.

Beads (p.67)

Challenge/What if?

Results of the challenge will vary.

How tall? (p.68)

Challenge

Ruby is correct. Your height is approximately the same as three times around your head.

What if?

Ruby is correct. Your height is approximately the same as six times the length of your foot.

Newspaper (p.69)

Challenge/What if?

Results of the challenge will vary.

Sheet of paper (p.70)

Challenge/What if?

Results of the challenge will vary.

Yoghurt pots (p.71)

Challenge/What if?

Results of the challenge will vary.

Jobs rota (p.72)

Challenge/What if?

Results of the challenge will vary.

Names' worth (p.73)

Challenge/What if?

Results of the challenge will vary.

Cover it (p.74)

Challenge/What if?

Results of the challenge will vary.

Things with wheels (p.75)

Challenge/What if?

Results of the challenge will vary.

Pizza box (p.76)

Challenge/What if?

Results of the challenge will vary.

Things that move (p.77)

Challenge/What if?

Results of the challenge will vary.

Turning letters (p.78)

Challenge

Answers will vary depending on the font used or the child's handwriting.

The following letters look the same after a half turn:

H I N O S X

The following letters look the same after a quarter turn right:

O X

The following letters look the same after a quarter turn left:

O X

What if?

The following letters have straight lines only:

A E F H I K L M

N T V W X Y Z

The following letters have curved lines only:

C O S U

The following letters have straight and curved lines:

B D G J P Q R

The following letters fold exactly in half:

A B C D E H I K

M O T U V W X Y

Treasure (p.79)

Challenge/What if?

Results of the challenge will vary.