Answers

Solving mathematical problems

Rounding (p.8)

Challenge/What if?

Results of the challenge will vary.

Aiming for zero (p.9)

Challenge/What if?

Results of the challenge will vary.

Between 200 and 300 (p.10)

Challenge/What if?

Pupils' calculations will vary.

Factors (p.11)

Challenge

Numbers less than 100 that have proper factors that are only even numbers: 4, 8, 16, 32 and 64.

Numbers less than 100 that have proper factors that are only odd numbers: 9, 15, 21, 25, 27, 33, 35, 39, 45, 49, 51, 55, 57, 63, 65, 69, 75, 77, 81, 85, 87, 91, 93, 95 and 99.

What if?

There are 51 numbers less than 100 that have two prime factors:

6: 2 and 3	24: 2 and 3	40: 2 and 5	55: 5 and 11
10: 2 and 5	26: 2 and 13	44: 2 and 11	56: 2 and 7
12: 2 and 3	28: 2 and 7	45: 3 and 5	57: 3 and 19
14: 2 and 7	33: 3 and 11	46: 2 and 23	58: 2 and 29
15: 3 and 5	34: 2 and 17	48: 2 and 3	62: 2 and 31
18: 2 and 3	35: 5 and 7	50: 2 and 5	63: 3 and 7
20: 2 and 5	36: 2 and 3	51: 3 and 17	65: 5 and 13
21: 3 and 7	38: 2 and 19	52: 2 and 13	69: 3 and 23
22: 2 and 11	39: 3 and 13	54: 2 and 3	72: 2 and 3

74: 2 and 37

77: 7 and 11

82: 2 and 41

85: 5 and 17

86: 2 and 43

87: 3 and 29

88: 2 and 11

91: 7 and 13

92: 2 and 23

93: 3 and 31

94: 2 and 47

95: 5 and 19

96: 2 and 3

98: 2 and 7

99: 3 and 11

Multiplication and division cards (p.12)

Challenge/What if?

Results of the challenge will vary.

1, 2, 5 and 8 (p.13)

Challenge

0: 8 – 5 – 2 – 1

1: (2 × 5) – (8 + 1)

2: (2 × 5 × 1) – 8

3: (2 × 5) + 1 – 8

4: (8 × 2) ÷ (5 – 1)

5: (8 ÷ 1) + 2 – 5

6: 18 ÷ (5 – 2)

7: 28 ÷ (5 – 1)

8: (8 ÷ 2) + 5 – 1

9: (8 ÷ 2) + (5 × 1)

10: (2 × 8) – 5 – 1

Different calculations are possible for each number.

What if?

11: 18 – 5 – 2

12: (2 × 8) – 5 + 1

13: (8^2 + 1) ÷ 5

14: (18 ÷ 2) + 5

15: 18 + 2 – 5

16: 5^2 – 8 – 1

17: 5^2 – (8 ÷ 1)

18: 5^2 – 8 + 1

19: 15 + (8 ÷ 2)

20: (5 × 8) ÷ (2 × 1)

Different calculations are possible for each number.

Pupils' calculations for other numbers will vary.

Unit fractions (p.14)

Challenge/What if?

Pupils' calculations will vary.

Decimal multiplication (p.15)

Challenge/What if?

Pupils' calculations will vary.

Equivalences (p.16)

Challenge

The following shows the fractions and their decimal equivalents from $\frac{1}{2}$ to $\frac{1}{15}$.

Tenths: $\frac{1}{2}$ (0·5), $\frac{1}{5}$ (0·2) and $\frac{1}{10}$ (0·1)

Hundredths: $\frac{1}{4}$ (0·25)

Thousandths: $\frac{1}{8}$ (0·125)

Recurring decimals: $\frac{1}{3}$ ($0{\cdot}\dot{3}$), $\frac{1}{6}$ ($0{\cdot}1\dot{6}$), $\frac{1}{9}$ ($0{\cdot}\dot{1}$), $\frac{1}{12}$ ($0{\cdot}08\dot{3}$), $\frac{1}{15}$ ($0{\cdot}0\dot{6}$) and $\frac{1}{11}$ (0·090909 …)

Anything different: $\frac{1}{7}$ (0·1428571), $\frac{1}{13}$ (0·076923) and $\frac{1}{14}$ (0·0714285)

Pupils' observations and generalisations will vary.

What if?

$\frac{1}{2}$ / 0·5 / 50%

$\frac{1}{3}$ / $0{\cdot}\dot{3}$ / 33%

$\frac{1}{4}$ / 0·25 / 25%

$\frac{1}{5}$ / 0·2 / 20%

$\frac{1}{6}$ / $0{\cdot}1\dot{6}$ / 16%

$\frac{1}{7}$ / 0·1428571 / 14%

$\frac{1}{8}$ / 0·125 / 13%

$\frac{1}{9}$ / $0{\cdot}\dot{1}$ / 11%

$\frac{1}{10}$ / 0·1 / 10%

$\frac{1}{11}$ / 0·090909 … / 9%

$\frac{1}{12}$ / $0{\cdot}08\dot{3}$ / 8%

$\frac{1}{13}$ / 0·076923 / 8%

$\frac{1}{14}$ / 0·0714285 / 7%

$\frac{1}{15}$ / $0{\cdot}0\dot{6}$ / 7%

Pupils' non-unit fraction conversions to decimals and percentages will differ.

Pupils' observations and generalisations will vary.

Percentages (p.17)

Challenge/What if?

Pupils' statements will vary.

Domino ratios (p.18)

Challenge

The fraction of the dominoes that have an even total is $\frac{15}{27}$ or $\frac{5}{9}$.

The fraction of the dominoes that have an odd total is $\frac{12}{27}$ or $\frac{4}{9}$.

The ratio of even totals to odd totals is 5 : 4.

What if?

The fraction of the dominoes that have an even difference is $\frac{9}{21}$ or $\frac{3}{7}$.

The fraction of the dominoes that have an odd difference is $\frac{12}{21}$ or $\frac{4}{7}$.

The ratio of even differences to odd differences is 3 : 4.

The fraction of the dominoes that have an even product is $\frac{6}{21}$ or $\frac{2}{7}$.

The fraction of the dominoes that have an odd product is $\frac{15}{21}$ or $\frac{5}{7}$.

The ratio of even products to odd products is 2 : 5.

Algebraic expressions (p.19)

Challenge

Pupils' predictions will vary.

Pupils' generalisations will vary. However, they should realise that when positive whole numbers are substituted for the letters a, b and c:

- the algebraic expression $a + b + c$ will result in the greatest answer
- the algebraic expressions $a - (b + c)$ and $a - b - c$ will both result in the smallest answer
- the algebraic expressions $a - (b + c)$ and $a - b - c$ will result in the same answer
- the algebraic expressions $a + (b - c)$ and $(a + b) - c$ will also result in the same answer.

Pupils should realise that, regardless of which positive whole numbers are substituted for the letters *a*, *b* and *c*, the above generalisations will always be true, for example:

If *a* = 10, *b* = 8 and *c* = 2

or *a* = 10, *b* = 2 and *c* = 8

or *a* = 2, *b* = 8 and *c* = 10

or *a* = 2, *b* = 10 and *c* = 8

or *a* = 8, *b* = 10 and *c* = 2

or *a* = 8, *b* = 2 and *c* = 10

What if?

Pupils' generalisations will vary. However, they should realise that when positive whole numbers are substituted for the letters *a*, *b* and *c*, the expressions that result in the greatest answer and the smallest answer will vary depending on the relative size of the three numbers substituted. They should also realise that when the same three numbers are substituted, no expressions will result in the same answer, for example:

If *a* = 10, *b* = 8 and *c* = 2, then:

10 × (8 – 2)	(10 × 8) + 2	(10 × 8) – 2	(10 – 8) × 2	10 + (8 × 2)	(10 + 8) × 2
= 10 × 6	= 80 + 2	= 80 – 2	= 2 × 2	= 10 + 16	= 18 × 2
= 60	= 82	= 78	= 4	= 26	= 36

If *a* = 10, *b* = 2 and *c* = 8, then:

10 × (2 – 8)	(10 × 2) + 8	(10 × 2) – 8	(10 – 2) × 8	10 + (2 × 8)	(10 + 2) × 8
= 10 × – 6	= 20 + 8	= 20 – 8	= 8 × 8	= 10 + 16	= 12 × 8
= – 60	= 28	= 12	= 64	= 26	= 96

If *a* = 2, *b* = 8 and *c* = 10, then:

2 × (8 – 10)	(2 × 8) + 10	(2 × 8) – 10	(2 – 8) × 10	2 + (8 × 10)	(2 + 8) × 10
= 2 × – 2	= 16 + 10	= 16 – 10	= – 6 × 10	= 2 + 80	= 10 × 10
= – 4	= 26	= 6	= – 60	= 82	= 100

If *a* = 2, *b* = 10 and *c* = 8, then:

2 × (10 – 8)	(2 × 10) + 8	(2 × 10) – 8	(2 – 10) × 8	2 + (10 × 8)	(2 + 10) × 8
= 2 × 2	= 20 + 8	= 20 – 8	= – 8 × 8	= 2 + 80	= 12 × 8
= 4	= 28	= 12	= – 64	= 82	= 96

If $a = 8$, $b = 10$ and $c = 2$, then:

8 × (10 – 2)	(8 × 10) + 2	(8 × 10) – 2	(8 – 10) × 2	8 + (10 × 2)	(8 + 10) × 2
= 8 × 8	= 80 + 2	= 80 – 2	= – 2 × 2	= 8 + 20	= 18 × 2
= 64	= 82	= 78	= – 4	= 28	= 36

If $a = 8$, $b = 2$ and $c = 10$, then:

8 × (2 – 10)	(8 × 2) + 10	(8 × 2) – 10	(8 – 2) × 10	8 + (2 × 10)	(8 + 2) × 10
= 8 × – 8	= 16 + 10	= 16 – 10	= 6 × 10	= 8 + 20	= 10 × 10
= – 64	= 26	= 6	= 60	= 28	= 100

Making magic squares (p.20)

Challenge

The magic number for the magic square is 33.

Pupils' magic squares will vary.

What if?

Pupils' magic square for the magic number 36 might look like the following. Other magic squares are possible.

7	19	10
15	12	9
14	5	17

Where:

$a = 12$

$b = 2$

$c = 5$

12 – 5	12 + 2 + 5	12 – 2
12 – 2 + 5	12	12 + 2 – 5
12 + 2	12 – 2 – 5	12 + 5

Metric and imperial measures (p.21)

Challenge/What if?

Results of the challenge will vary.

Time differences (p.22)

Challenge

The time difference between London and the following cities is:

Los Angeles: –8 hours

New York: –5 hours

Buenos Aires: –3 hours

Rome: +1 hour

Athens: +2 hours

Kolkata: +5 hours 30 minutes

Hong Kong: +8 hours

Sydney: +11 hours

NOTE: The above time zone differences will vary during the year, as different countries observe daylight saving during different periods.

What if?

The following are based on the time differences given above.

	If the time in …								
then the time in …	Los Angeles is 12:00	New York is 09:30	Buenos Aires is 06:30	London is 05:00	Rome is 16:00	Athens is 22:00	Kolkata is 23:00	Hong Kong is 14:00	Sydney is 17:30
Los Angeles is:		06:30	01:30	21:00	07:00	12:00	09:30	22:00	22:30
New York is:	15:00		04:30	00:00	10:00	15:00	12:30	01:00	01:30
Buenos Aires is:	17:00	11:30		02:00	12:00	17:00	14:30	03:00	03:30
London is:	20:00	14:30	09:30		15:00	20:00	17:30	06:00	06:30
Rome is:	21:00	15:30	10:30	06:00		21:00	18:30	07:00	07:30
Athens is:	22:00	16:30	11:30	07:00	17:00		19:30	08:00	08:30
Kolkata is:	1:30	20:00	15:00	10:30	20:30	01:30		11:30	12:00
Hong Kong is:	04:00	22:30	17:30	13:00	23:00	04:00	01:30		14:30
Sydney is:	07:00	01:30	20:30	16:00	02:00	07:00	04:30	17:00	

VAT (p.23)

Challenge

Country	Price of sunglasses including VAT
Luxembourg	(€24 × 0·17) + €24 = €4.08 + €24 = €28.08
Germany	(€24 × 0·19) + €24 = €4.56 + €24 = €28.56
France	(€24 × 0·2) + €24 = €4.80 + €24 = €28.80
Spain	(€24 × 0·21) + €24 = €5.04 + €24 = €29.04
Italy	(€24 × 0·22) + €24 = €5.28 + €24 = €29.28
Ireland	(€24 × 0·23) + €24 = €5.52 + €24 = €29.52
Finland	(€24 × 0·24) + €24 = €5.76 + €24 = €29.76

What if?

By referring to the table, pupils should realise that the cheapest country in which to buy the scooter is Luxembourg (with a VAT rate of 17%) and the most expensive country is Finland (with a VAT rate of 24%).

The difference in price between these two countries is:

Luxembourg	(€32 × 0·17) + €32 = €5.44 + €32 = €37.44
Finland	(€32 × 0·24) + €32 = €7.68 + €32 = €39.68

€39.68 – €37.44 = €2.24

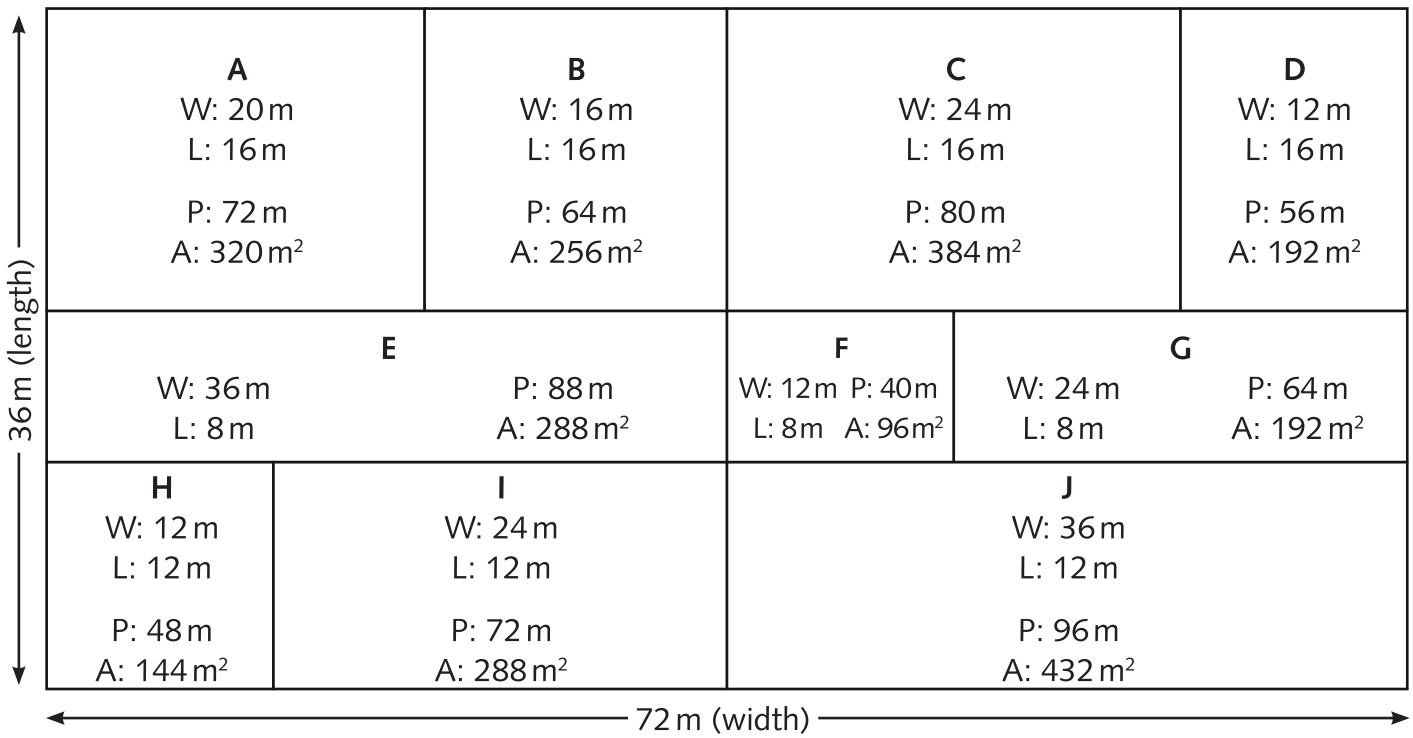
or:

24% – 17% = 7%

€32 × 0·07 = €2.24

Field measurements (p.24)

Challenge



What if?

Pupils' dimensions and diagrams will vary. However, the overall perimeter of the farm should total 216 m and the overall area 2592 m^2.

Measuring temperature (p.25)

Challenge

Results of the challenge will vary.

What if?

Answers are given in bold type.

Description	°C	°F
Hot oven	220	**428**
Moderate oven	**180**	356
Water boils	100	**212**
Hot bath	**40**	104
Body temperature	37	**98.6**
Hot day	**30**	86
Room temperature	21	**69.8**
Cool day	**10**	50
Water freezes	0	**32**

Diagonals (p.26)

Challenge

For a hexagon, the number of diagonals is 9.

For a square, the number of diagonals is 2.

For a pentagon, the number of diagonals is 5.

For a heptagon, the number of diagonals is 14.

For an octagon, the number of diagonals is 20.

What if?

For a nonagon (9-sided polygon), the number of diagonals is 27.

For a decagon (10-sided polygon), the number of diagonals is 35.

For a hendecagon (11-sided polygon), the number of diagonals is 44.

For a dodecagon (12-sided polygon), the number of diagonals is 54.

Pupils' symmetrical patterns will vary.

Polygon angles (p.27)

Challenge/What if?

For a square, the sum of all the interior angles is 360° and the size of each angle is 90°.

For a pentagon, the sum of all the interior angles is 540° and the size of each angle is 108°.

For a hexagon, the sum of all the interior angles is 720° and the size of each angle is 120°.

For a heptagon, the sum of all the interior angles is 900° and the size of each angle is 128.57…°.

For an octagon, the sum of all the interior angles is 1080° and the size of each angle is 135°.

For a nonagon (9-sided polygon), the sum of all the interior angles is 1260° and the size of each angle is 140°.

For a decagon (10-sided polygon), the sum of all the interior angles is 1440° and the size of each angle is 144°.

For a hendecagon (11-sided polygon), the sum of all the interior angles is 1620° and the size of each angle is 147.27…°.

For a dodecagon (12-sided polygon), the sum of all the interior angles is 1800° and the size of each angle is 150°.

Coordinates translations (p.28)

Challenge/What if?

Pupils' shapes will vary.

Coordinates reflections (p.29)

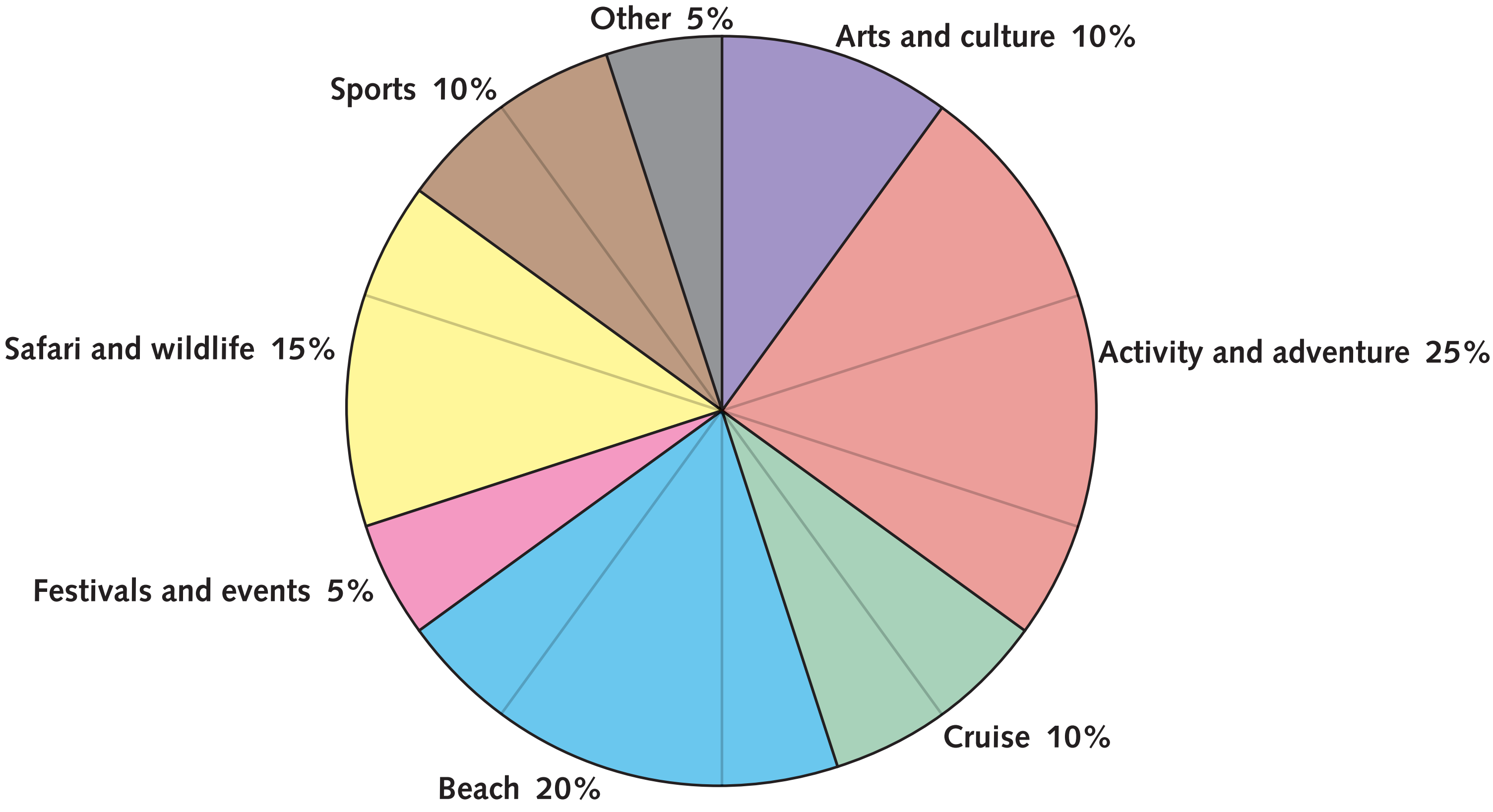
Challenge/What if?

Pupils' reflections and symmetrical patterns will vary.

Charts (p.30)

Challenge

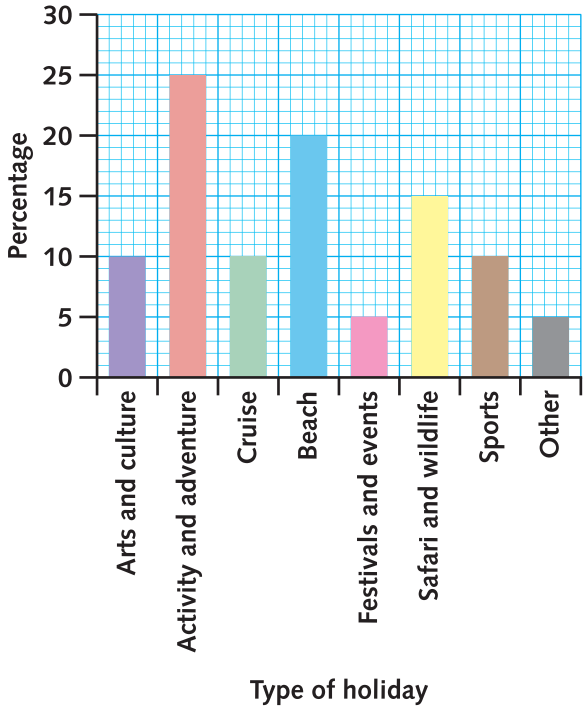
Pupils' pie charts will vary. However, they may look similar to the following:



Pupils' comparative statements, and explanation of which form of data presentation they preferred, will vary.

What if?

Pupils' bar charts will vary. However, they may look similar to the following:



Pupils' explanations as to which form of data presentation they find easiest to read and interpret will vary.

Averages (p.31)

Challenge/What if?

Results of the challenge will vary.

Reasoning mathematically

Who has which card? (p.32)

Challenge

David's number is 493 571.

Eve's number is 492 781.

Johannes' number is 493 781.

Sofia's number is 483 571.

Pupils' reasoning and explanations will vary depending on their depth of understanding. Use your professional judgment when assessing pupils' reasoning.

What if?

Pupils' numbers and clues will vary.

Are they correct? (p.33)

Challenge

David's statement is not correct: –12 + 5 = –7 does not have the smallest answer. The calculation with the smallest answer is –12 – 5 = –17.

Eve's statement is not correct: –12 – 5 and 12 + 5 do not have the same answer.

–12 – 5 = –17

12 + 5 = 17

Johannes' statement is correct: two of the answers are less than zero.

–12 – 5 = –17

–12 + 5 = –7

Sophia's statement is not correct: the answer of each calculation is not 7 or 17.

12 – 5 = 7

–12 – 5 = –17

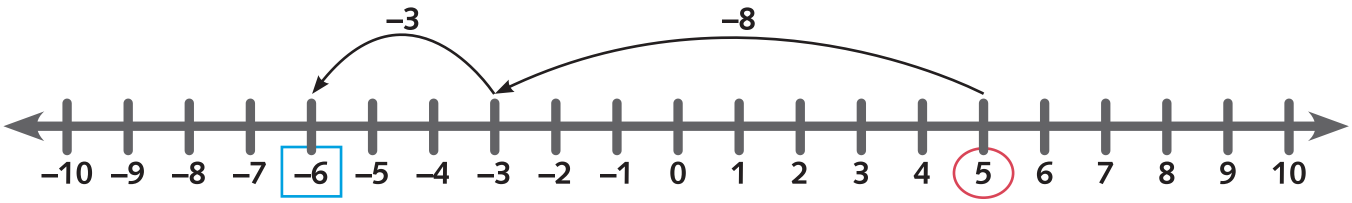
12 + 5 = 17

–12 + 5 = –7

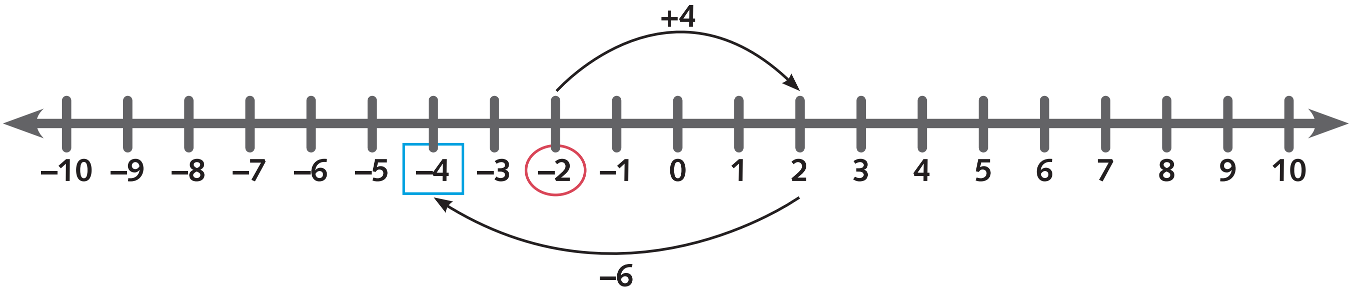
What if?

Pupils' explanations will vary depending on their depth of understanding. However, they may include the use of number lines as indicated below. Use your professional judgment when assessing pupils' reasoning.

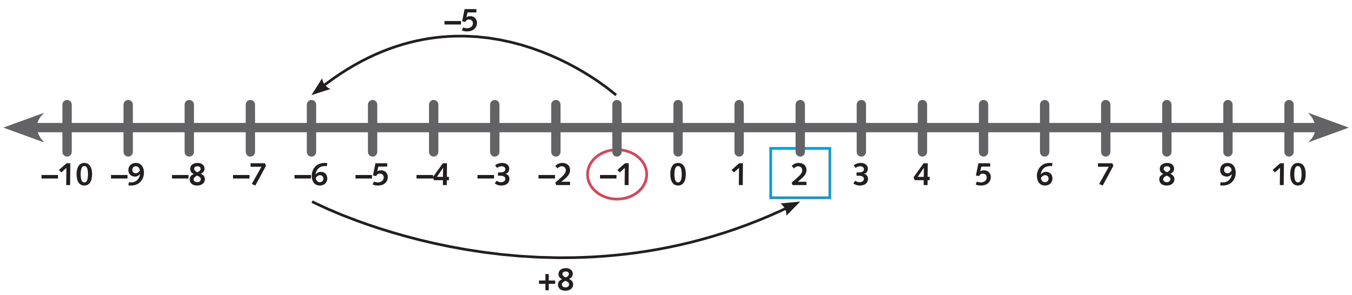
(5) − 8 − 3 = [−6]



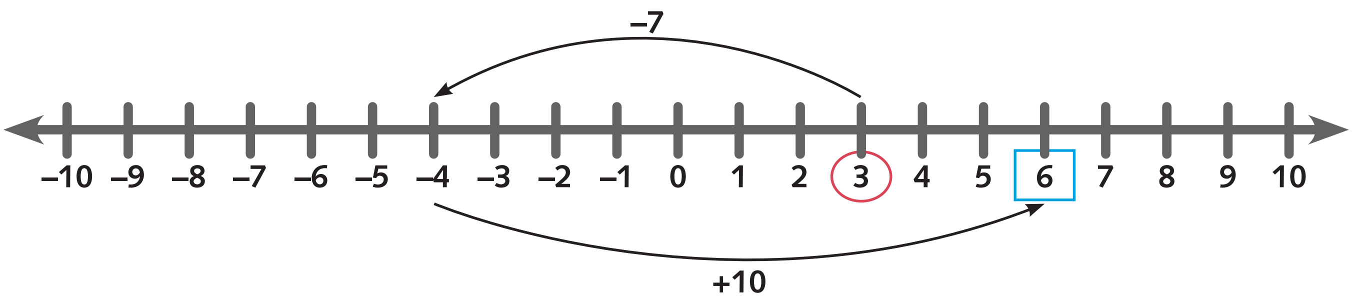
(−2) + 4 − 6 = [−4]



(−1) − 5 + 8 = [2]



(3) − 7 + 10 = [6]



Decimal calculation patterns (p.34)

Challenge

Pupils' observations will vary depending on their depth of understanding. However, they may include the following. Use your professional judgment when assessing pupils' reasoning.

11·1 + 1·11 = 12·21

22·2 + 2·22 = 24·42

33·3 + 3·33 = 36·63

The pattern continues:

44·4 + 4·44 = 48·84

55·5 + 5·55 = 61·05*

In the answer to each calculation:

- the tens and hundredths digits are identical
- the ones and tenths digits are identical.

In the answer to each consecutive calculation:

- the tens and hundredths digits increase by 1 each time
- the ones and tenths digits increase by 2 each time.

*The pattern alters once a place value boundary is crossed.

The difference between consecutive answers is 12·21: the answer to the first calculation.

111·1 + 1·111 = 112·211

222·2 + 2·222 = 224·422

333·3 + 3·333 = 336·633

The pattern continues:

444·4 + 4·444 = 448·844

555·5 + 5·555 = 561·055*

In the answer to each calculation:

- the hundreds, tens, hundredths and thousandths digits are identical
- the ones and tenths digits are identical.

In the answer to each consecutive calculation:

- the hundreds, tens, hundredths and thousandths digits increase by 1 each time
- the ones and tenths digits increase by 2 each time.

*The pattern alters once a place value boundary is crossed.

The difference between consecutive answers is 112·211: the answer to the first calculation.

111·11 + 11·111 = 122·221

222·22 + 22·222 = 244·442

333·33 + 33·333 = 366·663

The pattern continues:

444·44 + 44·444 = 488·884

555·55 + 55·555 = 611·105*

In the answer to each calculation:

- the hundreds and thousandths digits are identical
- the tens, ones, tenths and hundredths digits are identical.

In the answer to each consecutive calculation:

- the hundreds and thousandths digits increase by 1 each time
- the tens, ones, tenths and hundredths digits increase by 2 each time.

*The pattern alters once a place value boundary is crossed.

The difference between consecutive answers is 122·221: the answer to the first calculation.

What if?

11·1 – 1·11 = 9·99

22·2 – 2·22 = 19·98

33·3 – 3·33 = 29·97

The pattern continues:

44·4 – 4·44 = 39·96

55·5 – 5·55 = 49·95

In the answer to each calculation the ones and tenths digits are the same, i.e. 9.

In the answer to each consecutive calculation:

- the tens digit increases by 1 each time
- the hundredths digits decreases by 1 each time.

The difference between consecutive answers is 9·99: the answer to the first calculation.

111·1 – 1·111 = 109·989

222·2 – 2·222 = 219·978

333·3 – 3·333 = 329·967

The pattern continues:

444·4 – 4·444 = 439·956

555·5 – 5·555 = 549·945

In the answer to each calculation the ones and tenths digits are the same, i.e. 9.

In the answer to each consecutive calculation:

- the hundreds and tens digits increase by 1 each time
- the hundredths and thousandths digits decrease by 1 each time.

The difference between consecutive answers is 109·989: the answer to the first calculation.

111·11 – 11·111 = 99·999

222·22 – 22·222 = 199·998

333·33 – 33·333 = 299·997

The pattern continues:

444·44 – 44·444 = 399·996

555·55 – 55·555 = 499·995

In the answer to each calculation the tens, ones, tenths and hundredths digits are the same, i.e. 9.

In the answer to each consecutive calculation:

- the hundreds digit increases by 1 each time
- the thousandths decreases by 1 each time.

The difference between consecutive answers is 99·999: the answer to the first calculation.

Primes and factors (p.35)

Challenge

Sofia's method does work.

Pupils' explanations will vary depending on their depth of understanding. However, they should make some mention of the following. Use your professional judgment when assessing pupils' reasoning.

This method works because dividing by 2, 3, 5, and 7 will result in the same quotients as dividing by all of the numbers 2 to 9, i.e.

- dividing by 2 also tests divisibility for 4 and 8
- dividing by 3 also tests divisibility for 6 and 9
- dividing by 5 also tests divisibility for 10.

What if?

Johannes' statement is correct.

The product of the lowest common multiple (LCM) and greatest common factor (GCF) of any two numbers is always equal to the product of those two numbers. For example, 6 and 9: The LCM is 18, the GCF is 3. 18 × 3 is equal to 6 × 9.

Match the answer (p.36)

Challenge

$174 \times 83 = 14\,442$

$30\,831 - 16\,587 = 14\,244$

$2368 \div 24 = 98\frac{2}{3}$

$6317 + 7925 = 14\,242$

$12^2 \times 100 = 14\,400$

$1643 \div 9 = 182\frac{5}{9}$

What if?

Eve has worked out the wrong answer. Her answer should be 24 r 8, not 24 r 4.

The three other answers are all correct. They are just expressing the remainders in different ways, i.e.

$24\frac{1}{4}$ (as a fraction reduced to its simplest form)

$24\frac{8}{32}$ (as a fraction)

24·25 (as a decimal)

A, B, C or D? (p.37)

Challenge

1. $7 + 4 \times 5 =$ (C.) 27
2. $160 - 5 \times 6 =$ (A.) 130
3. $(92 - 10) \times 5 =$ (D.) 410
4. $9 \times (16 - 7) =$ (D.) 81
5. $(12 - 6) \times (4 - 1) =$ (B.) 18
6. $24 \div (12 - 4) =$ (C.) 3
7. $60 - 30 \div 6 =$ (A.) 55
8. $18 - 3 \times 6 =$ (C.) 0

Pupils' explanations will vary depending on their depth of understanding. However, they should make some mention of the order of operations. Use your professional judgment when assessing pupils' reasoning.

What if?

Pupils' explanations as to the errors that Sofia made will vary. However, they should make some mention of the order of operations. Use your professional judgment when assessing pupils' reasoning.

Sofia answered the following questions incorrectly:

1. $20 + 4 \times 5 \div 10 \neq 12$ (A).

   $20 + 4 \times 5 \div 10 = 22$ (D).

Sofia calculated the answer by working left to right and ignoring the order of operations.

3. $36 \div (12 - 3) \neq 0$ (B)

   $36 \div (12 - 3) = 4$ (C)

Sofia did not work out the calculation inside the brackets first.

Order the fractions (p.38)

Challenge/What if?

$\frac{2}{3} + \frac{3}{5}$
$= \frac{(2 \times 5) + (3 \times 3)}{(3 \times 5)}$
$= \frac{10 + 9}{15}$
$= \frac{19}{15}$
$= 1\frac{4}{15}$
(greatest answer)

$\frac{3}{4} - \frac{1}{3}$
$= \frac{(3 \times 3) - (4 \times 1)}{(4 \times 3)}$
$= \frac{9 - 4}{12}$
$= \frac{5}{12}$

$\frac{4}{5} \times \frac{3}{4}$
$= \frac{(4 \times 3)}{(5 \times 4)}$
$= \frac{12}{20}$
$= \frac{3}{5}$

$\frac{5}{6} \div 5$
$= \frac{5}{(6 \times 5)}$
$= \frac{5}{30}$
$= \frac{1}{6}$
(smallest answer)

Pupils' explanations will vary.

$\frac{3}{4} + \frac{1}{6}$
$= \frac{(3 \times 6) + (4 \times 1)}{(4 \times 6)}$
$= \frac{18 + 4}{24}$
$= \frac{22}{24}$
$= \frac{11}{12}$
(greatest answer)

$\frac{5}{6} - \frac{3}{4}$
$= \frac{(5 \times 4) - (6 \times 3)}{(6 \times 4)}$
$= \frac{20 - 18}{24}$
$= \frac{2}{24}$
$= \frac{1}{12}$
(smallest answer)

$\frac{1}{3} \times \frac{3}{8}$
$= \frac{(1 \times 3)}{(3 \times 8)}$
$= \frac{3}{24}$
$= \frac{1}{8}$

$\frac{2}{5} \div 4$
$= \frac{2}{(5 \times 4)}$
$= \frac{2}{20}$
$= \frac{1}{10}$

Pupils' explanations will vary.

Which do you prefer? (p.39)

Challenge/What if?

Pupils' preferred methods and explanations will vary.

Find the pairs (p.40)

Challenge

The two pairs of cards shown here in blue are the cards that Eve matched correctly. The other eight pairs were all matched incorrectly. The correct pairings are below.

25%	0·25
$\frac{5}{10}$	0·5
$\frac{3}{5}$	60%
54%	0·54
0·75	$\frac{3}{4}$
40%	0·4
0·125	$\frac{1}{8}$
0·2	20%
$\frac{1}{20}$	5%
4%	$\frac{1}{25}$

The missing equivalent fractions, decimals or percentages are:

25%	0·25	$\frac{1}{4}$
$\frac{5}{10}$	0·5	50%
$\frac{3}{5}$	60%	0·6
54%	0·54	$\frac{54}{100}$
0·75	$\frac{3}{4}$	75%
40%	0·4	$\frac{2}{5}$
0·125	$\frac{1}{8}$	12·5%
0·2	20%	$\frac{1}{5}$
$\frac{1}{20}$	5%	0·05
4%	$\frac{1}{25}$	0·04

NOTE: For fractions on green cards, other equivalent fractions are possible.

What if?

The order of the fractions smallest to greatest is: $\frac{1}{25}, \frac{1}{20}, \frac{1}{8}, \frac{1}{5}, \frac{1}{4}, \frac{2}{5}, \frac{5}{10}, \frac{54}{100}, \frac{3}{5}, \frac{3}{4}$

NOTE: Other equivalent fractions are possible.

0·04 rounded to the nearest tenth is 0.

0·05 rounded to the nearest tenth is 0·1.

0·25 rounded to the nearest tenth is 0·3.

0·54 rounded to the nearest tenth is 0·5.

0·75 rounded to the nearest tenth is 0·8.

0·125 rounded to the nearest hundredth is 0·13 and rounded to the nearest tenth is 0·1.

The percentages less than 50% are: 4%, 5%, 12·5%, 20%, 25% and 40%.

The percentages 50% or more are: 50%, 54%, 60% and 75%.

Using known percentages (p.41)

Challenge/What if?

Pupils' explanations will vary, but may include the following:

1% = divide by 100 or divide by 10 twice

10% = divide by 10

50% = halve

25% = halve and halve again

Pupils' explanations for finding other percentages will vary.

Describe the towers (p.42)

Challenge

Eve:

Tower C: ratio of red to blue is 1 : 2

Tower F: ratio of red to blue is 3 : 5

David:

Tower I: ratio of blue to red is 3 : 4

Tower J: ratio of blue to red is 3 : 7

Johannes:

Tower B: ratio of red to blue is 2 : 5

Tower G: ratio of red to blue is 1 : 5

Sofia:

Tower A: ratio of red to blue is 1 : 3.

Tower D: ratio of blue to red is 2 : 3.

Ms Moore:

Tower E: ratio of red to blue is 1 : 4

Tower H: ratio of red to blue is 5 : 4

What if?

Eve:

Tower C: The proportion of blue cubes is $\frac{2}{3}$ and the proportion of red cubes is $\frac{1}{3}$.

Tower F: The proportion of blue cubes is $\frac{5}{8}$ and the proportion of red cubes is $\frac{3}{8}$.

David:

Tower I: The proportion of blue cubes is $\frac{3}{7}$ and the proportion of red cubes is $\frac{4}{7}$.

Tower J: The proportion of blue cubes is $\frac{3}{10}$ and the proportion of red cubes is $\frac{7}{10}$.

Johannes:

Tower B: The proportion of blue cubes is $\frac{5}{7}$ and the proportion of red cubes is $\frac{2}{7}$.

Tower G: The proportion of blue cubes is $\frac{5}{6}$ and the proportion of red cubes is $\frac{1}{6}$.

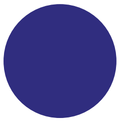
Ms Moore:

Tower E: The proportion of blue cubes is $\frac{4}{5}$ and the proportion of red cubes is $\frac{1}{5}$.

Tower H: The proportion of blue cubes is $\frac{4}{9}$ and the proportion of red cubes is $\frac{5}{9}$.

Algebraic shapes (p.43)

Challenge

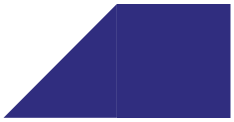


2*b* (or *b* + *b*)

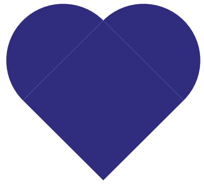
a + 2*b* (or *a* + b + *b*)

2*a* (or *a* + *a*)

$\frac{1}{2}a$ (or *a* ÷ 2)



$1\frac{1}{2}a$ (or $a + \frac{1}{2}a$)



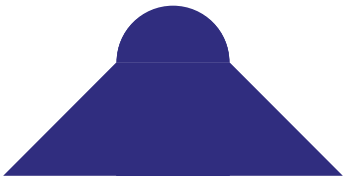
a + 2*b* (or *a* + *b* + *b*)

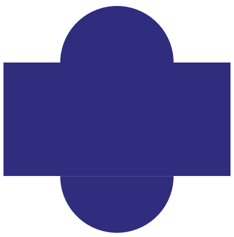
Pupils' shapes will vary, but may include shapes similar to the following:

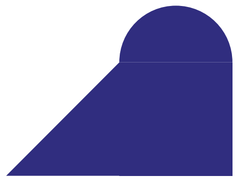
2*a* + *b*

2*a* + 2*b*

$1\frac{1}{2}a + b$





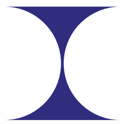


What if?

2*a* – *b* (or *a* + *a* – *b*)

2*a* – 2*b* (or *a* + *a* – *b* – *b*)

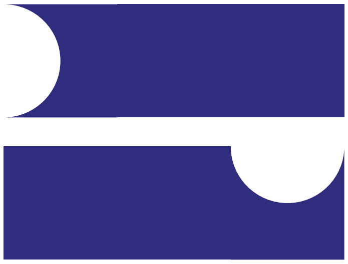
2*a* – *b* (or *a* + *a* – *b*)



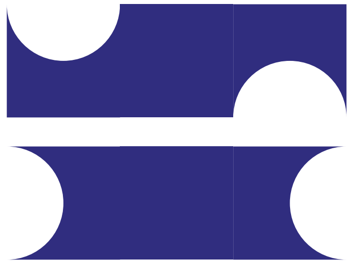
a – 2*b* (or *a* – *b* – *b*)

Pupils' shapes will vary, but may include shapes similar to the following:

$3a - b$



$3a - 2b$



$1\frac{1}{2}a - b$

What are the numbers? (p.44)

Challenge

Sofia's three numbers were:

$a = 9$

$b = 3$

$c = 4$

Pupils' reasoning and explanations will vary. Use your professional judgment when assessing pupils' reasoning.

What if?

David's three numbers could have been any of the following three combinations:

$a = 7$	$a = 8$	$a = 9$
$b = 4$	$b = 5$	$b = 6$
$c = 1$	$c = 2$	$c = 3$

Pupils' reasoning and explanations will vary. Use your professional judgment when assessing pupils' reasoning.

Who has more? (p.45)

Challenge

Sofia has more as $\frac{1}{2}$ litre (500 millilitres) is more than $\frac{1}{2}$ pint (approximately 284 millilitres).

Johannes has more as 700 grams is more than 1 pound (approximately 454 grams).

Eve has more as 15 inches (approximately 38 centimetres) is more than 30 centimetres.

Pupils' reasoning and explanations will vary depending on their depth of understanding of metric and imperial equivalences. Use your professional judgment when assessing pupils' reasoning.

NOTE: The equivalent metric and imperial measurements given above may be based on slightly different equivalences from those taught.

What if?

Altogether, Sofia and David have approximately 784 ml or 1·4 pints of apple juice.

The total mass of sweets that Johannes and Eve have is approximately 1154 grams or $2\frac{1}{2}$ pounds.

The combined length of liquorice that Eve and David have is approximately 68 centimetres or 27 inches.

Pupils' reasoning and explanations will vary depending on their depth of understanding of metric and imperial equivalences. Use your professional judgment when assessing pupils' reasoning.

NOTE: The equivalent metric and imperial measurements given above may be based on slightly different equivalences from those taught.

Decimal time (p.46)

Challenge

$2\frac{1}{2}$ hours would be 2·5 hours.

$1\frac{1}{4}$ hours would be 1·25 hours.

$\frac{3}{4}$ of an hour would be 0·75 hours.

Pupils' explanations will vary. However, they should make some mention of fraction and decimal equivalences.

What if?

2·1 hours would be 2 hours and 6 minutes.

5·3 hours would be 5 hours and 18 minutes.

1·8 hours would be 1 hour and 48 minutes.

2·9 hours would be 2 hours and 54 minutes.

3·6 hours would be 3 hours and 36 minutes.

3 hours and 12 minutes would be expressed as 3·2.

1 hour and 42 minutes would be expressed as 1·7.

4 hours and 24 minutes would be expressed as 4·4.

Pupils' explanations will vary. However, they should make some mention of the fact that 0·1 of an hour is equal to 6 minutes and be able to apply this to work out other decimals of an hour, i.e. 0·1 (6 minutes) × 2 = 0·2 (12 minutes); 0·1 (6 minutes) × 7 = 0·7 (42 minutes).

Which would you rather have? (p.47)

Challenge

Assuming that pupils would prefer to have the most money, then they would rather have the change from £50 after spending £16.23 (£33.77).

What if?

Ms Moore is incorrect. She will need to pay £727.50 each month, not £727.60.

Pupils' explanation will vary. However, it should make mention of the fact that 727 r 6 is actually $727\frac{6}{12}$ or $727\frac{1}{2}$ or 727.5. Which means that Ms Moore actually has to pay £727.50.

What's the method? (p.48)

Challenge

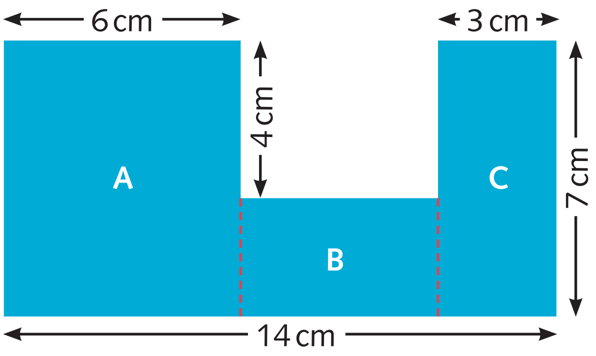
Eve:

A + B + C

(6 × 7) + (5 × 3) + (3 × 7)

= 42 + 15 + 21

= 78 cm^2



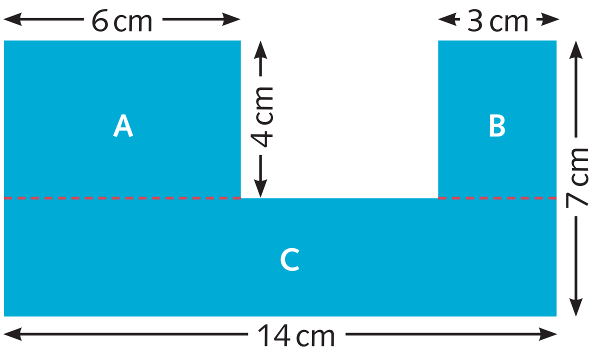
Sofia:

A + B + C

(6 × 4) + (3 × 4) + (14 × 3)

= 24 + 12 + 42

= 78 cm^2



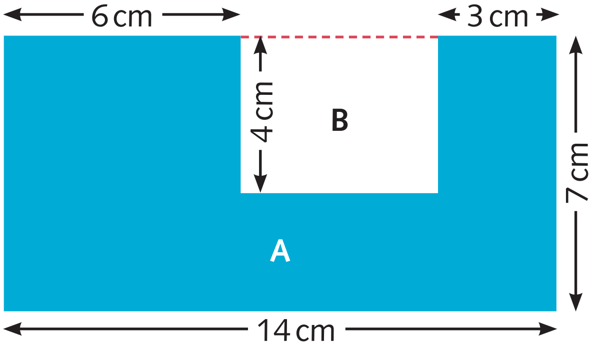
David:

A – B

(14 × 7) – (5 × 4)

= 98 – 20

= 78 cm^2



What if?

Sofia calculated the correct perimeter (50 cm).

Eve incorrectly calculated the perimeter as she divided the shape into three rectangles, found the perimeter of each rectangle, and then added these together, thereby duplicating some of the measurements.

David incorrectly calculated the perimeter as he only added together the given dimensions of the shape.

Pupils' shapes will vary.

Formula for what? (p.49)

Challenge

lwh: Volume of a cube or cuboid

$\frac{1}{2}bh$: Area of a triangle

bh: Area of a parallelogram

$2(l + w)$: Perimeter of a rectangle

$4l$: Perimeter of a square

lw: Area of a rectangle

Pupils' explanations will vary.

What if?

Pupils' shapes and use of each of the six formulae above will vary.

True or false? (p.50)

Challenge

A scalene triangle has no equal sides. (True)

The angles inside a quadrilateral always total 360°. (True)

Every quadrilateral is a parallelogram. (False)

The angles inside a triangle always add up to 180°. (True)

An isosceles triangle has three equal sides. (False)

A triangle can have two obtuse angles. (False)

Every rhombus is a parallelogram. (True)

In a polygon, the number of its sides is always the same as the number of its angles. (True)

Every square is a rhombus. (True)

Every square is a rectangle. (True)

Every parallelogram is a rectangle. (False)

Every rectangle is a parallelogram. (True)

The more sides a polygon has, the greater the size of each interior angle. (True)

All 2-D shapes are polygons. (False)

Every trapezium is a rhombus. (False)

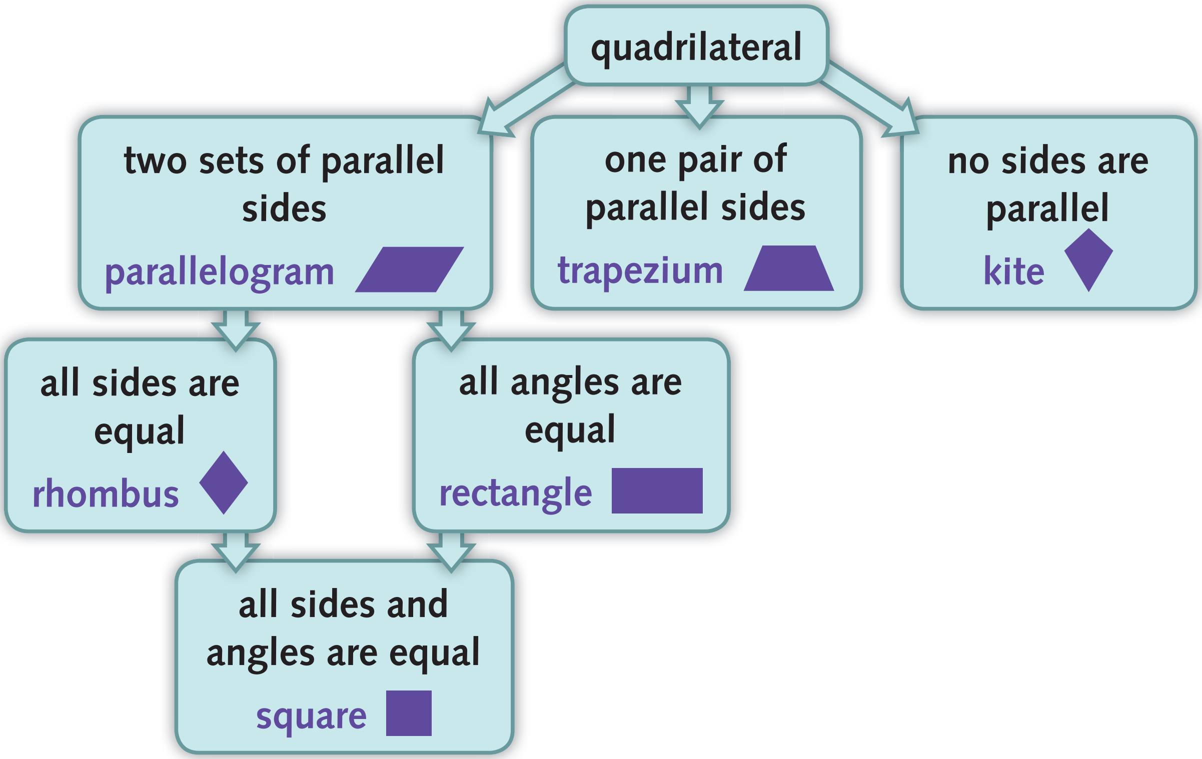
In a regular shape, all sides are equal and all angles are equal. (True)

Every hexagon has six equal sides and six equal angles. (False)

Pupils' explanations as to why an answer is false will vary.

What if?

Pupils' shapes will vary.



Forgotten angles (p.51)

Challenge

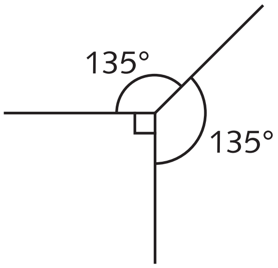
Letter	Size of angle
c	148°
g or h	115°
e	27°
a	117°
j or k	64°
b	53°
g or h	115°
i	116°
d	38°
j or k	64°
f	65°

Pupils' explanations will vary. However, they should make mention of the following:

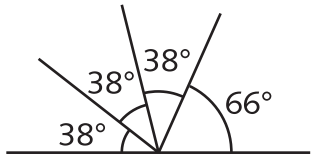
- Angles around a point total 360°.
- Angles at a point on a straight line total 180°.
- Vertically opposite angles are equal.
- Angles in a triangle total 180°.
- Angles in a quadrilateral total 360°.

What if?

The size of each of the other two angles is 135°.



The size of each of the other three angles is 38°.



Other diagrams are possible.

Describe the translation (p.52)

Challenge

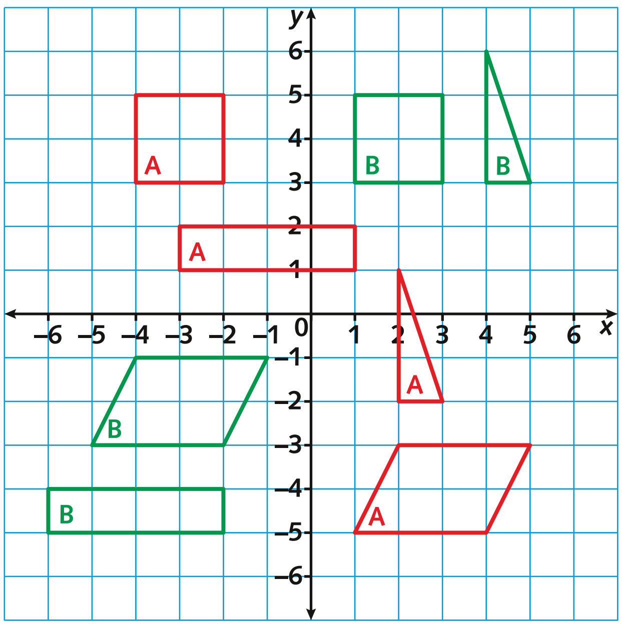
Sofia drew a square. She translated her Shape A 5 units to the right to create Shape B.

Eve drew a (right-angled) triangle. She translated her Shape A 2 units to the right and 5 units up to create Shape B.

Johannes drew a parallelogram. He translated his Shape A 6 units to the left and 2 units up to create Shape B.

David drew a rectangle. He translated his Shape A 3 units to the left and 6 units down to create Shape B.

What if?



Describe the reflection (p.53)

Challenge

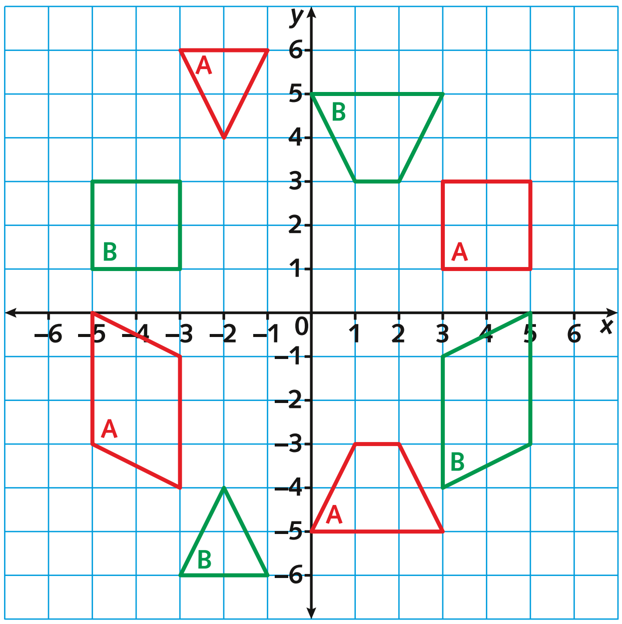
Sofia drew a trapezium. The coordinates of the reflected shape (Shape B) are: (1, 3) (0, 5) (3, 5) (2, 3).

Eve drew a square. The coordinates of the reflected shape (Shape B) are: (–3, 1) (–3, 3) (–5, 3) (–5, 1).

Johannes drew a triangle. The coordinates of the reflected shape (Shape B) are: (–2, –4) (–3, –6) (–1, –6).

David drew a parallelogram. The coordinates of the reflected shape (Shape B) are: (3, –4) (5, –3) (5, 0) (3, –1).

What if?



Pie chart storytelling (p.54)

Challenge

Pupils' conclusions will vary. However, they should make some reference to the following proportions of each pie chart:

	Red	Blue	Purple	Yellow	Green
Pie chart A	25%	5%	50%	10%	10%
Pie chart B	25%	12.5%	12.5%	20%	30%

What if?

Pupils' comparisons and conclusions will vary. However, they should make some reference to the above proportions of each pie chart.

What are their mean numbers? (p.55)

Challenge

The total of each character's set of chosen numbers is given below. While this is the only possible total for each character, their set of chosen numbers may vary.

Eve chose eight numbers, and the mean of her numbers is 3.

Therefore, the total of Eve's eight numbers is 24.

This means that Eve's eight numbers could be: 1, 2, 2, 2, 2, 4, 5, 6.

David chose six numbers, and the mean of his numbers is 4.

Therefore, the total of David's six numbers is 24.

This means that David's six numbers could be: 2, 2, 3, 5, 6, 6.

Sofia chose ten numbers, and the mean of her numbers is 3·5.

Therefore, the total of Sofia's ten numbers is 35.

This means that Sofia's ten numbers could be: 1, 2, 2, 2, 3, 4, 4, 5, 6, 6.

Johannes chose seven numbers, and the mean of his numbers is 3.

Therefore, the total of Johannes' seven numbers is 21.

This means that Johannes' seven numbers could be: 1, 2, 2, 2, 4, 4, 6.

What if?

Ms Moore could have rolled any of the following three combinations of two dice:

1 and 6, 2 and 5 or 3 and 4, i.e.

$1 + 2 + 2 + 2 + 2 + 3 + 4 + 4 + 5 + 5 + 6 + 6 + (1 + 6) = 49 \div 14 = 3{\cdot}5$

$1 + 2 + 2 + 2 + 2 + 3 + 4 + 4 + 5 + 5 + 6 + 6 + (2 + 5) = 49 \div 14 = 3{\cdot}5$

$1 + 2 + 2 + 2 + 2 + 3 + 4 + 4 + 5 + 5 + 6 + 6 + (3 + 4) = 49 \div 14 = 3{\cdot}5$

Using and applying mathematics in real-world contexts

Special number sequence 1 (p.56)

Challenge

Add the two previous terms together to get the next term.

The name given to this special number sequence is the Fibonacci sequence.

The pattern of numbers created by the Fibonacci sequence occurs in the natural world, such as in the number of petals on flowers, branches on trees, leaves on stems and the spiral of shells.

The next 10 numbers in the sequence are: … 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765.

What if?

The sum of the first 5 numbers in the sequence is 12.

The sum of the first 6 numbers in the sequence is 20.

The sum of the first 7 numbers in the sequence is 33.

The sum of the first 8 numbers in the sequence is 54.

Each of the answers above is 1 less than a number in the sequence, i.e. 12 is 1 less than 13, 20 is 1 less than 21, 33 is 1 less than 34 and 54 is 1 less than 55.

The sum of the first 9 numbers in the sequence is 88.

The sum of the first 10 numbers in the sequence is 143.

The sum of the first 11 numbers in the sequence is 232.

Special number sequence 2 (p.57)

Challenge

Results of the challenge will vary depending on the four consecutive numbers chosen. However, using 2, 3, 5, 8 as four consecutive numbers from the sequence: the product of the first and last numbers is 16 (2 × 8), and the product of the second and third numbers is 15 (3 × 5). The difference between these two products is 1.

The same applies for any set of four consecutive numbers from the sequence, e.g. 13, 21, 34, 55: the product of the first and last numbers is 715 (13 × 55), and the product of the second and third numbers is 714 (21 × 34). The difference between these two products is 1.

What if?

Results of the challenge will vary depending on the three consecutive numbers chosen. However, using 3, 5, 8 as three consecutive numbers from the sequence: the product of the first and last numbers is 24 (3×8), and the square of the third number is 25 (5^2). The difference between these two products is 1.

The same applies for any set of three consecutive numbers from the sequence, e.g. 34, 55, 89: the product of the first and last numbers is 3026 (34×89), and the square of the third number is 3025 (552). The difference between these two products is 1.

Pascal's triangle (p.58)

Challenge

In Pascal's triangle, each number is produced by adding the two numbers above:

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

The next two rows of Pascal's triangle are:

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

What if?

The sum of
each row in Pascal's triangle is the same as 2 and its powers, i.e.

1

1 + 1 = 2 = 2^1

1 + 2 + 1 = 4 = 2^2

1 + 3 + 3 + 1 = 8 = 2^3

1 + 4 + 6 + 4 + 1 = 16 = 2^4

1 + 5 + 10 + 10 + 5 + 1 = 32 = 2^5

1 + 6 + 15 + 20 + 15 + 6 + 1 = 64 = 2^6

1 + 7 + 21 + 35 + 35 + 21 + 7 + 1 = 128 = 2^7

The sum of row 10 is 512 (2^9).

The sum of row 11 is 1024 (2^{10}).

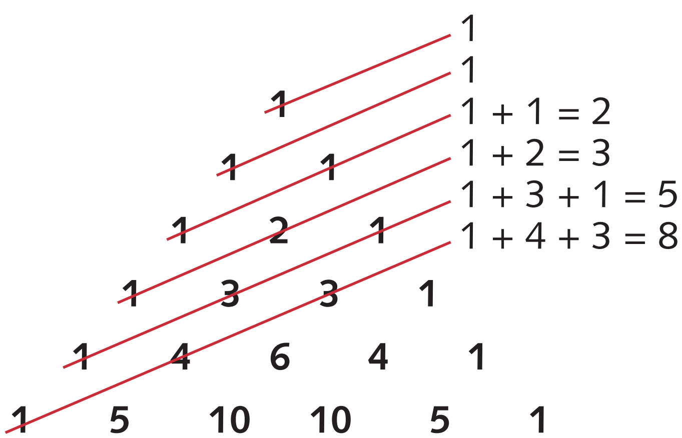
The sum of row 12 is 2048 (2^{11}).

Patterns in Pascal's triangle (p.59)

Challenge

The sum of the diagonals in Pascal's triangle is 1, 1, 2, 3, 5, 8, …

This is the same pattern investigated on pages 56 and 57, i.e. the Fibonacci sequence.



Answers

Triangular numbers appear along two of the diagonals in Pascal's triangle to form the following pattern:

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 21 35 35 21 7 1

Other patterns spotted by the pupils will vary. However, these may include:

The pattern of natural numbers:

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 21 35 35 21 7 1

The vertical symmetry of numbers:

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

What if?

Dividing each number greater than 2 on Pascal's triangle by 2 and colouring the numbers according to their remainder will result in the following odd and even pattern:

Blue numbers: remainder of 0

Red numbers: remainder of 1

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

Pupils' explanations of the patterns they notice will vary.

Dividing each number greater than 3 on Pascal's triangle by 3 and colouring the numbers according to their remainder will result in the following pattern:

Blue numbers: remainder of 0

Red numbers: remainder of 1

Green numbers: remainder of 2

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

Pupils' explanations of the patterns they notice will vary.

Pupils' other patterns will vary depending on the number(s) they divide by.

If the world were 100 people (p.60)

Challenge

Pupils' statements will vary.

What if?

	People who:	Number
Gender	are male	4 000 000 000
Age	are under the age of 15	2 000 000 000
	are aged 16 to 64	5 280 000 000
	are over the age of 64	720 000 000
Geography	are from Asia	4 800 000 000
	are from Africa	1 280 000 000
	are from Europe	800 000 000
	are from Latin America and the Caribbean	720 000 000
	are from North America	400 000 000
Religion	are Christian	2 480 000 000
	are Muslim	1 840 000 000
	are Hindu	1 200 000 000
	are of other faiths	1 200 000 000
	are of no faith or religion	1 280 000 000
First language	speak Chinese	960 000 000
	speak Spanish	480 000 000
	speak English	400 000 000
	speak Hindi	320 000 000
	speak other languages	5 840 000 000
Literacy	are unable to read and write	1 120 000 000
Education	have had a primary school education	6 160 000 000
	have had a secondary school education	5 120 000 000
	have studied at college or university	560 000 000
Dwellers	live in a city	4 320 000 000
	live in the country	3 680 000 000
Drinking water	have access to safe drinking water	7 280 000 000
Food	are undernourished	880 000 000
Electricity	do not have electricity	1 440 000 000
Technology	have a mobile phone	5 200 000 000
	are active internet users	3 760 000 000

Pupils' explanations will vary.

Who gets what? (p.61)

Challenge/What if?

Results of the challenge will vary.

Running ratios (p.62)

Challenge

The approximate ratio between the two times of the 100 m and 400 m male world record holders is:

10 : 43

The 400 m male world record is approximately 4 times longer than the 100 m male world record.

The approximate ratio between the two times of the 100 m and 400 m female world record holders is:

10 : 48 or 5 : 24

The 400 m female world record is approximately 5 times longer than the 100 m female world record.

Results of the challenge will vary.

What if?

Results of the challenge will vary.

Everyday algebraic expressions (p.63)

Challenge

Pupils' expressions will vary, but may be similar to the following:

Elsa (e) is 3 years old. Daniel (d) is 5 years older than Elsa. How old is Daniel?

$d = e + 5$ or $e + 5 = d$

There are 52 children (c) in Year 6. If there are 27 children in Red class (r), how many children are in Blue class (b)?

$b = c - r$ or $c - r = b$

There are 12 eggs in a carton (c). Sue buys 3 cartons and uses 8 eggs. How many eggs does Sue have left (e)?

$e = 3c - 8$ or $3c - 8 = e$

What if?

Pupils' scenarios will differ.

Wrapping your school (p.64)

Challenge/What if?

Results of the challenge will vary.

Redesigning your school (p.65)

Challenge/What if?

Results of the challenge will vary.

Flying to other planets (p.66)

Challenge/What if?

Planet	Approximate distance from Earth (km)	Days to travel from Earth (travelling at 500 000 km per day)	Age when landed if the person was 12 years old* when they departed Earth
Venus	41 million	82 days	12 years, 2 months
Mars	78 million	156 days	12 years, 5 months
Mercury	92 million	184 days	12 years, 6 months
Jupiter	630 million	1260 days	15 years, 5 months
Saturn	1276 million	2552 days	18 years, 11 months
Uranus	2724 million	5448 days	26 years, 10 months
Neptune	4350 million	8700 days	35 years, 9 months

*Adjust accordingly for pupils who will be younger or older than 12 years at next birthday.

Pupils' explanations as to how they worked out the answers will vary.

Ideal bedroom (p.67)

Challenge/What if?

Results of the challenge will vary.

Cost per kilometre (p.68)

Challenge

Results of the challenge will vary.

What if?

Results of the challenge will vary depending on the destinations chosen by the pupils. However, it is often the case that less busy destinations/routes are more expensive than more popular destinations.

Making playdough (p.69)

Challenge

Playdough (US recipe)

2 cups plain flour

$\frac{2}{5}$ cup of salt (or using the common US cupful measurements: $\frac{1}{3}$ cup)

$\frac{1}{2}$ cup water

1 to 2 tablespoons of cooking oil

few drops of food colouring (optional)

What if?

Results of the challenge will vary.

Greatest volume (p.70)

Challenge

By cutting away corners, pupils will make nets with different surface areas, so the purpose of the challenge is not to find the maximum volume for a given surface area, but to work systematically finding volumes produced by cutting various amounts from the corners of the paper.

If pupils use squared paper and cut off whole squares, the maximum volume is obtained by cutting 2 by 2 squares off each corner. This folds to a box with dimensions 2 by 6 by 6 with a volume of 72 units.

What if?

The three shapes will hold different amounts – but this will only be evident if measuring is done accurately and with a small uniform lightweight substance, such as rice, that 'fills' the containers without leaving gaps.

Earning interest (p.71)

Challenge

Results of the challenge will vary depending on the interest rate. However, assuming that the pupil invests their £100 at 2% per year, with interest paid yearly, and that they reinvest the interest each year, then after five years, the child would have £110 (rounded to the nearest pound), i.e.

Start of Year 1: £100

End of Year 1: 2% of £100 = £102

End of Year 2: 2% of £102 = £104 (exact amount: £104.04)

End of Year 3: 2% of £104.04 = £106 (exact amount £106.12)

End of Year 4: 2% of £106.12 = £108 (exact amount £108.24)

End of Year 5: 2% of £108.24 = £110 (exact amount £110.41)

What if?

Results of the challenge will vary depending on the amount invested, the interest rate and the investment period.

Property prices (p.72)

Challenge/What if?

Results of the challenge will vary.

Living expenses (p.73)

Challenge/What if?

Results of the challenge will vary.

Cost of light (p.74)

Challenge/What if?

Results of the challenge will vary.

Going organic (p.75)

Challenge/What if?

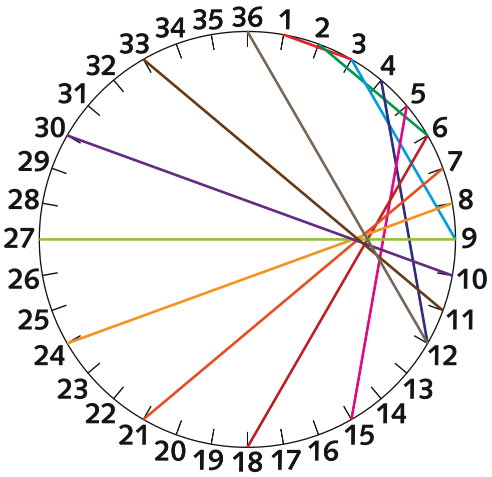
Results of the challenge will vary.

Shape patterns (p.76)

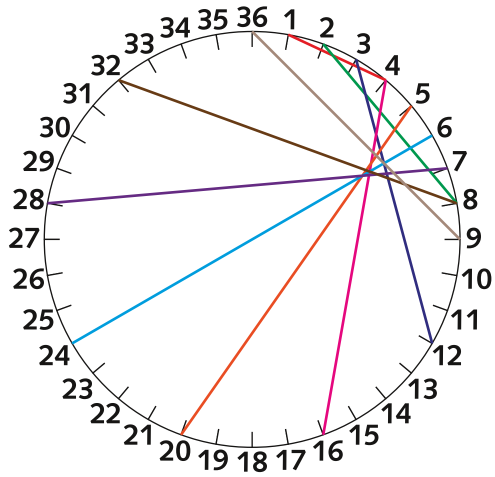
Challenge

If pupils display their patterns on four separate grids they should be as shown here:

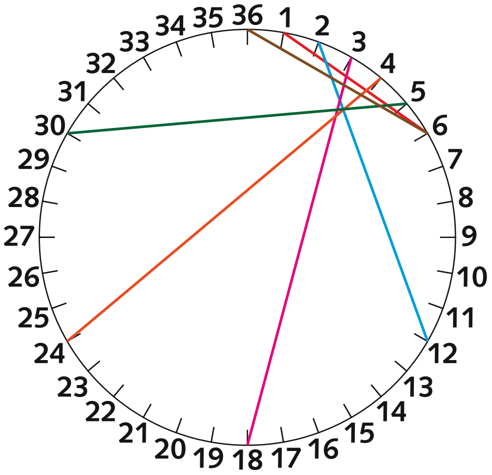
Multiply by 3 pattern



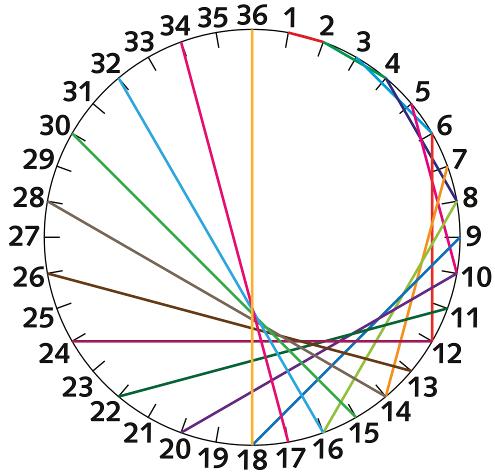
Multiply by 4 pattern



Multiply by 6 pattern

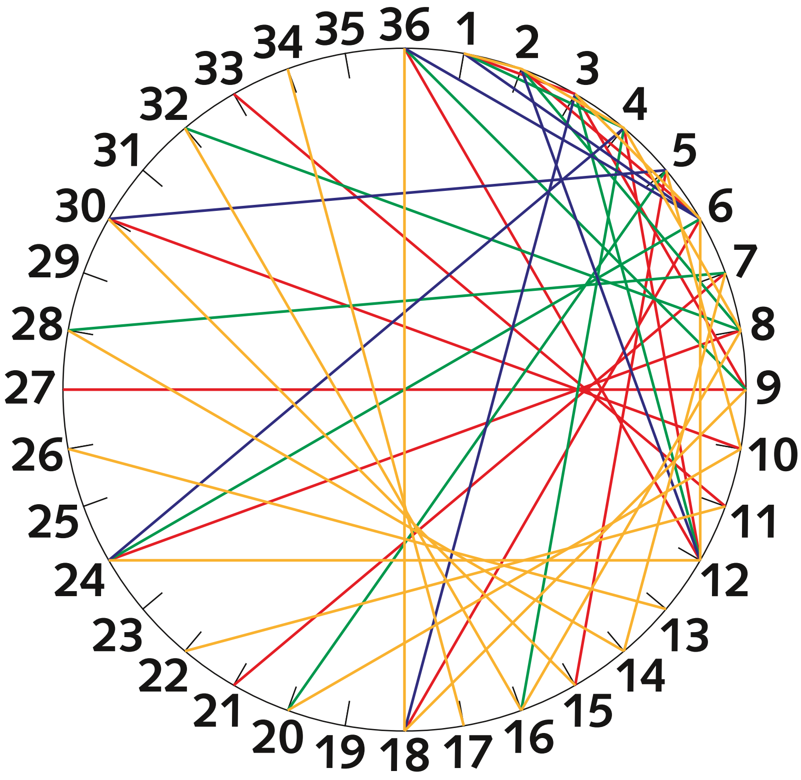


Multiply by 2 pattern



If pupils display their patterns on one grid they should be as shown here:

Multiples of 2, 3, 4 and 6 pattern

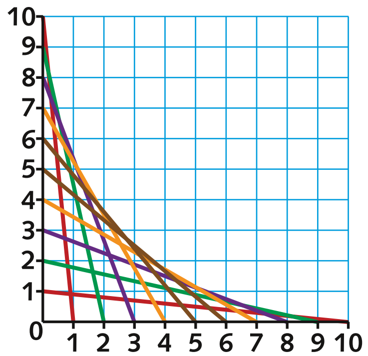


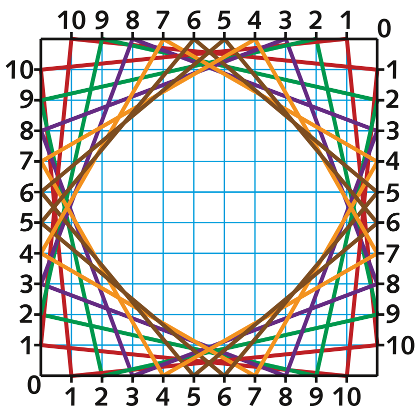
What if?

Pupils' patterns will vary.

Coordinates patterns (p.77)

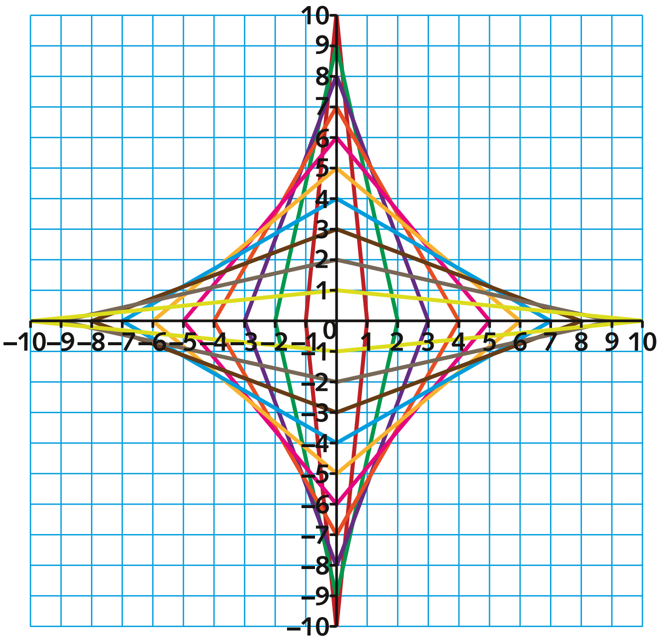
Challenge





Pupils' other first quadrant coordinates grid patterns will vary.

What if?



Pupils' other four quadrant coordinates grid patterns will vary.

Different languages (p.78)

Challenge

Pupils' conclusions will vary.

What if?

Pupils' comments will vary regarding the relationship between the number of dots and dashes used for different letters in Morse code and the frequency with which the letters are used.

Generally, the vowels have fewer dots and dashes than the consonants, but there are exceptions, such as the letters T, M and N.

Pupils' comments on the patterns of dots and dashes used for different digits in Morse code will vary. However, they should mention the fact the each digit is made up of five dots or dashes. The digits 1 to 5 have one dot to represent the numerical value of the digit followed by a series of dashes that together total five. For the digits 6 to 9, each digit begins with a series of dashes followed by dots. The pattern of dashes and dots mirrors (and reverses) the patterns for the digits 4 to 1, i.e. 6 mirrors 4, 7 mirrors 3, 8 mirrors 2 and 9 mirrors 1.

A	● —	1	● — — — —
B	— ● ● ●	2	● ● — — —
C	— ● — ●	3	● ● ● — —
D	— ● ●	4	● ● ● ● —
E	●	5	● ● ● ● ●
F	● ● — ●	6	— ● ● ● ●
G	— — ●	7	— — ● ● ●
H	● ● ● ●	8	— — — ● ●
I	● ●	9	— — — — ●
J	● — — —	0	— — — — —
K	— ● —		
L	● — ● ●		
M	— —		
N	— ●		
O	— — —		
P	● — — ●		
Q	— — ● —		
R	● — ●		
S	● ● ●		
T	—		
U	● ● —		
V	● ● ● —		
W	● — —		
X	— ● ● —		
Y	— ● — —		
Z	— — ● ●		

Top 5 books (p.79)

Challenge/What if?

Results of the challenge will vary.