CHAPTER 1
Number and Algebra 1

LESSON 1.1

1 Work out the answer to each of these:

a \(5 \times -4\)  b \(-2 \times 4\)  c \(-6 \times 3\)  d \(-3 \times -3\)  e \(-2 \times 9\)

f \(5 \times -11\)  g \(9 \times 2\)  h \(-12 \times -3\)  i \(-5 \times -2 \times -2\)  j \(-3 \times 5 \times -2\)

k \(15 \div -5\)  l \(-24 \div 3\)  m \(-8 \div 2\)  n \(-9 \div -3\)  o \(-40 \div 5\)

p \(50 \div -10\)  q \(16 \div 4\)  r \(-9 \div -2\)  s \(-6 \div -4 \div -3\)  t \(-2 \times 8 \div -4\)

3 Find the missing number:

a \(5 \times -3 = \Box\)  b \(-2 \times \Box = -10\)  c \(3 \times \Box = -12\)

d \(6 \times -4 \div \Box = -12\)  e \(-10 \times \Box \div -2 = -10\)  f \(\Box \times -3 \div -2 = 15\)

LESSON 1.2

1 Find the LCM of

a 6 and 10  b 6 and 21  c 4 and 10  d 6 and 27  e 8 and 18

f 12 and 27  g 15 and 25  h 9 and 11

2 Find the HCF of

a 16 and 20  b 15 and 20  c 8 and 12  d 6 and 10  e 3 and 18

f 8 and 20  g 15 and 25  h 9 and 11

3 a Two numbers have an LCM of 30 and an HCF of 3. What are they?

b Two numbers have an LCM of 12 and an HCF of 3. What are they?

LESSON 1.3

1 Without using a calculator, write down the following:

a \(\sqrt{1}\)  b \(\sqrt{64}\)  c \(\sqrt{8}\)  d \(\sqrt{27}\)  e \(\sqrt{64}\)

2 Use a calculator to find the value of:

a \(17^2\)  b \(17^3\)  c \(25^3\)  d \(6^4\)  e \(3^7\)  f \(8^5\)

3 Given that \(0.1^2 = 0.01\), \(0.1^3 = 0.001\), \(0.1^4 = 0.0001\), write down the answers to

a \(0.1^5\)  b \(0.1^6\)
LESSON 1.4

1 These are the prime factors of some numbers. What are the numbers?
   a \(2 \times 3 \times 5\)  
   b \(2 \times 2 \times 3 \times 5\)  
   c \(2^3 \times 5^2\)

2 Using a prime factor tree, work out the prime factors of:
   a 44  
   b 120  
   c 250

3 Using the division method, work out the prime factors of:
   a 84  
   b 125  
   c 240

4 The prime factors of 100 are \(2 \times 2 \times 5 \times 5\). The prime factors of 150 are \(2 \times 3 \times 5 \times 5\).
   Use this information to work out the HCF and LCM of 100 and 150.

LESSON 1.5

1 Write down four sequences beginning 1, 2, …, and explain how each of them is generated.

2 Describe how each of the following sequences is generated and write down the next two terms
   a 50, 48, 46, 44, 42, 40, …  
   b 9, 12, 18, 27, 39, 54, …  
   c 1, 3, 6, 10, 15, 21, …  
   d 2, 6, 8, 14, 22, 36, …

3 You are given a starting number and a multiplier. Write down at least the first six terms.
   a start 1, multiplier 4  
   b start 2, multiplier –1  
   c start 20, multiplier 10  
   d start 40, multiplier \(\frac{1}{2}\)

LESSON 1.6

1 Given the first term \(a\) and the constant difference \(d\), write down the first 6 terms of each of these sequences:
   a \(a = 2, d = 6\)  
   b \(a = 0.5, d = 2\)  
   c \(a = –8, d = 3\)

2 The \(n\)th term of a sequence is given by each of the rules below. Use this to write down the first six terms of each sequence:
   a \(6n – 1\)  
   b \(10n + 3\)  
   c \(4n + 1\)  
   d \(8n – 3\)

LESSON 1.7

Write up one of the investigations for a wall display, and include:
- the problem;
- your working;
- the table of results;
- your rule;
- the answer.
Lesson 2.1

Work out the size of the lettered angles in these diagrams:

a)

b)

b)

b)

b)
**LESSON 2.2**

1. Work out the size of the lettered angles in these diagrams:
   - a. 
   - b. 
   - c. 
   - d. 
   - e. 
   - f. 
   - g. 
   - h. 

2. Work out the size of the lettered angles in these diagrams:
   - a. 
   - b. 
   - c. 
   - d. 

3. Work out the size of the lettered angles in these diagrams:
   - a. 
   - b. 

**LESSON 2.3**

1. Write out a proof to show that the sum of the angles of a triangle is 180°.
2. Write out a proof to show that the exterior angle of a triangle is equal to the sum of the two interior opposite angles.
LESSON 2.4

1 Copy and complete the table:

<table>
<thead>
<tr>
<th></th>
<th>Square</th>
<th>Rectangle</th>
<th>Parallelogram</th>
<th>Rhombus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lines of symmetry</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order of rotational symmetry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All sides equal</td>
<td>Yes</td>
<td></td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>All angles equal</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opposite sides parallel</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 a Which quadrilaterals have diagonals that bisect each other?
b Which quadrilaterals have diagonals that intersect at right angles?

3 The instructions below are to draw the rectangle shown.

```
REPEAT TWICE
FORWARD 5
TURN RIGHT 90°
FORWARD 12
TURN RIGHT 90°
```

Write down a set of similar instructions to draw a rectangle that has sides twice the length of those on the diagram.

LESSON 2.5

1 Draw a line XY 8cm in length. Using compasses, construct the perpendicular bisector of the line.

2 Draw an acute angle of any size. Using compasses, construct the angle bisector.

3 Explain how to draw an angle of 45° without having to use a protractor.

CHAPTER 3

Handling Data 1

LESSON 3.1

1 Draw a probability scale and label it with words. Under each word put a number value from 0 for impossible to 1 for certain.

2 A bag contains 10 counters. How many red counters are in the bag if the chance of picking out a red counter is:
   a fifty–fifty  
   b impossible  
   c certain

3 10 cards are numbered from 1 to 10. Describe in words the chance of picking:
   a an odd number  
   b a number less than 11  
   c a number greater than 3
LESSON 3.2

1 The probabilities of different events happening are given. Write down the probability of these events **not** happening:
   a 0.1   b 0.25   c 0.5   d 0.6   e 0.85   f 0.91   g 0.001
   h 1     i $\frac{1}{2}$   j $\frac{1}{3}$   k $\frac{1}{5}$   l $\frac{1}{3}$   m $\frac{1}{6}$   n $\frac{1}{9}$

2 There are eight outcomes when throwing three coins. Make a list of all the outcomes. Write down the probability of obtaining:
   a three heads   b at least one tail   c three tails   d at least one head

LESSON 3.3

1 A coin is tossed and a die is rolled:
   a Make a list of all the possible outcomes   b Make a table of all the possible outcomes

2 There are three pets in a house: a cat, a dog and a hamster. There are also three children, Mark, David and Paul, who each own one of the pets. Make a table of all the possibilities of who owns each pet.

3 Five girls, Bev, Val, Lynne, Sarah and June, go to the cinema. Bev wants to sit next to Val and June wants to sit on the end. Make a list of the possible seating arrangements.

LESSON 3.4

1 Two four-sided dice are thrown and the scores added together. Copy and complete the table of scores:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write down the probability of:
   a 3   b 4   c 8   d less than 4
   e greater than 5   f an even number   g a prime number   h a square number
   i a multiple of 3

2 A room is painted using two different colours. The colours can be chosen from red, green, blue and yellow. Make a list of the six different combinations that could be chosen. Write down the probability of choosing:
   a red and green   b green with any other colour   c no red
LESSON 3.5

This homework is connected to the extension work, which some pupils may already have started.

1. Having decided on an experiment of your own, collect your data. Try to collect as much as possible.
2. Write a brief report about the data you have collected.
3. Work out an experimental probability for your data.

LESSON 4.1

1. Write the following decimals as fractions with a denominator of 10, 100 or 1000 and then cancel to their simplest form if possible:
   a) 0.44   b) 0.78   c) 0.625   d) 0.928
2. Use a calculator to work out (or write down) the following terminating decimals:
   a) \(\frac{1}{5}\)   b) \(\frac{7}{10}\)   c) \(\frac{1}{8}\)   d) \(\frac{3}{4}\)   e) \(\frac{5}{8}\)
3. Use a calculator to work out (or write down) the following recurring decimals:
   a) \(\frac{1}{3}\)   b) \(\frac{1}{2}\)   c) \(\frac{1}{4}\)   d) \(\frac{1}{5}\)   e) \(\frac{1}{7}\)
4. In each of these pairs of fractions, which is larger?
   a) \(\frac{3}{7}\) and \(\frac{4}{5}\)   b) \(\frac{5}{6}\) and \(\frac{4}{3}\)

LESSON 4.2

1. Convert the following fractions to equivalent fractions with a common denominator, and then work out the answer, cancelling down or writing as a mixed number, if appropriate:
   a) \(\frac{1}{2} + \frac{1}{3}\)   b) \(\frac{5}{6} + \frac{1}{3}\)   c) \(\frac{2}{3} + \frac{1}{2}\)   d) \(\frac{1}{3} + \frac{1}{4}\)   e) \(\frac{2}{3} - \frac{1}{4}\)
   f) \(\frac{1}{3} - \frac{1}{2}\)   g) \(\frac{3}{10} - \frac{1}{4}\)   h) \(\frac{1}{2} + \frac{3}{4} - \frac{1}{2}\)
2. Work out:
   a) \(\frac{3}{4}\) of £36   b) \(\frac{3}{4}\) of 49 kg
3. Work out, cancelling down or writing as mixed numbers, as appropriate:
   a) \(3 \times \frac{1}{4}\)   b) \(4 \times \frac{3}{2}\)   c) \(\frac{1}{2} \div 6\)   d) \(\frac{3}{4} \div 8\)
LESSON 4.3

Homework

1 Without using a calculator, work out what percentage the first quantity is of the second:
   a 45 out of 50  b 13 out of 20  c 22 out of 40  d 16 out of 200

2 Use a calculator to work out what percentage the first quantity is of the second (round off to the nearest percent if necessary):
   a 21 out of 60  b 28 out of 80  c 35 out of 75  d 46 out of 85

3 In the Year 10 exams, Tamsin scored 84 out of 120 in Maths, 54 out of 75 in English and 64 out of 90 in Science. Convert these scores into percentages. Which test did Tamsin do best in?

LESSON 4.4

Homework

Do not use a calculator for Questions 1 and 2.

1 A car has a top speed of 130 miles per hour. After tuning, the top speed increases by 15%.
   a How many miles per hour faster is the car now?
   b What is the new top speed of the car?

2 Work out the final amount when:
   a £44 is increased by 20%
   b £58 is decreased by 10%
   c £140 is increased by 25%
   d £80 is decreased by 20%

3 Work out the final amount when:
   a £48 is increased by 12%
   b £62 is decreased by 8%
   c £235 is decreased by 15%
   d £88 is decreased by 32%

LESSON 4.5

Homework

1 A scooter that normally costs £1599.99 can be bought using two different plans:

<table>
<thead>
<tr>
<th>Plan</th>
<th>Deposit</th>
<th>Number of payments</th>
<th>Each payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20%</td>
<td>24</td>
<td>£65</td>
</tr>
<tr>
<td>B</td>
<td>50%</td>
<td>12</td>
<td>£66.67</td>
</tr>
</tbody>
</table>

   a Work out how much the scooter costs using each plan.
   b Work out the percentage of the original price that each plan costs.

2 A shop buys a table for £62 and sells it for £86.80. Work out the percentage profit made by the shop.

3 Work out the tax paid by the following people:

<table>
<thead>
<tr>
<th>Person</th>
<th>Income</th>
<th>Tax allowance</th>
<th>Tax rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xavier</td>
<td>£35 000</td>
<td>£4600</td>
<td>22%</td>
</tr>
<tr>
<td>Yves</td>
<td>£52 000</td>
<td>£5300</td>
<td>35%</td>
</tr>
</tbody>
</table>
LESSON 5.1

1 Write each of these expressions in as simple a way as possible:
   a) \(5 \times p\)  
   b) \(2 \times t\)  
   c) \(8 \times q\)  
   d) \(k \times t\)  
   e) \(m \times (a - c)\)  
   f) \(t \times (5 + d)\)  
   g) \((a - b) \times d\)  
   h) \(m \times n \times p\)  
   i) \(m \div 3\)  
   j) \(5 \div n\)  
   k) \((a + b) \div m\)  

2 Solve the following equations, making correct use of the equals sign:
   a) \(4x + 1 = 21\)  
   b) \(3x - 3 = 18\)  
   c) \(5x + 4 = 29\)  
   d) \(3x + 1 = 13\)  
   e) \(7x + 3 = 17\)  
   f) \(8x - 3 = 13\)  
   g) \(10x + 9 = 12\)  
   h) \(2x - 7 = 10\)

3 Show which of the statements below are true (not all are):
   a) \(b - c = d + e\) is the same as \(d - e = b + c\).
   b) \(p - b = 6\) is the same as \(6 = p - b\).
   c) \(5t = t + 3\) is the same as \(t = 6x + 3\)

LESSON 5.2

1 Make a list of the terms in each of the following:
   a) \(2y - 3c\)  
   b) \(6 + m + \frac{1}{m}\)  
   c) \(4a = 24\)  
   d) \(9 = 3b^2 - 2b\)

Simplify the expressions in Questions 2, 3 and 4.

2 a) \(2a + 4a\)  
   b) \(9k - 3k\)  
   c) \(5t - 7t\)  
   d) \(-m - 2m\)  
   e) \(4n + 2n + 7n\)  
   f) \(9r - 2r - 3r\)  
   g) \(4xy - 2xy\)  
   h) \(3m^2 + 8m^2 - 6m^2\)

3 a) \(2h + 5h + 4g\)  
   b) \(5y - 3y + 2z\)  
   c) \(8a + 3b - 20b\)  
   d) \(4i - 7j + 2j\)  
   e) \(2bc + 5bc + 3b\)  
   f) \(9f^2 - 2f - 5f^2\)

4 a) \(4w + 3w + 2x + 3x\)  
   b) \(9p - 3p + 7q - 9q\)  
   c) \(3d + 2e + 5d + e\)  
   d) \(4f + 6g - 2g + 3f\)  
   e) \(5m + 3n - 2m - 8n\)  
   f) \(-3a + 2b + 4a - b\)

LESSON 5.3

1 Expand the following brackets.
   a) \(5(a - b)\)  
   b) \(d(w + f)\)  
   c) \(4(s + 2t)\)  
   d) \(m(2k - 3n)\)  
   e) \(4(3r - 2t + 4b)\)  
   f) \(-(2 + m)\)  
   g) \(-(b - c)\)  
   h) \(-2(x + 5)\)  
   i) \(-3(2i - h)\)  
   j) \(-6(3d + 4h)\)

For Questions 2–5, expand the brackets and then simplify the expressions.

2 a) \(2(d + e) + 3d\)  
   b) \(5t + 4(s + 2t)\)  
   c) \(2(3u - 2v) - 8u\)

3 a) \(4(m + n) + 2(2m + n)\)  
   b) \(5(2i + 3j) + 4(3i - 3j)\)  
   c) \(5(3b - 2a) + 6(2a - b)\)

4 a) \(7p - (2p + 3q)\)  
   b) \(9x - (7x - 2y)\)  
   c) \(4d - (5e - 3d)\)

5 a) \(5(s + t) - (2s + 4t)\)  
   b) \(7(a + 3b) - 3(2a - 4b)\)  
   c) \(3(2g - 3h) - 2(4g - h)\)
LESSON 5.4

1 Write down the perimeter of each of the following shapes as simply as possible:

a \[3a + b\]

b \[2d + 3a + d\]

c \[2t + 2t\]

2 Write down the area of each smaller rectangle in this larger rectangle:

LESSON 5.5

1 Write the following expressions using index form.

a \[h \times h \times h \times h \times h \times h\]

b \[c \times 3c\]

c \[4d \times d \times d\]

d \[3w \times w \times 2w \times w \times 2w\]

2 Write the following expressions as briefly as possible.

a \[i + i + i + i + i\]

b \[eeeee\]

c \[ppppp + q + q + q\]

3 Expand the following brackets.

a \[d(d + 5)\]

b \[q(2q + 3p)\]

c \[5t(2k – 5t)\]

4 Expand and simplify the following expressions.

a \[v(2t + 3) + 4vt\]

b \[u(3a + h) + 2a^2\]

c \[8jk – j(2k + j)\]

d \[m(m + n) + n(2m + 3n)\]

e \[t(7t – 3y) – y(4t – 2y)\]

f \[3b^2 + b(4b + d)\]

g \[w(2w + 5x) + w(4x + 3w)\]
Lesson 6.1

1. Calculate the area of each of the following triangles:
   a. \[ \triangle ABC \]
      - Base: 6 cm
      - Height: 5 cm
   b. \[ \triangle DEF \]
      - Base: 7 cm
      - Height: 10 cm
   c. \[ \triangle GHJ \]
      - Base: 20 mm
      - Height: 24 mm

2. Calculate the area of each of the following triangles:
   a. \[ \triangle LMN \]
      - Base: 8 cm
      - Height: 8 cm
   b. \[ \triangle PQR \]
      - Base: 20 m
      - Height: 18 m
   c. \[ \triangle STU \]
      - Base: 3 cm
      - Height: 9 cm

3. Calculate the area of each of the following compound shapes:
   a. \[ \text{Rectangle with dimensions 11 cm x 6 cm and a triangle with base 7 cm and height 2 cm} \]
   b. \[ \text{L-shape with dimensions 10 m x 6 m and 5 m x 12 m} \]
LESSON 6.2

1 Calculate the area of each of the following parallelograms:

- **a**
  - Parallelogram with base 4.5 cm and height 6 cm.

- **b**
  - Parallelogram with base 8 cm and height 3 cm.

- **c**
  - Parallelogram with base 9 m and height 12 m.

2 Calculate the height of each of the following parallelograms:

- **a** Area = 63 cm²
  - Parallelogram with area 63 cm² and base 9 cm.

- **b** Area = 130 m²
  - Parallelogram with area 130 m² and base 10 m.

- **c** Area = 400 mm²
  - Parallelogram with area 400 mm² and base 25 mm.

3 The perpendicular height of a parallelogram is 10 cm and it has an area of 55 cm². Find the length of the base of the parallelogram.

LESSON 6.3

1 Calculate the area of each of the following trapezia:

- **a**
  - Trapezium with bases 8 cm and 5 cm, and height 4 cm.

- **b**
  - Trapezium with bases 3 m and 5 m, and height 1 m.

- **c**
  - Trapezium with bases 15 mm and 28 mm, and height 5 mm.

2 For each of the following trapezia, calculate:
   - **i** its perimeter
   - **ii** its area

- **a**
  - Trapezium with bases 12 cm and 4 cm, and height 5 cm.

- **b**
  - Trapezium with bases 9 m and 6 m, and height 17 m.

3 Find the height of the trapezium below if it has an area of 100 cm²:

- Trapezium with bases 7 cm and 13 cm, and area 100 cm².
LESSON 6.4

1 Find the volume for each of the following cuboids:
   a  
   
   b  
   
   c  

2 Find the volume of a cube with edge length 3 cm.

3 The measurements of the sides of a rectangular water tank are: \( l = 4 \text{ m} \), \( w = 3 \text{ m} \) and \( h = 2 \text{ m} \):
   a Find the volume of the tank.
   b How many litres of water does the tank hold when it is full?

4 A cube has a surface area of 294 cm\(^2\):
   a Find the length of an edge of the cube.
   b Find the volume of the cube.
   c Find the capacity of the cube, giving your answer in millilitres.

LESSON 6.5

1 Express each of the following in the unit given in brackets:
   a 3 ft 6 in (in)  
   b 3 yd 2 ft (ft)  
   c 1 lb 14 oz (oz)  
   d 10 st 2 lb (lb)  
   e 3 gallons 7 pints (pints)

2 Express each of the following in the units given in brackets:
   a 47 in (ft and in)  
   b 14 ft (yd and ft)  
   c 42 oz (lb and oz)  
   d 21 lb (st and lb)  
   e 36 pints (gallons and pints)

3 Convert each of the following Imperial quantities into the approximate metric quantity given in brackets:
   a 9 in (cm)  
   b 15 miles (km)  
   c 4 lb (kg)  
   d 5\( \frac{1}{2} \) pints (l)  
   e 2 gallons (l)

4 Sam goes on a diet and loses 8 kg. Before he started the diet his weight was 15 stone 4 pounds. After the diet, what is his weight, approximately, in stones and pounds?

5 A cask holds 100 gallons of wine. Approximately how many litre bottles of wine can be filled from the cask?
CHAPTER 7

Algebra 3

LESSON 7.1

1 a Using number lines from –5 to 15, draw mapping diagrams to illustrate the functions:
   i \( x \rightarrow 3x + 2 \)    ii \( x \rightarrow 4x - 3 \)    iii \( x \rightarrow 2x + 3 \)    iv \( x \rightarrow 3x - 1 \)
   b In each mapping diagram draw the lines from –2.5, –0.5 and 1.5

LESSON 7.2

What are the functions that generate the following mixed outputs from the given mixed inputs? (*Hint: put them into order first.*)
   a \{3, 0, 4, 1\} \rightarrow \{9, 1, 13, -3\}    b \{4, -2, 5, 0\} \rightarrow \{13, -2, -8, 10\}
   c \{3, -1, 4, 0\} \rightarrow \{-2, 18, 3, 23\}    d \{5, 0, -1, 6\} \rightarrow \{35, -1, 5, 41\}

LESSON 7.3

Draw the graphs of:
   a \( y = 4x + 3 \)    b \( y = 4x - 1 \)    c \( y = 4x + 5 \)    d \( y = 4x - 3 \)

LESSON 7.4

Find four functions with graphs that pass through the point (–1, 1).

LESSON 7.5

Dean drove from home at an average speed of 40 km/h for 2 hours. He stopped for 40 minutes to pick up Helen, and then set off back home at an average speed of 60 km/h:
   a Draw a travel graph to illustrate this journey.
   b How long did the journey take Dean?
CHAPTER 8
Number 3

LESSON 8.1

1. Round these numbers to i one decimal place, and ii two decimal places:
   a. 2.478  
   b. 6.089  
   c. 2.997  

2. Write down the answers to:
   a. $4.8 \times 10$  
   b. $0.56 \times 10^2$  
   c. $7.92 \times 10^3$  
   d. $21 \div 10^3$  
   e. $214 \div 10^2$  
   f. $876 \div 10^3$  
   g. $0.007 \times 10^2$  
   h. $57 \div 10^2$  

3. Multiply these numbers by i 0.1, and ii 0.01:
   a. 7.9  
   b. 652  

4. Divide these numbers by i 0.1, and ii 0.01:
   a. 0.5  
   b. 85  

LESSON 8.2

1. Write the following numbers in words:
   a. 5 504 055  
   b. 3 089 089  

2. Write the following numbers using figures:
   a. Two million, one hundred and three thousand, one hundred and six.  
   b. Eight million, six hundred and seventy thousand and eighty one.  

3. Round off the following numbers to i the nearest ten thousand, ii the nearest hundred thousand and iii the nearest million:
   a. 2 578 913  
   b. 7 908 688  

LESSON 8.3

1. Estimate the answers to:
   a. $18\% \text{ of } 288$  
   b. $\sqrt{60}$  
   c. $5.6^2$  
   d. $193 \times 52$  
   e. $29.3 - 15.2$  
   f. $228 \times 12$  
   g. $42.1 \times 7.5$  
   h. $9.3^2$  

2. Pick out the answer that is the most appropriate for the calculation shown and justify your choice:
   a. $\sqrt{80}$ (possible answers 7.9, 8.9, 9)  
   b. $29 \times 37$ (possible answers 1073, 1703, 3073)  
   c. $48 \times 0.51$ (possible answers 23, 25, 27)  
   d. $3.2 \div 0.001$ (possible answers 30, 300, 3000)
LESSON 8.4

1 Work out the following:
   a \(1.89 + 32.407 + 601.2\)
   b \(6.5 + 5 + 12.04 + 2.184\)
   c \(16.23 + 12.39 - 11.18\)
   d \(51.3 + 18.2 - 28.615\)
   e \(20.07 + 3.4 - 12.35 - 9.92 + 5.8\)

2 In an experiment, a beaker of water has a mass of 1.256 kg. The beaker alone weighs 0.135 kg. What is the mass of water in the beaker?

3 A rectangle is 1.76 m by 39 cm. What is its perimeter?

LESSON 8.5

1 Use the fraction key on your calculator to work out each of these (give your answer as a mixed number or a fraction in its simplest form):
   a \(\frac{1}{3} + \frac{2}{3} + \frac{5}{6}\)
   b \(1\frac{2}{5} + 1\frac{1}{2} - \frac{3}{10}\)
   c \(\frac{3}{4} \times \frac{5}{6} + 1\frac{1}{2}\)
   d \((1\frac{1}{2} + 1\frac{1}{3}) \div \frac{1}{4}\)
   e \(\frac{2\frac{1}{3} - 1\frac{1}{4}}{1\frac{1}{2} + 1\frac{1}{8}}\)

2 Use the power key and/or the cube/cube-root key on your calculator to work out each of these:
   a \(2^7\)
   b \(3.2^3\)
   c \(3\sqrt{2197}\)
   d \(\sqrt{3^2 + 2^3}\)

LESSON 8.6

1 Without using a calculator, and using any method you are happy with, work out:
   a \(5.4 \times 6.8\)
   b \(3.82 \times 5.5\)

2 Without using a calculator, and using any method you are happy with, work out:
   a \(50.4 \div 18\)
   b \(153 \div 3.4\)

3 Exercise books cost £0.78 each. How much will 88 exercise books cost?

4 Geometry sets cost £1.20 each. How many can be bought for £114?
LESSON 9.1

1. For each pair of shapes below, state whether they are congruent or not:

   a  
   b  
   c  
   d  
   e  

2. Which of the isosceles triangles on the grid below are congruent?

   A  B  C  D  E
   F  G  H  I  J

LESSON 9.2

Find three different combinations of two transformations that will map shape A onto shape B.
LESSONS 9.3 and 9.4

1 Draw copies of the shapes shown and enlarge each one by the given scale factor about the centre of enlargement O:

   a Scale factor 2
   b Scale factor 3
   c Scale factor 2

   O × ☐
   O × ☐
   O × ☐

2 Copy the shapes below onto centimetre-squared paper and enlarge each one by the given scale factor about the origin O:

   a Scale factor 2
   b Scale factor 3

   O
   O
   O

LESSON 9.5

1 Express each of the following ratios in their simplest form:

   a 12 cm : 16 cm
   b 40 mm : 5 cm
   c 30 cm : 1 m
   d 500 m : 2.5 km
   e 500 cm³ : 1 l

2 Rectangle A is 6 cm by 2 cm and rectangle B is 6 cm by 8 cm. Find each of the ratios given below for the two rectangles, giving your answers in their simplest form:

   a the perimeter of rectangle A to the perimeter of rectangle B.
   b the area of rectangle A to the area of rectangle B.

3 A rectangle of length 12 cm and width 10 cm has a black square of edge length 2 cm in each corner (four black squares in total). If the four black squares are cut off the rectangle, find the ratio of the area of the black squares to the area of the remaining shape.
LEsson 10.1

1 Solve the following equations.
\[ a \] \(2x + 7 = 13\)  \[ b \] \(3x - 8 = 10\)
\[ c \] \(2y + 5 = 19\)  \[ d \] \(3s - 7 = 17\)
\[ e \] \(4f + 5 = 13\)  \[ f \] \(5q - 4 = 16\)
\[ g \] \(4p + 7 = 39\)  \[ h \] \(5t - 3 = 12\)

2 Solve the following equations.
\[ a \] \(19 - 2t = 7\)  \[ b \] \(13 - 3x = 4\)
\[ c \] \(17 - 4v = 5\)  \[ d \] \(39 - 5z = 4\)
\[ e \] \(15 - 4g = 3\)  \[ f \] \(19 - 2x = 5\)
\[ g \] \(26 - 3f = 8\)  \[ h \] \(11 - 5k = 1\)

3 Solve the following equations.
\[ a \] \(2(5x + 3) = 26\)  \[ b \] \(4(3x - 1) = 44\)
\[ c \] \(5(2j + 3) = 35\)  \[ d \] \(4(4w + 5) = 36\)
\[ e \] \(6(5q - 5) = 30\)  \[ f \] \(10(4m - 9) = 30\)

LEsson 10.2

1 Solve the following equations.
\[ a \] \(3x + 4 = -11\)  \[ b \] \(4x - 3 = -15\)
\[ c \] \(3x + 5 = -13\)  \[ d \] \(2x - 7 = -13\)
\[ e \] \(4x + 5 = -15\)  \[ f \] \(2x - 5 = -1\)
\[ g \] \(2x + 7 = -37\)  \[ h \] \(3x - 7 = -10\)

2 Solve the following equations.
\[ a \] \(19 - 2x = 13\)  \[ b \] \(11 - 3x = 17\)
\[ c \] \(13 - 4x = 29\)  \[ d \] \(27 - 5x = 12\)
\[ e \] \(17 - 4p = 5\)  \[ f \] \(17 - 2r = 21\)
\[ g \] \(25 - 3t = 31\)  \[ h \] \(19 - 5m = 34\)

3 Solve the following equations.
\[ a \] \(2(2x + 8) = 8\)  \[ b \] \(4(3x - 1) = -16\)
\[ c \] \(5(4x + 13) = 25\)  \[ d \] \(4(3q + 7) = 4\)
\[ e \] \(6(2g - 5) = -66\)  \[ f \] \(10(3y + 19) = 70\)

LEsson 10.3

1 Solve the following equations.
\[ a \] \(5x + 3 = 12 + 2x\)  \[ b \] \(7x + 3 = 19 + 3x\)
\[ c \] \(6x + 4 = 16 + 2x\)  \[ d \] \(7x - 4 = 11 + 2x\)
\[ e \] \(6x - 5 = 19 + 2x\)  \[ f \] \(7x - 6 = 9 + 2x\)
\[ g \] \(7 + 6x = 13 + 3x\)  \[ h \] \(4 + 3x = 10 + 5x\)
\[ i \] \(6 + 9x = 21 + 4x\)

2 Solve the following equations.
\[ a \] \(3(x + 5) = 21 + x\)  \[ b \] \(4(2x + 3) = 26 + x\)
\[ c \] \(4(3x - 1) = 6 + 7x\)
\[ d \] \(5x - 7 = 2(1 + x)\)  \[ e \] \(8x + 9 = 3(5 + 2x)\)
\[ f \] \(7x - 2 = 2(1 + 3x)\)
\[ g \] \(2(4x + 7) = 3(8 + x)\)  \[ h \] \(3(8 + 3x) = 4(7 + 2x)\)
\[ i \] \(2(5x - 6) = 4(3 + x)\)
LESSON 10.4

Homework

1 If \(a = 3\) and \(b = 5\) find the value of each of the following.
   a \(2a + b\)  
   b \(3a - b\)  
   c \(2(b + 3a)\)  
   d \(4(2b - a)\)

2 If \(c = 7\) and \(d = -1\) find the value of each of the following.
   a \(5c + d\)  
   b \(8c - 3d\)  
   c \(2(4d + 5c)\)  
   d \(2(5c - 2d)\)

3 If \(e = 6\) and \(f = -2\) find the value of each of the following.
   a \(e^2 + f^2\)  
   b \(e^2 - f^2\)  
   c \(ef + 4e^2 - 3f^2\)  
   d \(e(9 - f^2)\)

LESSON 10.5

Homework

1 If \(M = DV\), find \(M\) when
   i \(D = 2\) and \(V = 150\)  
   ii \(D = 2.6\) and \(V = 200\)

2 If \(A = 4rh\), find \(A\) when
   i \(r = 15\) and \(h = 5\)  
   ii \(r = 1.5\) and \(h = 16\)

3 If \(n = \frac{A + 360}{180}\), find \(n\) when
   i \(A = 540\)  
   ii \(A = 720\)

4 If \(U = v - ft\), find \(U\) when
   i \(v = 80, f = 32\) and \(t = 2\)  
   ii \(v = 120, f = 15\) and \(t = 6\)

5 If \(L = \frac{A}{B}\), find \(L\) when
   i \(A = 36\) and \(B = 4\)  
   ii \(A = 10\) and \(B = 2.5\)

6 \(T = \frac{P(q - r)}{2}\), find \(T\) when
   i \(P = 14, q = 19\) and \(r = 11\)  
   ii \(P = 8.1, q = 17.5\) and \(b = 8.5\)

7 \(Q = w(k^2 + g^2)\), find \(Q\) when
   i \(w = 16, k = 4\) and \(g = 3\)  
   ii \(w = 8, k = 5\) and \(g = 10\)

LESSON 10.6

Homework

1 Using the letters suggested, construct a simple formula in each case:
   a The sum, \(S\), of four numbers \(a, b, c\) and \(d\).  
   b The product, \(P\), of two numbers \(A\) and \(B\).
   c The sum, \(S\), of five consecutive integers.

2 Give the number of hours in:
   a 4 days  
   b \(d\) days

3 A boy is now 15 years old.
   a How many years old he will be in:
      i 6 years  
      ii \(t\) years?
   b How many years old was he:
      i 7 years ago  
      ii \(n\) years ago?

4 A train is travelling at an average speed of 50 mph. Give how many miles it will travel in:
   a 3 hours  
   b \(t\) hours

5 Give how many metres there are in:
   a 7 km  
   b \(y\) km

6 How many seconds are there in \(t\) minutes?

7 Write down the number that is a quarter of \(M\).

8 Write down the number that is three times as big as \(K\).
LESSON 11.1

The homework could be used to complete the first stage of the problem as outlined in the lesson plan.
If time permitted, the class could investigate a further problem from the exercise list or choose their own. Alternatively, they could work on the extension task.

LESSON 11.2

1 Put the following sets of data into stem-and-leaf diagrams. Remember to give a key. In each case write down the range, the mode and the median.

   a
   22 45 36 32 32 33 27 42 41
   37 29 31 34 30 44 42 29 30
   44 32 25 26 32 29 41 22 32

   b
   72 91 83 77 92 92 84
   83 70 77 87 95 77 94
   91 78 85 93 77 78 87

   c
   3 14 25 36 6 31 22 27 8 4 4 26
   21 25 4 25 32 5 4 27 23 23 28 33
   38 4 30 10 31 11 29 34 4 34 24 29

LESSON 11.3

Draw pie charts to represent the following data:

   a The favourite TV programme of 30 adults

<table>
<thead>
<tr>
<th>Subject</th>
<th>News</th>
<th>Soaps</th>
<th>Documentaries</th>
<th>Drama</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>8</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

   b The ages of 60 teachers in a school

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>21–30</th>
<th>31–40</th>
<th>41–50</th>
<th>51–60</th>
<th>Over 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>11</td>
<td>19</td>
<td>17</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

   c The favourite hobbies of 24 pupils

<table>
<thead>
<tr>
<th>Hobby</th>
<th>Sport</th>
<th>Computing</th>
<th>Games console</th>
<th>Music</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>
LESSON 11.4

1 The test results of 10 pupils are recorded for Maths and Science.

<table>
<thead>
<tr>
<th>Pupil</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths</td>
<td>50</td>
<td>62</td>
<td>24</td>
<td>35</td>
<td>85</td>
<td>38</td>
<td>75</td>
<td>90</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>43</td>
<td>65</td>
<td>18</td>
<td>30</td>
<td>38</td>
<td>48</td>
<td>82</td>
<td>95</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

a Plot the results on a scatter graph:
   Take the x-axis as the Maths result from 0 to 100;
   Take the y-axis as the Science result from 0 to 100.

b Describe in words what the graph tells you.

2 The table shows the cost of CDs in a record shop sale and the number sold in one day.

<table>
<thead>
<tr>
<th>CD</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>£8</td>
<td>£12</td>
<td>£14</td>
<td>£10</td>
<td>£12</td>
<td>£9</td>
<td>£8</td>
<td>£10</td>
<td>£13</td>
<td>£12</td>
</tr>
<tr>
<td>Number sold</td>
<td>20</td>
<td>12</td>
<td>8</td>
<td>15</td>
<td>10</td>
<td>18</td>
<td>18</td>
<td>13</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

a Plot the results on a scatter graph:
   Take the x-axis as the Cost from £0 to £20;
   Take the y-axis as the Number sold from 0 to 25.

b Describe in words what the graph tells you.

LESSON 11.5

The homework could be used to collect further data, but the main activity is to complete a written report using the data collected, in which the data is analysed and presented using the methods used in this chapter.

If extra time is available, investigate the time spent on homework compared with the time working on a problem in class. You could compare this for different subjects.

CHAPTER 12

Number 4

LESSON 12.1

1 Write these fractions as mixed numbers (cancel down if necessary):
   a nine sixths   b fourteen thirds   c twelve sevenths   d thirteen halves
   e \( \frac{2}{3} \)   f \( \frac{5}{7} \)   g \( \frac{3}{4} \)   h \( \frac{5}{6} \)

2 a Write the fraction of a full turn that the minute hand of a clock goes through from:
   i 8:15 to 9:45  ii 9:25 to 11:10  iii 7:12 to 9:36

   b Write the fraction of a metre given by:
       i 675 cm  ii 4225 mm  iii 310 cm

   c Write the fraction of a kilogram given by:
       i 3300 g  ii 4450 g  iii 8500 g
LESSON 12.2

1. Convert the following fractions to equivalent fractions with a common denominator, and then work out the answer, cancelling down or writing as a mixed number, as appropriate:
   a \( \frac{1}{2} + \frac{1}{2} \)  b \( \frac{1}{3} + \frac{1}{3} \)  c \( \frac{1}{4} + \frac{1}{4} \)  d \( \frac{1}{5} + \frac{1}{5} \)  e \( \frac{1}{6} + \frac{1}{6} \)  f \( \frac{1}{7} + \frac{1}{7} \)  g \( \frac{1}{8} + \frac{1}{8} \)
   h \( \frac{1}{9} + \frac{1}{9} \)  i \( \frac{1}{10} + \frac{1}{10} \)  j \( \frac{1}{11} + \frac{1}{11} \)  k \( \frac{1}{12} + \frac{1}{12} \)  l \( \frac{1}{13} + \frac{1}{13} \)  m \( \frac{1}{14} + \frac{1}{14} \)  n \( \frac{1}{15} + \frac{1}{15} \)
   o \( \frac{1}{16} + \frac{1}{16} \)  p \( \frac{1}{17} + \frac{1}{17} \)  q \( \frac{1}{18} + \frac{1}{18} \)  r \( \frac{1}{19} + \frac{1}{19} \)  s \( \frac{1}{20} + \frac{1}{20} \)  t \( \frac{1}{21} + \frac{1}{21} \)  u \( \frac{1}{22} + \frac{1}{22} \)  v \( \frac{1}{23} + \frac{1}{23} \)  w \( \frac{1}{24} + \frac{1}{24} \)  x \( \frac{1}{25} + \frac{1}{25} \)  y \( \frac{1}{26} + \frac{1}{26} \)  z \( \frac{1}{27} + \frac{1}{27} \)

LESSON 12.3

1. Write the operation that you do first in each of these calculations, and then work out each one:
   a \( 6 + 2 \times 3 \)  b \( (6 + 2) \times 3 \)  c \( 6 \times 7 - 5 \)  d \( 6 \times (7 - 5) \)
   e \( 32 \div 4 + 4^2 \)  f \( 32 \div (4 + 4)^2 \)  g \( 6 \times 7 - 5 \)  h \( 2 \times 3^2 \)
   i \( \sqrt{132 - 5^2} \)  j \( 2 \times 3 + 2^2 \)  k \( 2 + 3 \times 1 + 4 \)  l \( 2 + 3 \times 1 + 4 \)

2. Work out the following, showing each step of the calculation:
   a \( 32 \div 4 + 4^2 \)  b \( 32 \div (4 + 4)^2 \)  c \( 2 \times 3 + 2^2 \)  d \( 2 \times (3 + 2)^2 \)
   e \( \frac{100}{2 \times 4} \)  f \( \frac{90 - 30}{3 \times 5} \)  g \( \sqrt{13^2 - 5^2} \)  h \( \frac{(3 + 3)^2}{3 - 1} \)

3. Write out each of the following with brackets to make the calculation true:
   a \( 2 \times 9 - 1 = 16 \)  b \( 5 + 3 \times 2 = 16 \)  c \( 2 + 3 \times 1 + 4 = 25 \)

4. Work out the following (do the inside bracket first):
   a \( 150 \div [20 - (3 + 2)] \)  b \( 150 \div [(25 - 3) - 2] \)  c \( 3 + [7 \times (4 - 1)] \)

LESSON 12.4

1. Without using a calculator, write down the answer to:
   a \( 0.5 \times 0.2 \)  b \( 0.5 \times 0.02 \)  c \( 0.8 \times 0.8 \)  d \( 0.9 \times 0.3 \)
   e \( 0.03 \times 0.5 \)  f \( 0.6 \times 0.08 \)  g \( 0.07 \times 0.2 \)  h \( 0.5 \times 0.05 \)

2. Without using a calculator, work out:
   a \( 200 \times 0.06 \)  b \( 0.07 \times 300 \)  c \( 0.4 \times 400 \)  d \( 0.03 \times 700 \)
   e \( 0.02 \times 600 \)  f \( 0.003 \times 800 \)  g \( 0.006 \times 800 \)  h \( 0.003 \times 7000 \)

3. Chews cost £0.03. A sweet shop orders 50 000 chews. How much will this cost?

LESSON 12.5

1. Without using a calculator, work out:
   a \( 0.6 \div 0.03 \)  b \( 0.8 \div 0.2 \)  c \( 0.08 \div 0.1 \)  d \( 0.8 \div 0.04 \)
   e \( 0.5 \div 0.01 \)  f \( 0.08 \div 0.02 \)  g \( 0.09 \div 0.03 \)  h \( 0.12 \div 0.03 \)

2. Without using a calculator, work out:
   a \( 600 \div 0.6 \)  b \( 800 \div 0.2 \)  c \( 80 \div 0.08 \)  d \( 600 \div 0.02 \)
   e \( 900 \div 0.03 \)  f \( 20 \div 0.04 \)  g \( 60 \div 0.1 \)  h \( 900 \div 0.2 \)

3. Without using a calculator, work out:
   a \( 4.2 \div 20 \)  b \( 2.8 \div 400 \)  c \( 16 \div 400 \)  d \( 4.5 \div 90 \)
   e \( 32 \div 800 \)  f \( 80 \div 2000 \)  g \( 2.1 \div 70 \)  h \( 4.4 \div 40 \)
LESSON 13.1

1 Simplify the following:
   a $7m + 3k + 2m$  
   b $5p + q + 3p$  
   c $6t + 2d - t$  
   d $8k + 5g - k$

2 Expand the following:
   a $2(3a + 4b)$  
   b $3(5t - 2k)$  
   c $6(n + 2p)$  
   d $5(2q - p)$

   e $q(7 + w)$  
   f $a(5 + 2m)$  
   g $n(3y - t)$  
   h $y(2x - 3n)$

3 Expand and simplify the following:
   a $4x + 3(2x + 3)$  
   b $9a - 2(4a + 5)$  
   c $17t - 3(4t - 1)$  
   d $5x + 3(2x - 5)$

   e $9t - 4(2t - 2)$  
   f $17m - 3(5m - 4)$

4 Expand and simplify the following:
   a $2(4k + 1) + 3(5k + 1)$  
   b $4(3x + 2) + 3(2x + 3)$  
   c $4(2m + 3) + 5(2m + 3)$

   d $6(3k + 2) - 3(k + 5)$  
   e $5(4t + 3) - 2(6t + 3)$  
   f $3(7k + 6) - 4(3k + 5)$

LESSON 13.2

1 Solve the following equations:
   a $4x = 16$  
   b $3x = 30$  
   c $2m = 18$  
   d $5n = 35$

2 Solve the following equations:
   a $6 = \frac{18}{n}$  
   b $4 = \frac{24}{x}$  
   c $2 = \frac{8}{m}$  
   d $9 = \frac{27}{x}$

3 Solve the following equations:
   a $4(3t + 1) = 28$  
   b $3(4m + 5) = 33$  
   c $4(5m + 3) = 72$  
   d $5(2k + 3) = 60$

   e $3(3t - 5) = 12$  
   f $5(2x - 3) = 30$  
   g $4(2t - 5) = 36$  
   h $6(8 - 3x) = 12$

4 Solve the following equations:
   a $2.5x + 1.7 = 7.4$  
   b $4.6x + 9.3 = 25.4$  
   c $2.6x - 5.1 = 6.6$

5 Solve the following equations:
   a $2(x + 2) + 3(x - 4) = 27$  
   b $5(x + 4) + 2(x - 3) = 42$

   c $5(3x + 4) + 4(2x - 2) = 127$  
   d $6(2x + 4) - 3(2x + 3) = 45$
LESSON 13.3

1 Grandma is seven times as old as her grandson is now. If their ages add up to 96, how old is Grandma?

2 If \( n \) is an even number:
   i Write, as simply as possible, an expression for the sum of the next four consecutive even numbers.
   ii If the sum of these four numbers is 84, find \( n \).

3 The sum of two consecutive odd numbers is 152; find the numbers.

4 Mark weighs 7 kg more than his brother. Their total weight is 71 kg. How much does Mark weigh?

5 Phoebe’s Auntie Ann is three times as old as Phoebe. If the sum of their ages is 52, find their ages.

6 I think of a number, add 8 to it, double the answer, subtract 10 and I end up with 16.
   i If the number I first thought of was \( n \), write down an equation that involves \( n \) and 16.
   ii Solve the equation to find the number I first thought of.

LESSON 13.4

1 Find the gradient of the straight line that joins the following pairs of coordinates:
   a (1, 4) and (2, 8)  
   b (1, 8) and (3, 0)  
   c (1, 9) and (3, 3)

2 Find the gradient and the \( y \)-axis intercept of each of the following equations:
   a \( y = 5x + 3 \)  
   b \( y = 3x \)  
   c \( y = -3x + 2 \)  
   d \( y = -4x - 7 \)

3 Write equations for lines in the form \( y = mx + c \), where:
   a \( m = 4 \) and \( c = 3 \)  
   b \( m = 5 \) and \( c = -2 \)  
   c \( m = -3 \) and \( c = 7 \)  
   d \( m = -5 \) and \( c = -2 \)  
   e \( m = 6 \) and \( c = 0 \)  
   f \( m = 0 \) and \( c = 9 \)

4 Find the gradient, the \( y \)-intercept and the equation of each linear graph shown below:
   a  
   b  
   c  
   d

LESSON 13.5

1 An express parcel delivery agency charges £5 for any delivery up to a mile, then another £4 for each mile after that up to 4 miles. For journeys over 4 miles they charge an extra £1 per mile over the 4.
   a How much is charged for the following journeys:
      i half a mile  ii 1 mile  iii 2 miles  iv 4 miles  v 7 miles  vi 12 miles?
   Draw a step graph to show the charges for journeys up to 12 miles.

2 Look at each of the following graphs and write a short story to go with each graph.
**LESSON 13.6**

1. Rewrite each of the following formulae as indicated:
   - a. \( A = DK \)
     Make \( K \) the subject of the formula.
   - b. \( T = 3(n + m) \)
     Make \( m \) the subject of the formula.
   - c. \( F = K(2 + T) \)
     Make \( T \) the subject of the formula.
   - d. \( V = lbh \)
     Make \( b \) the subject of the formula.
   - e. \( Q = 4g - 7 \)
     Make \( g \) the subject of the formula.

2. \( d = 8p - 3 \)
   - a. Find \( d \) when \( p = 11 \).
   - b. Make \( p \) the subject of the formula.
   - c. Find \( p \) when \( d = 53 \).

3. \( T = m + 3k \)
   - a. Find \( T \) when \( m = 6 \) and \( k = 5 \).
   - b. Make \( k \) the subject of the formula.
   - c. Find \( k \) when \( T = 23 \) and \( m = 5 \).

4. \( y = 6x - t \)
   - a. Find \( y \) when \( x = 3 \) and \( t = 8 \).
   - b. Make \( x \) the subject of the formula.
   - c. Find \( x \) when \( y = 21 \) and \( t = 3 \).

---

**CHAPTER 14**

**Solving Problems**

**LESSON 14.1**

1. Each of these measurements is given to the nearest centimetre. Write down the lowest possible measurement for each one.
   - a. 7 cm
   - b. 15 cm
   - c. 45 cm
   - d. 105 cm

2. A rectangle has length 4 cm and width 3 cm. Each measurement is to the nearest centimetre. What is the smallest possible perimeter?

3. Find two consecutive numbers for which the product is 756.

4. A map has a scale of 1 cm to 4 km. The distance between two places on the map is 2.5 cm. What is the actual distance between the two places?

5. Which is the greater length, 3 feet or 1 metre? Explain your answer.

6. Which is the greater, 9 pints or 5 litres? Explain your answer.

7. Which is the greater mass, 4 kg or 9 pounds? Explain your answer.
LESSON 14.2

1 The sum of two numbers is 27 and the difference is 5. What are the two numbers?
2 The sum of two numbers is 41 and the difference is 7. What are the numbers?
3 Two parcels weigh 12 kg altogether. The heavier parcel weighs 3 kg more than the lighter parcel. How much does each parcel weigh?
4 Two pieces of wood are made from a plank 6 m long. One piece is 50 cm shorter than the other piece. How long is each piece?
5 I think of a number, double it and add four to give an answer of 26:
   a Write down an equation to represent this information. 
   b What is the number?
6 I think of a number, square it and add seven to give an answer of 43:
   a Write down an equation to represent this information. 
   b What is the number?
7 I think of a number, double it and subtract two. The answer is the same as the number plus seven:
   a Write down an equation to represent this information. 
   b What is the number?

LESSON 14.3

1 Copy and complete the following number problems, filling in the missing digits:
   a \[\begin{array}{c}
   2 \\
   \hline
   3 \\
   \end{array}\] 
   b \[\begin{array}{c}
   3 \\
   \hline
   4 \\
   \end{array}\] 
   c \[\begin{array}{c}
   9 \\
   \hline
   11 \\
   \end{array}\] 
   d \[3\times1\] 
2 Give an example to show that the sum of two odd numbers is always even.
3 Give an example to show that the sum of three consecutive whole numbers is a multiple of 3.
4 Find the three factors of 25.
5 Find the four factors of 15.
6 Which is the better value for money:
   a 5 pies for £3 or 6 pies for £3.50? 
   b 12 pencils for £1.44 or 10 pencils for £1.18?

LESSON 14.4

1 A family spends £30 at the cinema on tickets and £5 on refreshments. What proportion of the spending is on refreshments?
2 A bus travels at 12 miles per hour:
   a How far will it travel in 15 minutes? 
   b How far will it travel in 20 minutes?
   c How far will it travel in 35 minutes? 
   d How far will it travel in 1 hour 20 minutes?
3 Five burgers cost £3.50. What will 15 burgers cost?
4 Three plants cost £18. What will four plants cost?
5 10 pens cost £12. What will seven pens cost?
6 1 kg is approximately equal to 2.2 pounds:
   a How many pounds are equal to 4 kg? 
   b How many kilograms are equal to 11 pounds?
LESSON 14.5

1 Simplify the ratios:
   a 8 : 4
   b 5 : 15
   c 14 : 7
   d 12 : 9
   e 15 : 5
   f 18 : 12
   g 3 : 12
   h 24 g : 18 g
   i 4 cm : 16 cm
   j £10 : £7.50
   k 33 m : 3 m
   l £1 : 50p
   m 10 kg : 4000 g
   n 5 m : 1000 mm
   o 1 hour : 45 minutes

2 a Divide 24 m in the ratio 1 : 3
   b Divide 400 g in the ratio 3 : 1
   c Divide £36 in the ratio 5 : 4
   d Divide 150 cm in the ratio 2 : 3
   e Divide 60p in the ratio 3 : 2 : 1
   f Divide 21 000 tonnes in the ratio 1 : 2 : 4.

CHAPTER 15

Shape, Space and Measures  4

LESSONS 15.1 and 15.2

1 Draw an accurate copy of the cuboid shown on an isometric grid.

2 For each of the following 3-D shapes below, draw on centimetre-squared paper:
   i the plan
   ii the front elevation
   iii the side elevation.

a
b

c
LESSON 15.3

1 The lines below are drawn using a scale 1 cm to 4 m. Write down the length each line represents.
   a ____________________________ (3 cm)
   b ____________________________ (7 cm)
   c ____________________________ (4.5 cm)
   d ____________________________ (5.4 cm)
   e ____________________________ (8.7 cm)

2 The diagram shown is a scale drawing of Mr Peters' garden:
   a Find the actual dimensions of the garden.
   b Find the actual dimensions of the lawn.
   c Find the actual dimensions of the vegetable patch.
   d Find the actual area of the path.

3 The length of a netball court is 30 m and its width is 16 m. On centimetre-squared paper, draw a plan of the netball court, using a scale of 1 cm to 4 m.

LESSON 15.4

1 Copy the grid shown and plot the points A, B, C and D.
   a Write down the coordinates of the points A, B, C and D.
   b Using the grid to help, write down the coordinates of the mid-point of each of the following line segments:
      i AD
      ii BC
      iii CD
      iv AB

2 On a grid draw the x- and y-axes from –5 to 5:
   a Plot the points P(1, 3), Q(4, −1), R(1, −5) and S(−2, −1) and join them to make a quadrilateral.
   b What is the special name given to the quadrilateral?
   c Write down the coordinates of the mid-point of each of the following lines:  i PR  ii QS
   d Explain your answer to part c.
LESSON 15.5

1. Construct each of the following triangles (remember to label all the lines):
   - a. \(\triangle ABC\) with \(AB = 7\) cm, \(BC = 12\) cm, \(CA = 7\) cm
   - b. \(\triangle DEF\) with \(DE = 6\) cm, \(EF = 10\) cm, \(FD = 8\) cm
   - c. \(\triangle GHI\) with \(GH = 3.5\) cm, \(HI = 4\) cm, \(IG = 3\) cm

2. Construct the \(\triangle XYZ\) with \(XY = 7.4\) cm, \(XZ = 6.2\) cm and \(YZ = 4.8\) cm.

3. Construct an equilateral triangle with sides of length 4 cm.

LESSON 15.6

1. Draw a sketch and describe the locus for each of the following situations:
   - a. the trail left on the ground by a snail
   - b. the path of the tip of a windscreen wiper on a car
   - c. the path of a ball thrown upwards into the air
   - d. the path of a satellite as it travels around the Earth
   - e. the path of a boy on a helter-skelter at the fun-fair.

2. The diagram shows two towns, A and B:
   A motorway is to be built so that it is equidistant from both towns:
   - a. On a sketch of the diagram, draw the locus of the path that the motorway will take.
   - b. Describe the locus of its path.

3. The diagram shows a ball rolling along the ground:
   - a. On a sketch of the diagram, draw the locus of the path of the centre of the ball as it rolls along the ground.
   - b. Describe the locus of the path of the centre of the ball.

4. The diagram shows a boat in a harbour:
   - a. On a sketch of the diagram, draw the locus of the path that the boat takes.
   - b. Describe the locus of its path.
LESSON 15.7

1. Write down each of the following compass bearings as three-figure bearings:
   a) north          b) east          c) north-west      d) south-east

2. Write down the three-figure bearing of B from A for each of the following:
   a)                       b)  
   c)                       d)  

3. Draw a rough sketch to show each of the bearings below (mark the angle on each sketch):
   a) From a ship P, the bearing of a harbour Q is 070°.
   b) From a helicopter S, the bearing of a landing pad T is 100°.
   c) From a rocket R, the bearing of the Moon M is 225°.
   d) From an aeroplane Y, the bearing of an airport Z is 310°.

4. The diagram shows the positions of a tanker at sea, a light-house and a harbour:
   a) Find the bearing of the tanker from the light-house.
   b) Find the bearing of the tanker from the harbour.
   c) Find the bearing of the harbour from the light-house.

LESSON 15.8

Homework

Complete the write up of the cube investigation, explaining clearly what you have done and how you recorded your results. Remember that if another person reads your work, they should understand exactly what the problem is and what you have done to find the answer.
Lesson 16.1

1. Complete a frequency table for the following temperatures, $T$ (°C). Use class intervals of $0 < T \leq 10$, $10 < T \leq 20$, $20 < T \leq 30$ and $30 < T \leq 40$.

<table>
<thead>
<tr>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 17 32 30 10 22 26 8 16 5</td>
</tr>
</tbody>
</table>

2. Complete a frequency table for the ages (years) of a group of people. Use class intervals of $20 \leq \text{Age} < 25$, $25 \leq \text{Age} < 30$, $30 \leq \text{Age} < 35$ and $35 \leq \text{Age} < 40$.

<table>
<thead>
<tr>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 28 25 36 30 37 33 22 27 39</td>
</tr>
<tr>
<td>22 29 34 21 31 30 29 21 32 35</td>
</tr>
</tbody>
</table>

3. Complete a frequency table for the distances $d$ (kilometres) that pupils live from school. Use class intervals of $0 < d \leq 1$, $1 < d \leq 2$, $2 < d \leq 3$, $3 < d \leq 4$ and $4 < d \leq 5$.

<table>
<thead>
<tr>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 3.2 4.7 0.8 0.7 1.4 2.5</td>
</tr>
<tr>
<td>2.8 1.7 3.3 0.2 0.3 1.0 3.0</td>
</tr>
</tbody>
</table>

Lesson 16.2

1. Find the mean of 16, 19, 21, 22, 25. Use 20 as the assumed mean.

2. Find the mean of 42, 49, 51, 56, 59. Use 50 as the assumed mean.

3. Find the mean of 22.3, 28.1, 34.2. Use 30 as the assumed mean.

4. Write down four numbers with a mode of 10 and a range of 6.

5. The mean of a set of numbers is 10 and the range is 5. The numbers are now doubled.
   - a. What is the new mean?
   - b. What is the new range?

6. The mean of a set of numbers is 8.4 and the range is 11.1. The numbers are now decreased by 5.
   - a. What is the new mean?
   - b. What is the new range?
LESSON 16.3

1. For each frequency table, construct a frequency diagram.

   a. Bus journey times:

<table>
<thead>
<tr>
<th>Time, $T$ (minutes)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; T \leq 20$</td>
<td>12</td>
</tr>
<tr>
<td>$20 &lt; T \leq 40$</td>
<td>15</td>
</tr>
<tr>
<td>$40 &lt; T \leq 60$</td>
<td>9</td>
</tr>
<tr>
<td>$60 &lt; T \leq 80$</td>
<td>4</td>
</tr>
</tbody>
</table>

   b. Average temperatures of 37 European Regions:

<table>
<thead>
<tr>
<th>Average temperature, $T$ ($^\circ$C)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; T \leq 5$</td>
<td>4</td>
</tr>
<tr>
<td>$5 &lt; T \leq 10$</td>
<td>8</td>
</tr>
<tr>
<td>$10 &lt; T \leq 15$</td>
<td>12</td>
</tr>
<tr>
<td>$15 &lt; T \leq 20$</td>
<td>9</td>
</tr>
<tr>
<td>$20 &lt; T \leq 25$</td>
<td>4</td>
</tr>
</tbody>
</table>

   c. Heights of 50 buildings:

<table>
<thead>
<tr>
<th>Heights, $h$ (metres)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; h \leq 10$</td>
<td>25</td>
</tr>
<tr>
<td>$10 &lt; h \leq 20$</td>
<td>15</td>
</tr>
<tr>
<td>$20 &lt; h \leq 30$</td>
<td>10</td>
</tr>
</tbody>
</table>

LESSON 16.4

1. The table shows the mean and range of a set of golf scores per hole for Emily and Lorna:

<table>
<thead>
<tr>
<th></th>
<th>Emily</th>
<th>Lorna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.2</td>
<td>6.1</td>
</tr>
<tr>
<td>Range</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

   Compare the mean and range and explain what they tell you.

2. The table shows the median and range of weekly sales of two magazines:

<table>
<thead>
<tr>
<th>Magazines</th>
<th>Only</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>12 000</td>
<td>14 000</td>
</tr>
<tr>
<td>Range</td>
<td>1000</td>
<td>3500</td>
</tr>
</tbody>
</table>

   Compare the median and range and explain what they tell you.

3. The table shows the mode and range of goals scored by two hockey teams:

<table>
<thead>
<tr>
<th></th>
<th>Rotherfield</th>
<th>Shefham</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Range</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

   Compare the mode and range and explain what they tell you.
LESSON 16.5

1. Look at each set of data and give a reason why the chosen average is suitable or not:
   a. 1, 3, 4, 8, 10, 11  Mean  b. 2, 2, 2, 4, 6, 8  Mode
   c. 2, 4, 6, 8, 10, 11, 11  Median  d. 2, 2, 2, 3, 5, 6, 6  Mode
   e. 1, 2, 4, 6, 8, 8, 8  Median  f. 1, 12, 13, 15, 19, 19  Mean

2. Look at each set of data and decide whether the range is suitable or not, and explain your answer:
   a. 2, 3, 6, 8, 9, 10  b. 1, 1, 1, 1, 20  c. 2, 2, 4, 6, 8
   d. 1, 2, 5, 7, 8, 9  e. 1, 2, 2, 8, 9, 9, 20

LESSON 16.6

1. a. A coin is thrown and an ordinary dice is rolled. Copy and complete the sample space diagram to show all possible outcomes:
   
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>H1</td>
<td>H2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tail</td>
<td>T1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   b. What is the theoretical probability of throwing a head and rolling an even number?
   c. Design and carry out an experiment to test whether you think the coin and dice are fair.

2. a. Complete the list to show all the outcomes for throwing two coins and rolling a dice:
   HH1, HT1, TH1, TT1

   b. What is the theoretical probability of throwing two heads and rolling a number 6?