



# Unit 12 – Statistics

## I Interpret line graphs

→ pages 8–11

### Discover

- The temperature increased by 3 °C.
  - It was 1 °C just before 7:15 am.  
A reasonable estimate would be 7:10 am.

### Think together

- Approximately 2 hours 50 minutes. Accept any answers from 2 hours 45 minutes to 3 hours.
- |       |       |       |
|-------|-------|-------|
| Day 1 | Day 2 | Day 3 |
| 38.7  | 37.75 | 37.1  |
- She takes 4 minutes. Children should be able to tell you that they know this because the line flattens out.  
She stays 10 minutes.  
The shop is 250 m from her home.
  - The vertical axis is labelled 'distance walked' not 'distance from home'.

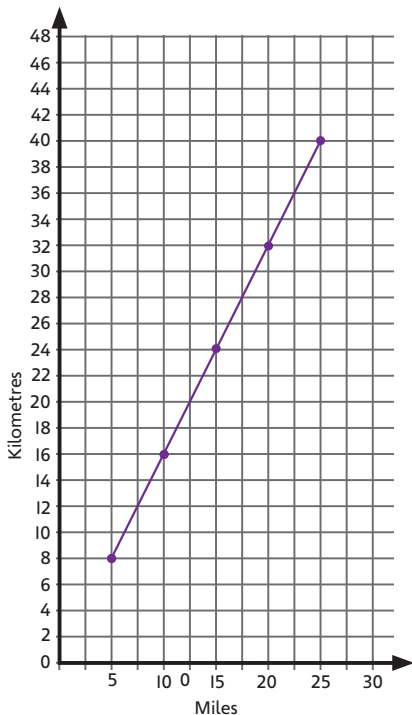
## 2 Draw line graphs

→ pages 12–15

### Discover

1. a)

Miles	Kilometres
5 miles	8 km
10 miles	16 km
15 miles	24 km
20 miles	32 km
25 miles	40 km

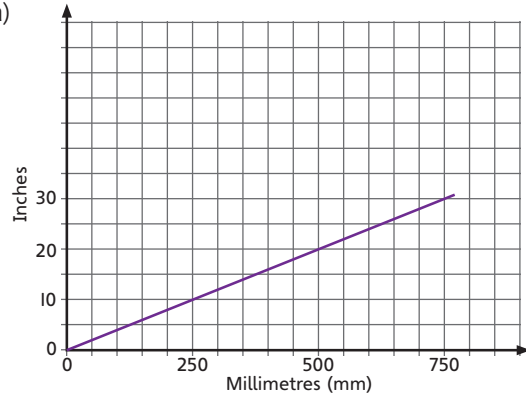


- 44 km is half-way between 40 and 48 km.  
27.5 miles is half-way between 25 and 30 miles.  
So, 27.5 miles converts to 44 km.

### Think together

- 10 miles is equivalent to **16** kilometres.  
20 kilometres is equivalent to **12.5** miles.  
There are **1.6** kilometres in 1 mile.
- The shadow was 10 m long between 8:45 and 9 am, approximately at 8:52 am.
  - Between 18 m and 20 m.

3. a)



- 25 inches = **635** mm    1 m = **40** inches  
800 mm = 31.5 inches    6 ft = 1.8 m  
15 inches = 38 cm

## 3 Advanced bar charts

→ pages 16–19

### Discover

- Each bar is split to show the results for children in Year 5 and also for children in Year 6.
  - Football is the most popular club overall.  
Basketball is the most popular choice for children in Year 6.

### Think together

- 2013, 2018, 2023
  - 4,000 evergreens were planted in total.
  - Approximately 1,600 deciduous (just under half-way between 1,500 and 1,750).
- 25 households have fewer than 11 pets.
  - 1 household has more than 16 pets.
- Various responses are possible, for example:  
A: How much screen time do Year 2 spend in school A (or B)?  
What is the total screen time recorded for school A?  
Which year group has more screen time in every school?  
B: How does the graph show which year group has less screen time?  
C: What is the total screen time recorded for school B?  
How much more screen time does Year 6 have than Year 2 in school C?



# 4 Understand and complete pie charts

→ pages 20–23

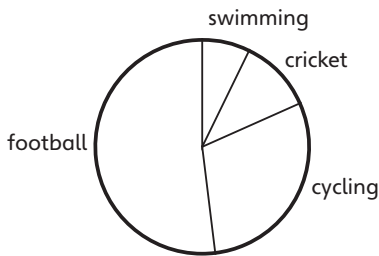
### Discover

- a) The pie chart shows most clearly that no activity received half the votes.  
b)

	Tally chart	Bar chart	Pie chart
Advantages	Can fill it in while you collect <b>data</b> . Easy to draw. Easy to see 5s.	Easy to compare which is most and least. Can use the scale to work out how much more or less.	Very easy to compare the parts with the whole.
Disadvantages	Have to count to compare. Does not show the whole clearly.	Does not show the whole clearly.	Not always easy to compare the parts. Can be difficult to draw accurately.

### Think together

1.



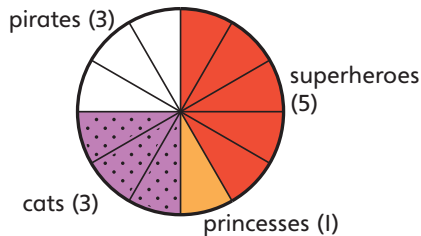
- a) The team won 4 more gold medals than silver.  
b) Bronze medals are about  $\frac{1}{4}$  of the total medals.  
c) 67 medals were won in total.
- Pie chart C. The cat is just under half of the total number.

# 5 Read and interpret pie charts

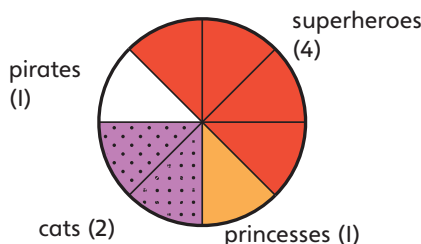
→ pages 24–27

### Discover

1. a)

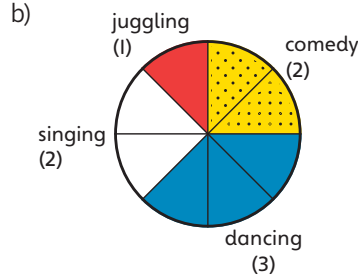


b)



### Think together

- Singing: true. More than a quarter of the children in class 1 chose singing, whereas less than a quarter of the children in class 2 chose singing. 4 out of 12 is more than 4 out of 20.  
Musical statues: false. Although the section representing musical statues is a quarter of each pie chart, it shows 3 (out of 12) for class 1 and 5 (out of 20) for class 2. So more children chose musical statues in class 2 than in class 1.
- 2 voted for rock and 2 voted for rap.
- a) 6 more people danced; 18 people did not sing.



# 6 Pie charts and fractions (I)

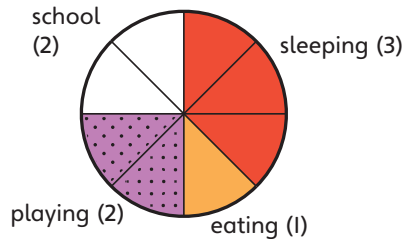
→ pages 28–31

### Discover

- a)  $\frac{14}{24} = \frac{7}{12}$   
Emily sleeps for  $\frac{7}{12}$  of each day.  
b) Ebo is not correct. Emily spends  $\frac{4}{24}$  of the day eating.  
 $\frac{4}{24} = \frac{1}{6}$  of the day

### Think together

- $\frac{1}{2}$  of Emily's time is spent sleeping.  
 $\frac{4}{24} = \frac{1}{6}$  of Emily's time is spent eating.  
 $\frac{8}{24} = \frac{1}{3}$  of Emily's time is spent playing.
- 



Each section represents 3 hours.

- $\frac{1}{8}$  of Emily's time is spent eating.
- $\frac{3}{8}$  of her time is spent sleeping.
- $\frac{1}{4}$  of her time is spent at school or playing.



3. a) A good estimate that add to 1 is:

- Ask for help  $\frac{1}{2}$
- Try to fix it  $\frac{3}{10}$
- Use a different device  $\frac{3}{20}$
- Do something else  $\frac{1}{20}$

You can use the fractions to work out the value of each section.

$$\frac{1}{2} \text{ of } 80 = 40$$

$$\frac{3}{10} \text{ of } 80 = 24$$

$$\frac{3}{20} \text{ of } 80 = 12$$

$$\frac{1}{20} \text{ of } 80 = 4$$

$$\text{Total} = 80$$

b) It is difficult to tell accurately, but it does seem that more adults than children would use a different device. The size of the section does not show this, however, as one pie chart represents 80 adults and the other only 30 children. So the size of the segments cannot be compared directly. Approximately  $\frac{3}{10}$  of 30 children = 9 children would use a different device and  $\frac{3}{20}$  of 80 = 12 adults would ask for help.

## 7 Pie charts and fractions (2)

→ pages 32–35

### Discover

1. a) 5 days were sunny in London.
- b) 26 days were sunny in Cyprus.

### Think together

1. a)  $\frac{1}{2}$  of the class like fish fingers.  
 $\frac{1}{6}$  of the class like popcorn.  
 $\frac{1}{3}$  of the class like strawberries.
- b) 24 people were asked.  
 $\frac{1}{3} = \frac{1}{6} + \frac{1}{6}$  so  $\frac{1}{6} = 4$  items  
 $4 \times 6 = 24$
2. 36 children said the winter holidays.  
 $45 \div 5$  sections = 9 people per section  
 $9 \times 4$  sections = 36 people
3. a) Class 5 collected  $\frac{1}{4}$  of 20 kg = 5 kg of paper.  
 Class 6 collected 10 kg of metal which is just under half of their total.  
 Class 6's total must be more than 20 kg.  
 Class 6 collected more than a  $\frac{1}{4}$  of 20 kg.  
 Children may use an approximate fraction representing the metal in Class 6 and work out the total for Class 6 from that:  $\frac{1}{3} = 10$  kg, so the total is 30 kg;  $\frac{2}{5} = 10$  kg so the total is 25 kg.  $\frac{1}{4}$  of 30 kg and 25 kg >  $\frac{1}{4}$  of 20 kg.
- b) The section is a bit less than treble 3.5, 10.5 kg.  
 An answer between 9 kg and 10 kg is a good approximation.

## 8 Pie charts and percentages

→ pages 36–39

### Discover

1. a) Nitrogen and Argon both =  $2\% = \frac{2}{100} = \frac{1}{50}$   
 Carbon dioxide =  $100\% - 4\% = 96\% = \frac{96}{100} = \frac{24}{25}$
- b) Oxygen =  $100\% - 78\% - 1\% = 21\%$   
 $\frac{1}{5} = \frac{20}{100} = 20\%$   
 Aki's estimate is just 1% too small.

### Think together

1. Salt water = 70%  
 Land that can be farmed = 15%  
 Desert = 5%  
 Mountain = 5%  
 Snow/ice = 5%
2. More than one third of his food is bread = true  
 $35\% > 33\% = \frac{1}{3}$   
 Out of every 250 g, 50 g was cheese = true  
 $\frac{50}{250} = \frac{1}{5} = 20\%$   
 $\frac{1}{3}$  of his food was fruit and vegetables = false  
 $15\% + 10\% = 25\% = \frac{1}{4}$  not  $\frac{1}{3}$   
 He ate three times as much pasta as eggs = true  
 Eggs =  $100\% - (35 + 20 + 15 + 15 + 10)\% = 5\%$   
 $3 \times 5\% = 15\%$
3. a)  $36^\circ = 10\%$ ,  $72^\circ = 20\%$ ,  $90^\circ = \frac{1}{4} = 25\%$   
 Jogging =  $100\% - 55\% = 45\%$   
 Or  $360^\circ - (90 + 72 + 36) = 162^\circ$   
 $\frac{162}{360} = \frac{9}{20} = \frac{45}{100} = 45\%$   
 45% of people preferred jogging.
- b)  $90^\circ = \frac{1}{4} = 240$   
 $240 \times 4 = 960$  in total  
 $72^\circ = \frac{72}{360} = \frac{1}{5} = 20\%$   
 20% of 960 = 192  
 192 people liked team sport.

## 9 Introduction to the mean

→ pages 40–43

### Discover

1. a) The mean (average) number of marshmallows on a stick is 9.
- b) The mean (average) number of marshmallows on a stick is 11.

### Think together

1. The mean (average) number of marshmallows is 8.
2. a) The mean number of cubes in each group of towers is 6.
- b) The mean number of cubes in each group of towers is 6.  
 Both sets have 30 cubes in total shared between 5 towers.



3. a) Lee made towers of 8, 4 and 9 cubes, moving the cubes around to make towers of equal height. Isla had added up the three numbers then divided by 3, the number of numbers.
- b) Children should know to use Isla's method because making towers of those heights would not be practical.  
The mean height of the four children is 130 cm.

## End of unit check

→ pages 52–53

1. B
2. D
3. B
4. D
5. 7.5 km

## 10 Calculate the mean

→ pages 44–47

### Discover

1. a) Ambika's mean score is 6.  
Jamie's mean score is 6.5.  
Jamie had the higher mean score.
- b) Ambika received the highest mark, but also the lowest mark.  
Her most common mark was 5.  
Jamie was more consistent. The judges all gave similar marks.  
Her most common mark was 6.

### Think together

1. Mo's mean score is 7. Danny's mean score is 5.2.  
Mo had the higher mean score.  
Danny had more scores to count.
2. Amelia's mean jump height is 1.3 m.  
Richard's mean jump height is 125 cm.  
Luis' mean jump height is 1.2 m. Children may give the answer 0.8 m if they include the no jump.
3. All of the mean scores are 2.

## 11 Problem solving – mean

→ pages 48–51

### Discover

1. a) The fifth snake must be 15 cm long.
- b) The new snake is 26 cm long.

### Think together

1. The height of the sixth tower is 6.
2. The mass of the last snake is 1.1 kg.
3. Three numbers with a mean of 11: any three numbers with a total of 33.  
For example, 9, 11, 13 or 8, 12, 13.  
Five numbers with a mean of 10: any five numbers with a total of 50.  
For example, 2, 8, 10, 13, 17 (including 10) or 3, 8, 9, 13, 17 (not including 10).  
Four numbers with a mean of 10 (total = 40) and a difference of four between highest and lowest numbers: only one answer of 8, 9, 11, 12.



# Unit 13 – Geometry – properties of shapes

## I Measure and classify angles

→ pages 56–59

### Discover

- $A = 45^\circ$ ,  $B = 110^\circ$  (the only obtuse angle) and  $C = 50^\circ$
  - Max has read the wrong scale. He started from the wrong side. He needs to measure the angle between the two lines.

### Think together

- $34^\circ$
  - $103^\circ$
  - $180^\circ$
- From smallest to largest: C ( $55^\circ$ ), A ( $75^\circ$ ), D ( $120^\circ$ ), B ( $135^\circ$ )
- Shape A: A-E =  $108^\circ$  each  
Shape B: A =  $56^\circ$ , B =  $102^\circ$ , C =  $90^\circ$ , D =  $61^\circ$ , E =  $231^\circ$

## 2 Vertically opposite angles

→ pages 60–63

### Discover

- Experiment 3:  $b = 40^\circ$ ,  $c = 140^\circ$ ,  $d = 40^\circ$
  - Children could take one of the diagrams and write down the pairs of angles that lie on a straight line and add up to  $180^\circ$ . This shows that two opposite angles must be equal. For example, if  $b + c = 180^\circ$  and  $b + a = 180^\circ$ , then  $a = c$  (vertically opposite angles).

### Think together

- $b = 100^\circ$  (vertically opposite angles);  
 $a + 100^\circ = 180^\circ$  (angles on a straight line),  
so  $a = 80^\circ$ ;  $c = a = 80^\circ$  (vertically opposite angles).
  - $e = 43^\circ$  (vertically opposite angles);  $d + 43^\circ = 180^\circ$   
(angles on a straight line), so  $d = 137^\circ$ ;  $f = d = 137^\circ$   
(vertically opposite angles).
  - $h + 62^\circ = 180^\circ$  (angles on a straight line), so  
 $h = 118^\circ$ ; angles g and i cannot be found using the  
information given.
- Children should draw several pairs of straight lines that cross at different angles and use a protractor to show that vertically opposite angles are equal.

- $a = 25^\circ$  (vertically opposite angles);  $c = 75^\circ$   
(vertically opposite angles);  $b + 25^\circ + 75^\circ = 180^\circ$   
(angles on a straight line), so  $b = 80^\circ$ ;  $d = b = 80^\circ$   
(vertically opposite angles).
  - $a = 38^\circ$  (vertically opposite angles);  $38^\circ + b = 180^\circ$   
(angles on a straight line), so  $b = 142^\circ$ ;  
 $c + 38^\circ + 90^\circ = 180^\circ$  (angles on a straight line),  
so  $c = 52^\circ$ .
  - Interior angle of regular pentagon =  $108^\circ$ ;  $x = 108^\circ$   
(vertically opposite angles).

## 3 Angles in a triangle

→ pages 64–67

### Discover

- A triangle cannot have two obtuse angles because two sides of the triangle will never meet.
  - Ambika's solution is incorrect. The right angle is correct, but both of the other angles are acute, so they cannot be  $130^\circ$  and  $140^\circ$ . Ambika has **not** solved the challenge; it is not possible.

### Think together

- The angles have all been measured correctly.
  - The angle labelled as  $60^\circ$  actually measures  $40^\circ$ .
  - The angle labelled as  $60^\circ$  actually measures  $40^\circ$ .
- Children should accurately draw the triangle and measure the angle as  $90^\circ$ .
- The three angles always form a straight line, no matter the order in which they are arranged.
  - Children should conclude that the angles in a triangle always add up to  $180^\circ$ .

## 4 Angles in a triangle – missing angles

→ pages 68–71

### Discover

- $b = 70^\circ$  and  $c = 60^\circ$ .
  - $x = 15^\circ$  and  $y = 85^\circ$ . Angles in a triangle add up to  $180^\circ$ , so  $z = 180^\circ - 15^\circ - 85^\circ = 80^\circ$ .

### Think together

- $a + 30^\circ + 70^\circ = 180^\circ$ , so  $a = 80^\circ$ .
  - $b + 55^\circ + 110^\circ = 180^\circ$ , so  $b = 15^\circ$ .
  - $c + 38^\circ + 90^\circ = 180^\circ$ , so  $c = 52^\circ$ .
- $a = 60^\circ$  and  $b = 30^\circ$ .

3. a) To find a: third angle in triangle =  $70^\circ$ ;  
 $a + 70^\circ = 180^\circ$  (angles on a straight line),  
 so  $a = 110^\circ$ .  
 To find b: third angle in triangle =  $55^\circ$ ;  
 $55^\circ + b = 360^\circ$  (angles around a point), so  $b = 305^\circ$ .  
 To find c: third angle in right-hand triangle =  $30^\circ$ ;  
 angles in whole outer triangle are now  
 $30^\circ + 30^\circ = 60^\circ$  and  $70^\circ$ , so third angle =  $50^\circ$   
 (angles in a triangle).  
 b) Children should create an angle puzzle that  
 requires finding a missing angle in a diagram using  
 the fact that angles in a triangle add up to  $180^\circ$ . It  
 may also use the fact that angles on a straight line  
 add up to  $180^\circ$ .

## 5 Angles in a triangle – special cases

→ pages 72–75

### Discover

1. a) The two lengths are equal, so they form isosceles triangles. Angles a and b both equal  $75^\circ$ . Angles c and d both equal  $40^\circ$ .  
 b) There are two possible solutions:  
 The  $80^\circ$  angle could be the angle between the equal sides. The other two angles would be  $50^\circ$ .  
 The  $80^\circ$  angle could be one of the equal angles. The other angle would be  $20^\circ$ .

### Think together

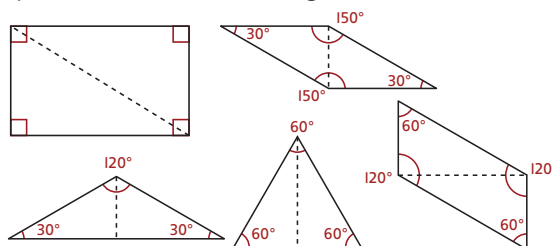
1. a) Isosceles triangle, so base angles are equal:  
 $180^\circ - 28^\circ = 152^\circ$ ;  $152^\circ \div 2 = 76^\circ$ .  
 b) Isosceles triangle, so base angles are equal:  
 $180^\circ - 112^\circ = 68^\circ$ ;  $68^\circ \div 2 = 34^\circ$ .  
 c) Isosceles triangle, so base angles are equal:  
 $180^\circ - 70^\circ - 70^\circ = 40^\circ$ .  
 2. There are many possible answers; the triangle must  
 have two sides of length 75 mm and the three angles  
 must add up to  $180^\circ$ .  
 3. To find a, b, c and d:  $a + b + 30^\circ = 180^\circ$  (angles in  
 a triangle), so  $a = b = 75^\circ$  (base angles in isosceles  
 triangle are equal);  $d = 54^\circ$  (base angles in isosceles  
 triangle are equal), so  $c = 180^\circ - (2 \times 54^\circ) = 72^\circ$   
 (angles in a triangle).  
 To find e: third angle in triangle =  
 $180^\circ - (2 \times 20^\circ) = 140^\circ$  (angles in a triangle);  
 $e + 90^\circ + 140^\circ = 360^\circ$  (angles at a point), so  $e = 130^\circ$ .  
 To find f: angle in square =  $90^\circ$  and angle in  
 equilateral triangle =  $60^\circ$ ;  $90^\circ + f + 60^\circ = 180^\circ$   
 (angles on a straight line), so  $f = 30^\circ$ .

## 6 Angles in quadrilaterals

→ pages 76–79

### Discover

1. a) The shape in step 1 is a rectangle. (It has two pairs  
 of parallel sides and four right angles. The angles  
 total:  $90^\circ + 90^\circ + 90^\circ + 90^\circ = 360^\circ$ )  
 After step 2, a trapezium is left. (It has one pair of  
 parallel sides, two right angles and sides of different  
 lengths. The angles total:  
 $60^\circ + 120^\circ + 90^\circ + 90^\circ = 360^\circ$ )  
 After step 3, an isosceles trapezium is left. (It has  
 two pairs of equal angles and one pair of parallel  
 sides. The angles total:  
 $60^\circ + 120^\circ + 60^\circ + 120^\circ = 360^\circ$ )  
 b) The left-over triangles can make one of three  
 quadrilaterals and two triangles.



### Think together

1. A parallelogram is left. There are always  $360^\circ$  in  
 a parallelogram. The angles total:  
 $60^\circ + 120^\circ + 60^\circ + 120^\circ = 360^\circ$ .  
 2. a)  $75^\circ + 105^\circ + 75^\circ + 105^\circ = 360^\circ$   
 b)  $115^\circ + 115^\circ + 65^\circ + 65^\circ = 360^\circ$   
 c)  $73^\circ + 90^\circ + 90^\circ + 107^\circ = 360^\circ$   
 d)  $101^\circ + 79^\circ + 101^\circ + 79^\circ = 360^\circ$   
 3. Children should notice that opposite angles in each  
 shape are equal, and that the pairs of angles next to  
 each other in each shape add up to  $180^\circ$ .

## 7 Angles in polygons

→ pages 80–83

### Discover

1. a) The angles in Lexi's quadrilateral have a total of  
 $40 + 80 + 165 + 75 = 360^\circ$ .  
 b) Children may notice that any quadrilateral can be  
 split into two triangles, so the total of all the angles  
 in a quadrilateral must be  $180^\circ \times 2 = 360^\circ$ .

### Think together

1. a)  $360^\circ - 120^\circ - 95^\circ - 60^\circ = 85^\circ$   
 b)  $360^\circ - 98^\circ - 87^\circ - 72^\circ = 103^\circ$   
 c)  $360^\circ - 90^\circ - 30^\circ - 30^\circ = 210^\circ$   
 2. a) Two angles: one of the side angles (which are  
 equal) and one of the other two.  
 b) Any one of the angles.

3. Hexagon: 6 sides, 4 triangles,  $180 \times 4, 720^\circ$   
 Heptagon: 7 sides, 5 triangles,  $180 \times 5, 900^\circ$   
 a is an angle in a regular pentagon, so  
 $a = 540^\circ \div 5 = 108^\circ$ .  
 b is an angle in a regular hexagon, so  
 $b = 720^\circ \div 6 = 120^\circ$ .  
 c is an angle in a regular heptagon, so  
 $c = 900^\circ \div 7 = 128.57^\circ$  (to 2 decimal places).

## 8 Circles

→ pages 84–87

### Discover

1. a) Three children will form a triangle around Amelia. Four children will form a quadrilateral. As more children join, the shape will have more vertices and it will start to form a circle.  
 b) The second class will form another circle. The radius will be 6 m, so it will be larger.

### Think together

1. Children accurately measure the radius in cm:  
 a) 2 cm  
 b) 3 cm
2. Children should accurately copy the design with the measurements given.
3. Children accurately measure the radius in cm:  
 a) 3.1 cm  
 b) 5 cm  
 c) 2.9 cm

## 9 Parts of a circle

→ pages 88–91

### Discover

1. a) There are different methods to measure the circumference of a wheel.  
 Method 1: Wrap a piece of rope or string around the circumference, then unwrap it and measure it in a straight line.  
 Method 2: Choose a point on the wheel and roll it until the point returns to the starting position. The distance it has rolled is the circumference.  
 b) The circumference of the wheel (the distance around the edge of the wheel) is always longer than its radius or diameter.

### Think together

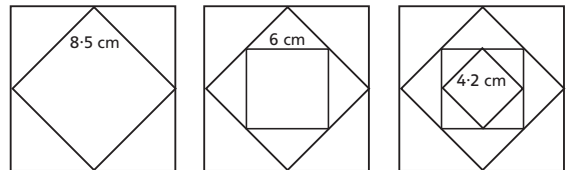
1. Children accurately measure the radius in cm:  
 a) 12 cm  
 b) 17.5 cm
2. Alex can form an isosceles triangle, a right-angled triangle or an equilateral triangle.
3. a) Children may notice that the angle at the circumference of the circle is  $90^\circ$  in both cases. Children may also point out that the other two angles add up to  $90^\circ$ .  
 b) Children may notice that if  $a + a + b + b = 180^\circ$ , then  $a + a = 90^\circ$  and  $b + b = 90^\circ$ . So,  $a + b = 90^\circ$ , showing that the angle at the circumference is a right angle.

## 10 Draw shapes accurately

→ pages 92–95

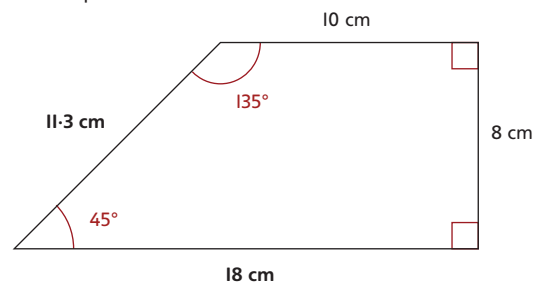
### Discover

1. a) Children should accurately draw a square with a side length of 12 cm, using a ruler and protractor.  
 b) Each new shape should form a square, with the following measurements:



### Think together

1. a) to c) Children should accurately draw the lines and angles using a ruler and protractor.  
 2. Children should accurately draw the shape using a ruler and protractor.



3. a) Each line on the grid should have an equal length line drawn opposite it, parallel to it. All the sides should join together to create four vertices.  
 b) Each line on the grid should have an equal length line drawn opposite it, parallel to it. All the sides should join together to create four vertices.  
 c) There are several possible answers. The shape should contain two pairs of parallel, equal length sides.

## 11 Nets of 3D shapes (1)

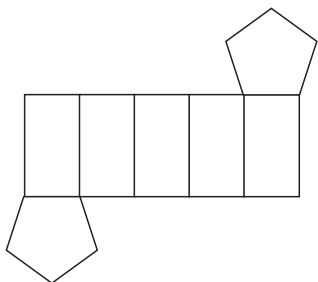
→ pages 96–99

### Discover

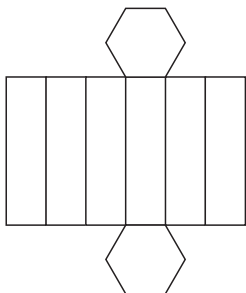
- Triangular prism, square-based pyramid and tetrahedron (four triangular faces).
  - There are multiple possible nets for a pentagonal-based pyramid. One example has the base in the centre and one triangular face on each edge of the base.

### Think together

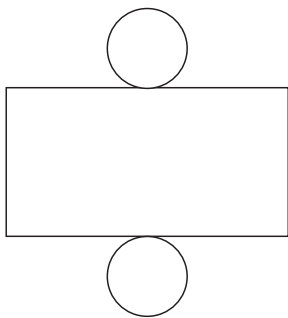
- Only net D will form a cuboid.
- Pentagonal prism: there are multiple possible variations. One example is:



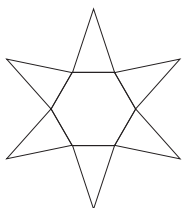
Hexagonal prism: there are multiple possible variations. One example is:



Cylinder: there are multiple possible variations. One example is:



- Children should draw a regular hexagon with sides of 4 cm and then construct an isosceles triangle off each side with sides of 4 cm, 8 cm and 8 cm.

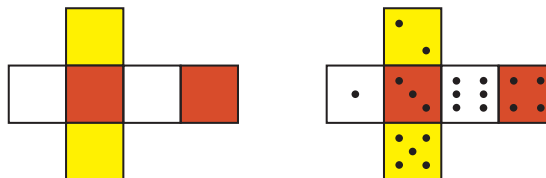


## 12 Nets of 3D shapes (2)

→ pages 100–103

### Discover

- The net must fold to make a cube and opposite faces of the dice must total 7. Only net D is correct.
  - There are multiple solutions. The opposite faces have been colour coded. Pairs totalling 7 must go on the same colour. Here is one solution:



### Think together

- Nets A and D correctly form a cube.
- Diagrams C and D are views of the cube.
- Reena is correct. There are eleven different nets that form a cube.

## End of unit check

→ pages 104–105

- D
- C
- B
- D
- D
- There are multiple possible answers.





# Unit 14 – Geometry – position and direction

## I The first quadrant

→ pages 108–111

### Discover

- a) D is at the coordinate (8,4).  
b) The perimeter is  $3 \times 4 = 12$  metres.

### Think together

- a) (4,3)  
b) (1,2) and (1,6) or (9,2) and (9,6)
- B (8,4), C (8,7), D (3,7)
- A (13,7), B (4,13)

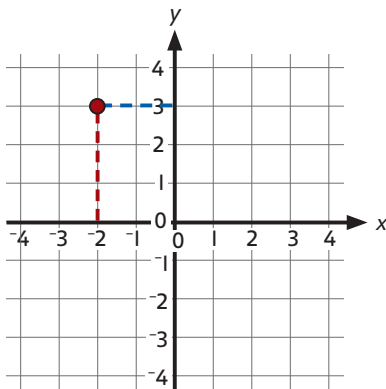
## 2 Read and plot points in four quadrants

→ pages 112–115

### Discover

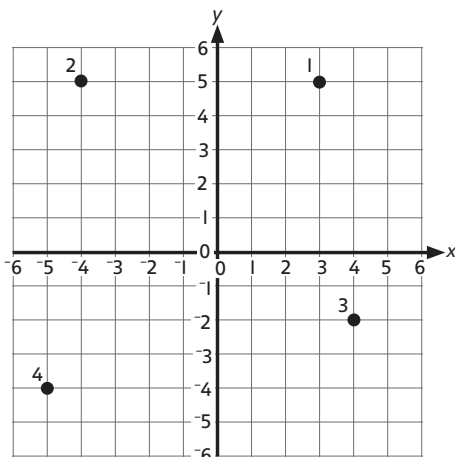
- a) The coordinates of ship A are (-3, -2).  
The coordinates of ship B are (3, -1).

b)



### Think together

- a) A (5, -2); B (-4, -2); C (-3, 3); D (3, 2)  
b)



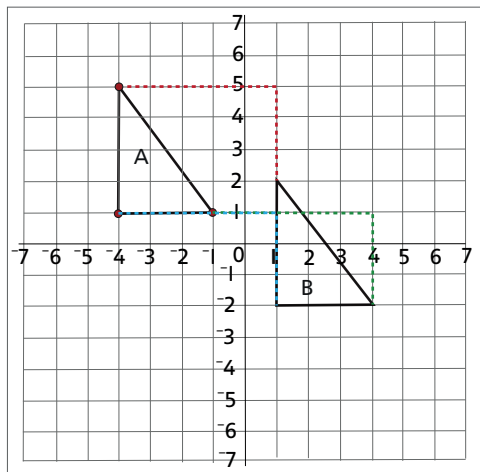
- A should be (-4, 1). Mark has put the coordinates in the wrong order.  
C should be (5, -3). Mark has not read the x-coordinate correctly.  
D should be (0, -2). Mark has put the coordinates in the wrong order.
- (1, 1), (2, 1), (2, 1), (1, -1)

## 3 Translations

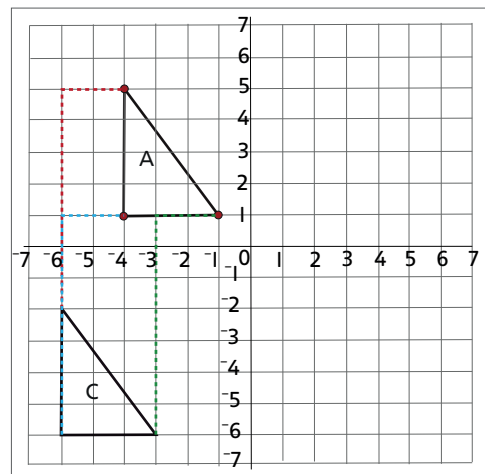
→ pages 116–119

### Discover

1. a)

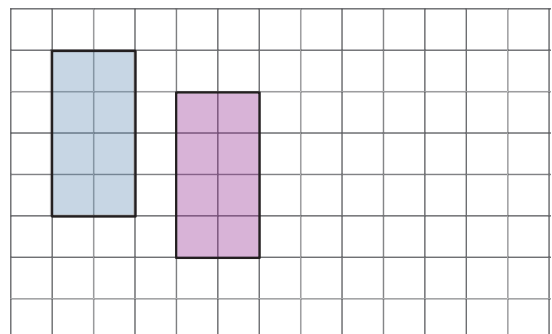


- b) Shape A has been translated 2 units left and 7 units down onto shape C.



### Think together

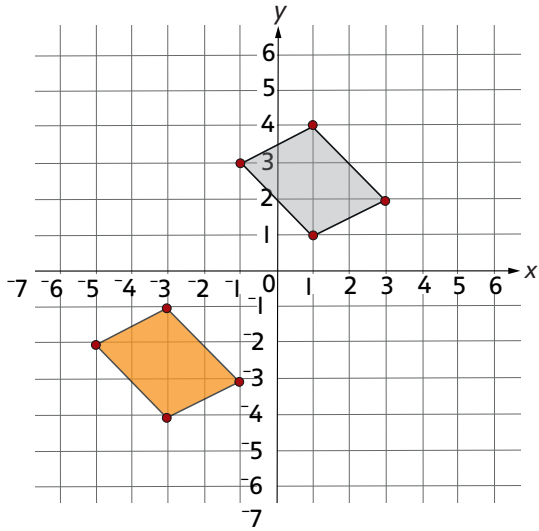
1.



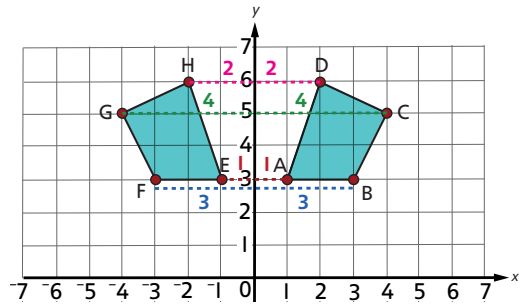


2. Shape F has been translated **2 units right** and **5 units down** to become shape G.

3. a)



b)



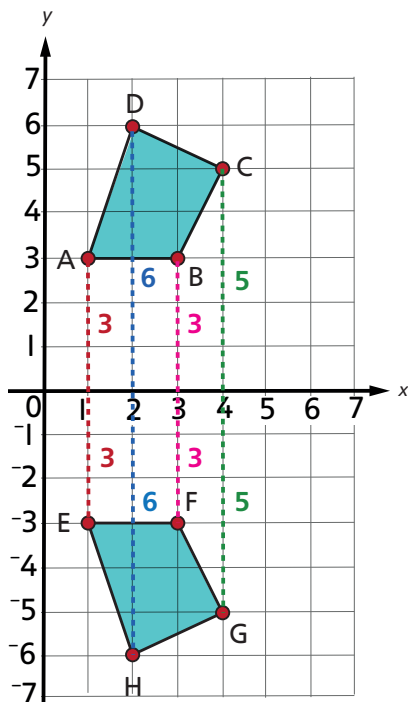
b) Possible answers: 5 right 1 down, 3 right 1 up, 5 right 2 up or 7 right.

## 4 Reflections

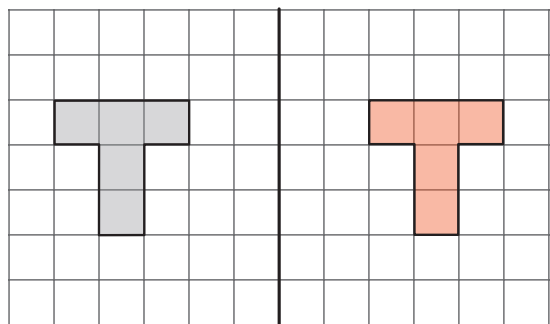
→ pages 120–123

### Discover

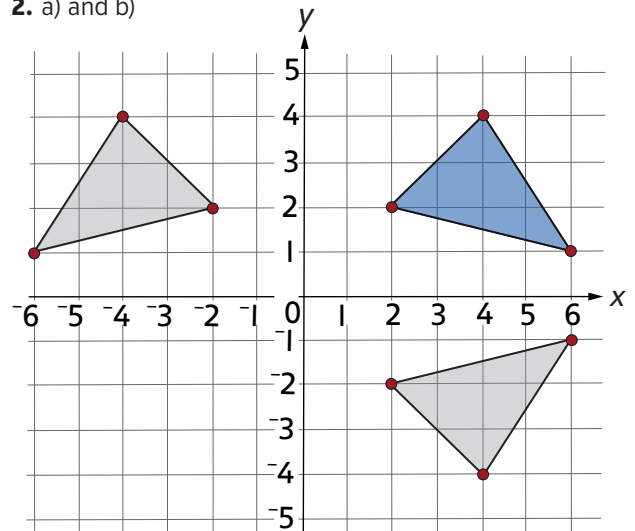
1. a)



b)

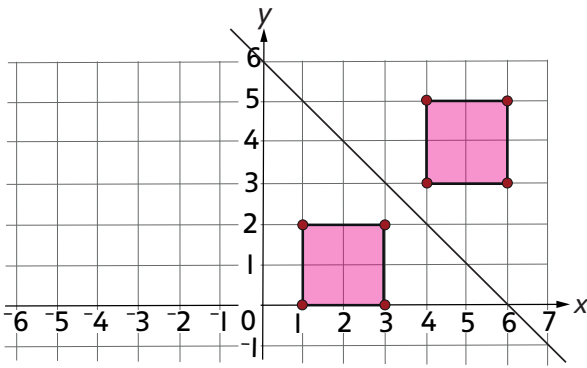


2. a) and b)





3.



## 5 Solve problems with coordinates

→ pages 124–127

### Discover

1. a) The coordinates of vertex C are (4,5).  
The coordinates of vertex D are (1,5).
- b) The missing coordinates for shape Q are:  
F (6,5), G (6,2) and H (3,2).

### Think together

1. a) Point B **(4,1)**  
Point C **(4,4)**
- b) Point E **(-6,-5)**  
Point F **(-3,-5)**  
Point G **(-3,-2)**
2. a) The coordinates of point C are (3,2).
- b) B has moved to (-2,7).  
C has moved to (-1,4).
3. C (1,0); D (3,0); E (1,5)

## End of unit check

→ pages 128–129

1. D
2. C
3. A
4. C
5. (9,4)

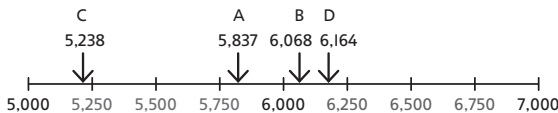


# Unit 15 – Problem solving

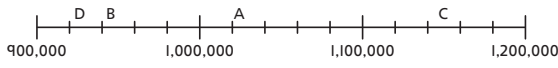
## 1 Problem solving – place value

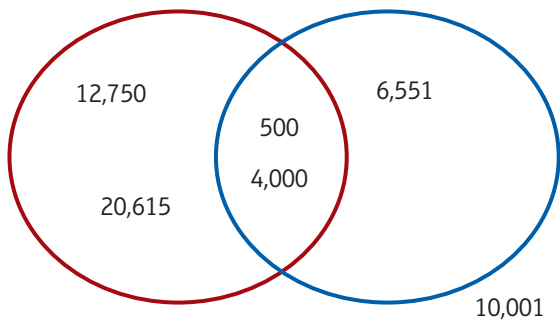
→ pages 132–135

### Discover

1. a) 
- b) City A: 5,837 rounds up to 6,000.  
 City B: 6,068 rounds down to 6,000.  
 City C: 5,238 rounds down to 5,000.  
 City D: 6,164 rounds down to 6,000.  
 The distance from Paris to cities A, B and D rounds to 6,000 km.

### Think together

1. a) 
- b) 924,500      942,000      1,025,000      1,150,000
2.      Multiple of 5      Less than 10,000



3. Section A: a number between 3,000 and 4,000 is not possible with these digits.  
 Section B: 4,605 is the only possible number.  
 Section C: 5,406 or 5,460.  
 Section D: 6,540

## 2 Problem solving – negative numbers

→ pages 136–139

### Discover

1. a) The value of A is  $-100$ .  
 The value of B is 60.  
 b) The value of the half-way point between A and B is  $-20$ .

### Think together

1. a) The inside temperature is  $30^{\circ}\text{C}$ .  
 b) The outside temperature is  $-15^{\circ}\text{C}$ .
2. 26, 14, 2,  $-10$ ,  $-22$ , 34

3. a) It was 12 degrees warmer.  
 b) The temperature at 7 pm is  $-1^{\circ}\text{C}$ .
4.  $-6$  is half-way between  $-30$  and 18.

## 3 Problem solving – addition and subtraction

→ pages 140–143

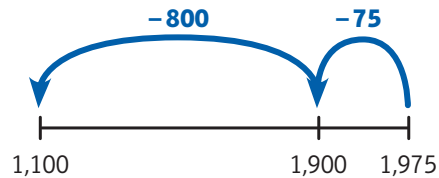
### Discover

1. a) 

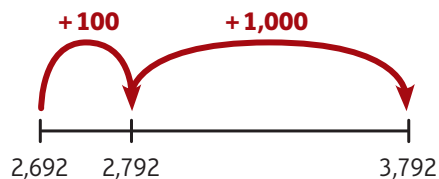
	Th	H	T	O
	1	6	8	2
-		8	7	5
	1	8	1	7
- |   |    |   |   |   |
|---|----|---|---|---|
|   | Th | H | T | O |
|   | 1  | 8 | 1 | 7 |
| + | 1  | 9 | 7 | 5 |
|   | 3  | 7 | 9 | 2 |
|   |    |   |   |   |

There are 3,792 trees in the forest now.

b)  $1,975 - 875 = 1,100$



$2,692 + 1,100 = 3,792$



There are 3,792 trees in the forest now.  
 The numbers are suitable for Max to work it out mentally with the aid of a number line.

### Think together

1. a)  $\pounds 3,100$  in 2023 –  $\pounds 1,800$  in 2021 =  $\pounds 1,300$  more was raised in 2023 than in 2021.  
 b) Fun run total is  $\pounds 4,100$ .  
 Singing total is  $\pounds 3,400$ .  
 The difference in the totals is  $\pounds 700$ .
2. Triangle = 2,000  
 Square = 299



3. a)

	TTh	Th	H	T	O
		5	3	6	4
+		6	5	3	9
	I	I	9	0	3

b)

	T	O	Tth	Hth
	6	9	8	5
-	2	3	5	6
	4	6	2	9

4. Pen = 65p Rubber = 45p

## 4 Problem solving – four operations (I)

→ pages 144–147

### Discover

- a) A puzzle book costs £7.50.  
A computer game costs £7.50 + £12.50 = £20.
- Isla can buy 3 boxes of pencils for £35.  
She will have £5 left over.

### Think together

- Whistle = £1.10 Car = £1.95
- The large bag is 6 kg more than the small bag.  
75 small = 600 kg      60 large = 600 kg  
1 small = 4 kg      1 large = 10 kg
- a) Children pay £27.75, £13 for the coach and £14.75 for the ticket.  
b) They do not pay enough because the actual cost is £13.45 which rounds down to £13.  
They pay 45p less per person than the actual cost of the coach.
- x = 50 cm  
Perimeter of the square is 120 cm × 4 = 480 cm.  
Perimeter of rectangle is 480 ÷ 3 = 160 cm.  
Two sides are 30 cm, two sides are x cm.  
160 – (2 × 30) = 100 cm  
x = 100 cm ÷ 2 = 50 cm

## 5 Problem solving – four operations (2)

→ pages 148–151

### Discover

- a)  $120 - (35 \times 2)$   
 $120 - 70 = 50$ , so = 50.  
 $2 \triangle = 120 - 70 = 50$   
 is half of 50, so = 25.

- b)

row: 70 + 100 + 70 = 240      column: 70 + 50 + 50 + 70 = 240

Lexi is correct, because doubling the totals is the same as adding the values in the row or column twice.

### Think together

- 120 mm
- 108 mm  
 $538 - (2 \times 90) - (2 \times 120) = 108$  mm
- A, D or E
- 1 tin = 320 g  
Mass of both sides is  $6 \times 448 = 2,688$  g.  
The right hand balance is 1 box + 7 tins.  
The mass of 7 tins is  $2,688 - 448 = 2,240$  g.  
1 tin =  $2,240 \div 7 = 320$  g

## 6 Problem solving – fractions

→ pages 152–155

### Discover

- a) Bella won the race because  $\frac{5}{6} > \frac{5}{8} > \frac{2}{5} > \frac{3}{8}$ .  
b) Olivia and Bella collected 5,800 ml of water in total.

### Think together

- Bella collected  $\frac{13}{30}$  of a bucket more than Mo.  
 $\frac{5}{6} - \frac{2}{5} = \frac{25}{30} - \frac{12}{30} = \frac{13}{30}$
- Danny collects  $\frac{3}{8}$  of a bucket.
- B has the greatest area shaded.  
A and C both have  $\frac{2}{5}$  shaded.  
 $\frac{7}{15} > \frac{2}{5} (\frac{2}{5} = \frac{6}{15})$
- Olivia started with £12.50.  
She spent £5 which is  $\frac{2}{5}$  of her money.  
 $\frac{1}{5} = £2.50$   
 $5 \times \frac{1}{5} = 5 \times £2.50 = £12.50$

## 7 Problem solving – decimals

→ pages 156–159

### Discover

- a) The price of one child ticket is £4.30.  
b) The cinema takes £103.20 more when the front row is filled with adults.

### Think together

- The mass of one carton is 0.78 kg.  
 $6.65 \text{ kg} - 0.41 \text{ kg} = 6.24 \text{ kg}$  is the mass of 8 cartons.  
The mass of 1 carton is  $6.24 \text{ kg} \div 8 = 0.78 \text{ kg}$ .
- The row is 30.05 m long.  
 $48 \times 0.6 + 1.25 = 30.05 \text{ m}$
- 0.35 is the closest to 0.4.
- 3.15 and 3.85



## 8 Problem solving – percentages

→ pages 160–163

### Discover

- a) Jen pays £360 for her computer.  
b) The full price of Amal's television is £440.

### Think together

- The full price of the monitor stand is **£60**.  
 $£42$  is 70%      $£42 \div 7 = £6 = 10\%$   
 $£6 \times 10 = £60 = 100\% =$  the full price
- The percentage of total children customers is **40%**.  
The number of adults customers is **1,050**.  
 $40\% = 700$ , so  $10\% = 175$   
 $60\% = 6 \times 10\% = 6 \times 175 = 1,050$
- a) B matches all the fractions and percentages.  
b) 25% of B is unfilled.
- Alex** was the winner with **40%** of the votes.  
 $\frac{2}{5} = 40\%$   
Luis got  $100\% - 40\% - 35\% = 25\%$  of the votes.

## 9 Problem solving – ratio and proportion

→ pages 164–167

### Discover

- a) Andy has 48 stickers in total.  
b) There are 25 packets of stickers in the box.

### Think together

- a) The train is 15 m long.  
b) The sticker is 8 cm long.
- 10 spoons of honey.
- a : b = **2 : 5**
- a) 24 small slabs  
b) 9 large slabs

## 10 Problem solving – time (I)

→ pages 168–171

### Discover

- a) 3 more appointments can be made in the afternoon than in the morning.  
b) The date of the previous dental clinic was 14 April.

### Think together

- a) 55 minutes  
b) 11:50 am

### 2. Jamilla runs faster.

Max runs 15 laps in 45 minutes, so 3 minutes per lap.  
Jamilla does 30 laps in 86 minutes, which is less than 3 minutes per lap (2.867 minutes).  
Jamilla runs twice as many laps as Max but does not take quite twice as much time as Max.

### 3. The company spent **£10,780** in total.

$(3 \times 12) + 8$  months = 44 months  
 $44 \times £245 = £10,780$

### 4. The next time they will both depart together is at 11:45.

There is 3 hours 45 minutes between each time they depart together, so 15:30 then 19:15.

## 11 Problem solving – time (2)

→ pages 172–175

### Discover

- a) Sofia will have to wait 22 minutes for her train.  
b) The bus leaves Winbeeceh at 10:54.

### Think together

- They pay **£19.95** in total.  
1 hour 40 mins = 5 twenty minute sessions:  
 $5 \times £2.95 = £14.75$   
2 rackets:  $2 \times £2.60 = £5.20$
- a) 6 hours 45 minutes  
b) 3 hours longer on a Saturday than on a Sunday.
- a) 08:30                      b) 2 hours 15 minutes
- Toshi** swims faster.  
Holly swims 630 m in 45 minutes = 1,260 m in 90 minutes.  
Toshi swims 1,280 m in 90 minutes.  
Other answers could include the speed per minute:  
Holly: 14 m per minute  
Toshi: 14.22 m per minute  
Or per hour using ratio and proportion:  
Holly:  $630 \div 3 \times 4 = 840$  m per hour  
Toshi:  $1,280 \div 3 \times 2 = 853.33$  m per hour

## 12 Problem solving – position and direction

→ pages 176–179

### Discover

- a) Vertex A is (4,5).     Vertex B is (10,15).  
b) (24,15), (18,5) and (24,5)

### Think together

- a)  $(-14,9)$ ,  $(-10,9)$   
b) A **(6,9)**     B **(10,19)**     C **(14,9)**
- P **(20,12)**     T **(60,36)**
- a)  $(6,-6)$   
b)  $(-4,-2)$



### 13 Problem solving – properties of shapes (I)

→ pages 180–183

**Discover**

- a) Angle a is **58°**.  
 $(180 - 116) \div 2 = 32^\circ$ ,  $90^\circ - 32^\circ = 58^\circ$   
 b) Angle b is **116°**.  
**Share** uses angle facts for triangles and straight lines.  
 Children could also use facts involving parallel lines:  
 Angle b is an alternate angle to the one marked 116°, so is also 116°.

**Think together**

- a) Angles a and b are both **48°**.  
 b) Angles c and d are both **96°**.  
 c and d are opposite angles, so they are equal.
- $m = 73^\circ$   
 $n = 285^\circ$   
 3rd angle in triangle =  $180 - 32 - 73 = 75^\circ$ .  
 $360^\circ - 75^\circ = 285^\circ$
- $a = 95^\circ$      $b = 190^\circ$      $c = 75^\circ$
- $x = 116^\circ$      $y = 58^\circ$      $z = 58^\circ$

### 14 Problem solving – properties of shapes (2)

→ pages 184–187

**Discover**

- a) Each angle in a regular pentagon is  $540^\circ \div 5 = 108^\circ$ .  
 b) Angle a is **72°**.  
 Angle b is **36°**.

**Think together**

- Each angle in a regular hexagon is  $720^\circ \div 6 = 120^\circ$ .  
 Angle x =  $180^\circ - 120^\circ = 60^\circ$ .  
 Angle y =  $180^\circ - 60^\circ - 90^\circ = 30^\circ$ .
- Angle a = **26°** ( $540^\circ$  – sum of all the other angles)
- For quadrilaterals the angle sum is  $360^\circ$ .  
 Parallelogram: angle a =  $(360^\circ - 260^\circ) \div 2 = 50^\circ$ .  
 Trapezium: angle a =  $360^\circ - 180^\circ - 130^\circ = 50^\circ$ .
- Angle a =  $180^\circ - 108^\circ - 60^\circ = 12^\circ$ .

### End of unit check

→ pages 188–191

- E, B, A, C, D
- $-7^\circ \text{C}$
- $x = 52^\circ$      $y = 30^\circ$
- £19,700
- $\frac{1}{10}$
- 42 cm

	Class 1	Class 2	Class 3	Total
Cake sale	£27.50	£40.71	£32.29	£100.50
Fun walk	£53.80	£45.20	£65	£164
				£264.50

- Raspberries = 40% of 800 g = 320 g  
 Or, strawberries = 200 g, cherries = 280 g,  
 raspberries =  $800 \text{ g} - 480 \text{ g} = 320 \text{ g}$ .
- 30 books altogether.  
 12 story books + 18 picture books
- 35 minutes