Section 4: Workbook answer sheets

Section 4 contains the completed Worksheets from the NGM Workbook. The final answers have been overlaid onto the actual Workbook pages, making these quick and easy memoranda that you can use when marking.
# Development of number systems

## Worked example

Add the following times together.Give the answers in hours and minutes.
3 h 40 min, 2 h 25 min, 28 min, 1 h 35 min

<table>
<thead>
<tr>
<th>h</th>
<th>min</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>28</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>35</td>
</tr>
</tbody>
</table>

Method in minutes column:

3 40 + 25 + 28 + 35 = 128 min
2 25 = 2 × 60 min + 8 min
28 = 2 h 8 min
1 35 write down 8 min and carry 2 h

8 8 answer: 8 h 8 min

1. Complete these number patterns.
   a 10; 20; 30; 40; 50; 60; 70; 80; 90; 100; 110; 120; 130
   b 25; 50; 75; 100; 125; 150; 175; 200; 225; 250; 275; 300; 325
   c 9; 18; 27; 36; 45; 54; 63; 72; 81; 90; 99; 108; 117
   d 40; 43; 46; 49; 52; 55; 58; 61; 64; 67; 70; 73; 76

2. a Complete the pattern: I; II; III; IV; V; VI; VII; VIII; IX
   b Name the number system. __________ ______
   c Which numbers do these letters represent?
      M = ______ D = ______
      C = ______ L = ______
   d Write the year in which you were born as Roman numerals. ______ Students' own answer

3. a Complete the table.

<table>
<thead>
<tr>
<th>Thousands</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Units</th>
<th>tenths</th>
<th>hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td>67</td>
<td></td>
<td>6</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td></td>
<td></td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.9</td>
<td></td>
<td>2</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>123</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>0.08</td>
<td></td>
<td></td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 666</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>34.34</td>
<td></td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>90.7</td>
<td></td>
<td>9</td>
<td>0</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>677</td>
<td></td>
<td>6</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56.09</td>
<td></td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>

b What do we use to separate whole numbers from decimals? __________

---

Worksheet 1
c Give an example of your answer to question 3b. any decimal number e.g. 5.67

d What number is the base of this number system? 10

4 Can you write the number words for one, two and three in any other three other languages besides English?

Students' own answer

5 Although our number system is a decimal system, we count time in different number patterns.

a How many months in one year? 12

b How many weeks in one year? 52

c How many days in one year? 365 except in Leap Year, then 366

d How many days in one week? 7

e How many minutes in one hour? 60

6 Calculate.

a Add: 7 h 15 min, 12 h 48 min and 3 h 12 min.

23 h 15 min

b Write 2 567 weeks as years and weeks.

49 years and 19 weeks

7 Which numbers have the same meaning as these?

a Penta = 5

b Tri = 3

c Quad = 4

d Hexa = 6

e Bi = 2
Express the following in a mixture of digits and words.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>N3 000 000</td>
<td>b</td>
<td>6 800 000 000</td>
<td>c</td>
</tr>
<tr>
<td>a</td>
<td>N3 000 000</td>
<td>=</td>
<td>N3 × 1 000 000</td>
<td>b</td>
</tr>
<tr>
<td>c</td>
<td>240 000 000</td>
<td>=</td>
<td>240 × 1 000 000</td>
<td>d</td>
</tr>
<tr>
<td>or</td>
<td>240 000 000</td>
<td>=</td>
<td>0.24 × 1 000 000 000</td>
<td>=</td>
</tr>
</tbody>
</table>

1. a  Our number system is based on a certain number. Underline this number.

   2  10  12  25

   b  Write down the digits used in this number system.

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

2. a  Complete the table.

<table>
<thead>
<tr>
<th>Thousand million</th>
<th>Hundred million</th>
<th>Ten millions</th>
<th>Millions</th>
<th>Hundred thousands</th>
<th>Ten thousands</th>
<th>Thousands</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 000 000 000</td>
<td>100 000 000</td>
<td>10 000 000</td>
<td>1 000 000</td>
<td>100 000</td>
<td>10 000</td>
<td>1 000</td>
<td>100</td>
<td>10</td>
<td>1</td>
</tr>
</tbody>
</table>

   b  Write the value of the underlined digit in each number.

   879  70
   27 694  20 000
   7 444 707  400 000
   9 345 678  30 000 000
   5 631  5 000
   223 970  900
   23 777 692  3 000 000
   1 204 567 876  1 000 000 000

   c  Four of the numbers in question 2b contain zeros. For each number, write which place value each zero holds.

   7 444 707 = tens  9 345 678 = hundreds  233 970 = units  1 204 567 876 = ten millions

3. a  If 0 × 1 = 0 and 1 × 0 = 0, write the answers to:

   i)  9 567 932 × 0 = 0
   ii) 0 × 9 567 932 = 0

   b  If 0 + 1 = 1 and 1 + 0 = 1, write the answers to:

   i)  0 + 23 765 892 = 23 765 892
   ii) 23 765 892 + 0 = 23 765 892

4. A builder plans to build 10 houses. Each house will cost N7 500 000 to build. He wants to sell the houses for N15 000 000 each.

   a  How much will it cost to build 10 houses?
b How much will the builder receive if he sells all 10 houses?
15 000 000 × 10 = ₦150 000 000

c How much profit will the builder make?
150 000 000 – 75 000 000 = ₦75 000 000

5 In a report, the population of Nigeria was 170 000 000, of Cameroon was 21 000 000, of Chad was 13 000 000 and of Niger was 18 000 000.
a What is the total population of all four countries?
222 000 000

b What is the difference between the population of the country with the most people, and the country with the least?
170 000 000 – 13 000 000 = 157 000 000

c What is the total population of Cameroon, Chad and Niger together?
52 000 000

d Make up your own word problem with the populations. Swap with a classmate and work out the answer.

6 Calculate.
a 7 + 6 = 13
b 77 + 49 = 126
c 398 + 821 = 1 249
d 9 – 4 = 5
e 92 – 65 = 27
f 704 – 379 = 325

7 Calculate.
a 457 + 198 = 655
b 7 369 + 778 = 8 147
c 894 – 456 = 438

d 92 304 – 74 894 = 17 410
e 523 × 317 = 165 791
f 250 893 750
# Factors and multiples

## Worked example

Express:

a) $9 \times 9 \times 9 \times 9$ in index form

b) 675 as a product of primes in index form.

<table>
<thead>
<tr>
<th>Expression</th>
<th>Index Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9 \times 9 \times 9 \times 9$</td>
<td>$9^4$</td>
</tr>
<tr>
<td>$675$</td>
<td>$3^3 \times 5^2$</td>
</tr>
</tbody>
</table>

1. **Underline the correct answer.**
   
   a) When you multiply a whole number by another whole number, the product is called a:
   
   - factor
   - multiple
   - difference

   b) When you divide a whole number by another whole number, the answer is called a:
   
   - factor
   - multiple
   - difference

2. **Circle the numbers in brackets that are factors of each given number.**
   
   a) 144
      (1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12)
   
   b) 375
      (5; 10; 15; 20; 25; 30; 35; 40; 45; 50)

3. **Circle the numbers in brackets that are multiples of each given number.**
   
   a) 11
      (1; 11; 21; 31; 41; 51; 61; 71; 81; 91)
   
   b) 50
      (5; 10; 20; 25; 50; 75; 100; 120; 150)

4. **Write down the multiples of each given number.**
   
   a) 5
      5, 10, 15, 20, 25, 30, 35, ...
   
   b) 3
      3, 6, 9, 12, 15, 18, 21, ...

   c) Which multiples are common to 5 and 3? 15, 30, 45, ...
   
   d) Which is the Lowest Common Multiple (LCM)? 15

5. **Write down the factors of each given number.**
   
   a) 27
      1, 3, 9, 27
   
   b) 36
      1, 2, 3, 4, 6, 9, 12, 18, 36
   
   c) 63
      1, 3, 7, 9, 21, 63

   d) Which factors are common to 27, 36 and 63? 1, 3, 9
   
   e) Which is the Highest Common Factor (HCF)? 9
A prime number has only two factors: 1 and itself.

Write the factors of each number. Tick if they are prime numbers.

<table>
<thead>
<tr>
<th>Number</th>
<th>Factors</th>
<th>Prime number?</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1, 7</td>
<td>yes</td>
</tr>
<tr>
<td>35</td>
<td>1, 5, 7, 35</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>1, 2, 4, 11, 22, 44</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>1, 23</td>
<td>yes</td>
</tr>
<tr>
<td>150</td>
<td>1, 2, 5, 10, 15, 25, 30, 50, 75, 150</td>
<td></td>
</tr>
</tbody>
</table>

Choose the correct answer to complete the statement.

A number that is not a prime number is called a **composite** number.

Colour all the prime numbers.

Choose any six numbers that are not coloured in. Write all the factors of each number.

Students select their own numbers and write the factors

Examples: 1, 2, 4

1, 2, 7, 14

Underline the prime factors in each set of factors in question 8b.
Fractions 1: Fractions and percentages

Worked example

a Express $4\frac{5}{6}$ as an improper fraction.

$$4\frac{5}{6} = 4 + \frac{5}{6} = \frac{24}{6} + \frac{5}{6} = \frac{29}{6}$$

or, more quickly,

$$4\frac{5}{6} = 4 \times \frac{6}{1} + \frac{5}{6} = 24 + \frac{5}{6} = \frac{29}{6}$$

b Express $\frac{19}{8}$ as a mixed number.

$$\frac{19}{8} = 2 + \frac{3}{8} = 2\frac{3}{8}$$

or, more quickly,

$$\frac{19}{8} = 19 \div 8 = 2 \text{ with remainder } 3,$$

but the remainder is also divided by 8:

$$19 \div 8 = 2 + \frac{3}{8} = 2\frac{3}{8}$$

1 Write the answers as common fractions.

a $\frac{12}{23}$

b $\frac{31}{42}$

c $\frac{101}{200}$

d $\frac{7}{15}$

e $\frac{1}{9}$

2 Write the answers as improper fractions and as mixed numbers.

a $\frac{120}{23} = \frac{5}{23}$

b $\frac{301}{42} = \frac{7}{42}$

c $\frac{507}{200} = \frac{2\frac{7}{20}}{200}$

d $\frac{77}{15} = \frac{5\frac{2}{15}}{15}$

3 Convert these fractions into their simplest form by dividing the numerator and denominator by the same number. Remember: $\frac{2}{2} = \frac{3}{3} = \frac{4}{4} = \frac{67}{67} = 1$

a $\frac{25}{30} = \frac{5}{6}$

b $\frac{49}{70} = \frac{7}{10}$

c $\frac{81}{180} = \frac{9}{20}$

d $\frac{150}{200} = \frac{3}{4}$

4 Write these fractions as percentages.

a $\frac{21}{100} = 21\%$

b $\frac{59}{100} = 59\%$

5 Convert these fractions to equivalent fractions with a denominator of 100. Then write each answer as a percentage:

a $\frac{9}{25} = \frac{36}{100} = 36\%$

b $\frac{17}{50} = \frac{34}{100} = 34\%$

c $\frac{98}{200} = \frac{49}{100} = 49\%$

d $\frac{150}{300} = \frac{50}{100} = 50\%$
Express these fractions as percentages by multiplying them by $\frac{100}{1}$.

a) \( \frac{17}{20} = \frac{17 \times 100}{20} = 85\% \)

b) \( \frac{49}{50} = \frac{49 \times 100}{50} = 98\% \)

c) \( \frac{14}{25} = \frac{14 \times 100}{25} = 56\% \)

d) \( \frac{140}{200} = \frac{140 \times 100}{200} = 70\% \)

Write the first quantity as a fraction of the second quantity.

a) 15 min; 1 hour = \( \frac{15}{60} = \frac{1}{4} \) in its simplest form.

This = \( \frac{25}{100} \). Convert to a percentage = \( 25\% \).

b) 8 mm; 1 cm = \( \frac{8}{100} = \frac{4}{50} \) in its simplest form.

This = \( \frac{80}{100} \). Convert to a percentage = \( 80\% \).

c) 500 m; 2 km = \( \frac{500}{2000} = \frac{1}{4} \) in its simplest form.

This = \( \frac{250}{1000} \). Convert to a percentage = \( 25\% \).

Rewrite these mixed numbers as improper fractions.

a) \( 2 \frac{1}{2} = \frac{5}{2} \)

b) \( 3 \frac{4}{5} = \frac{19}{5} \)

c) \( 9 \frac{7}{10} = \frac{97}{10} \)

d) \( 31 \frac{11}{12} = \frac{383}{12} \)

Find the lowest common denominator of each pair of numbers. Then add.

a) \( \frac{3}{4} + \frac{7}{8} = \frac{13}{8} = \frac{13}{8} \)

b) \( \frac{9}{10} + \frac{4}{5} = \frac{17}{10} = \frac{17}{10} \)

c) \( \frac{6}{7} + \frac{3}{5} = \frac{51}{35} = \frac{16}{35} \)

d) \( \frac{2}{9} + \frac{5}{12} = \frac{23}{36} \)

Write these percentages as fractions. Then convert them to their simplest form.

a) 25\% = \( \frac{25}{100} = \frac{1}{4} \)

b) 52\% = \( \frac{52}{100} = \frac{13}{25} \)

c) 150\% = \( \frac{150}{100} = \frac{11}{2} \)

Colour 45\% of the grid in red and 21\% in blue.
Use of symbols I: Letters for numbers

Worked example

Find the number that makes each sentence true.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>9 + 6 = □</td>
<td>9 – □ = 6</td>
<td>24 = □ × 3</td>
<td>□ ÷ 7 = 6</td>
</tr>
</tbody>
</table>

Checking method:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>□ = 15</td>
<td>□ = 3</td>
<td>□ = 8</td>
</tr>
</tbody>
</table>

1. Fill in the numbers to make each open sentence true.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>0 + 9 = □</td>
<td>2 + 7 = □</td>
<td>4 + 5 = □</td>
<td>8 + 1 = □</td>
</tr>
</tbody>
</table>

2. Replace the symbols with numbers to make each open sentence true.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>If ( y + 19 = 21 ) then ( y = ) □</td>
<td>If ( z + 46 = 90 ) then ( z = ) □</td>
<td>If ( a + 8 = 21 ) then ( a = ) □</td>
<td>If ( b + 53 = 121 ) then ( b = ) □</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>e</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>If ( a + 11 = 77 ) then ( a = ) □</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Replace the symbols with numbers to make each open sentence true.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>If ( y – 19 = 21 ) then ( y = ) □</td>
<td>If ( z – 46 = 90 ) then ( z = ) □</td>
<td>If ( a – 8 = 21 ) then ( a = ) □</td>
<td>If ( b – 53 = 121 ) then ( b = ) □</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>e</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>If ( c – 11 = 77 ) then ( c = ) □</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Replace the symbols with numbers that will make the sentences true.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>If ( 2 \times y = 24 ) then ( y = ) □</td>
<td>If ( 3 \times z = 90 ) then ( z = ) □</td>
<td>If ( 9 \times a = 63 ) then ( a = ) □</td>
<td>If ( b \times 7 = 140 ) then ( b = ) □</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>e</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>If ( c \times 11 = 77 ) then ( c = ) □</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. A boy has \( y \) marbles and his friend has 9 marbles. If together they have 12 marbles, how many marbles does each boy have?

If \( y + 9 = 12 \) then \( y = \) □
5 A girl has 24 sweets. She gives \(x\) sweets to her friend. If she has 10 sweets left, how many sweets did she give to her friend?

If \(24 - x = 10\) then \(x = 14\)

7 If \(y = 40\) and \(z = 5\), calculate the following.

a \(y + z = \frac{40 + 5}{5} = 8\)

b \(y - z = \frac{40 - 5}{5} = 7\)

c \(y \times z = \frac{40 \times 5}{5} = 80\)

d \(y + z = \frac{40}{5} = 8\)

8 A man is 25 years older than his youngest child. If the child is 12 years old, find the man’s age by finding the value of \(a\) in \(12 + 25 = a\).

\(a = 37\)

9 In \(\triangle ABC\), \(AC = x\) cm, \(AB = 4\) cm, \(BC = 5\) cm and the perimeter of the triangle is 14 cm. Find the value of \(x\).

\(x + 4 + 5 = 14\), so \(x = 5\)

10 Find the value of each letter if the following sentences are true.

a If \(2 \times y = 20\) then \(y = \frac{20}{2} = 10\).

b If \(5 \times y = y + y + y + y + y = 45\) then \(y = \frac{45}{5} = 9\).

c If \(34 - a = 7\) then \(a = 34 - 7 = 27\).

d If \(81 + b = 3 \times 3\) then \(b = 81 - 9 = 27\).

11a The highest monthly temperature in Nigeria is 30 °C in April and the lowest monthly temperature is 24 °C in January. Write a number sentence to show this. Then calculate the difference.

Example:

\(30 - 24 = a\) so \(a = 6\) °C

11b The lowest expected rainfall in Nigeria is 4 mm in December and the highest is 228 mm in August. Write a number sentence to show this. Then calculate the difference.

Example:

\(4\) mm \(+ b = 228\) mm so \(b = 224\) mm
1. Name these three-dimensional objects.
   - a
   - b
   - c
draw the nets for the objects in question 1 a, b, c and d.
   - a
   - b
2. Name these three-dimensional objects.
   - c
   - d
   - e
   - f
   - rectangular prism / cuboid
   - cube
   - triangular prism
   - triangular-base pyramid
   - cylinder
   - sphere
Complete the table about the objects in question 1.

<table>
<thead>
<tr>
<th>Name</th>
<th>Number of faces</th>
<th>Number of edges</th>
<th>Number of vertices</th>
</tr>
</thead>
<tbody>
<tr>
<td>a  rectangular prism</td>
<td>6</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>b  cube</td>
<td>6</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>c  triangular prism</td>
<td>5</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>d  triangular-base pyramid</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>e  cylinder</td>
<td>2 flat, 1 curved</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>f  sphere</td>
<td>1 curved</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Draw a skeleton view of a cube.
Remember to draw in broken lines to show the edges you can’t see.

Use capital letters of the alphabet, starting at A, to name the vertices of the cube you have drawn.

Name the edges of the cube.
AB, BC, CD, DA, AE, EH, DH, GH, EF, FG, BF, CG
d  Name the faces of the cube.
ABCD, ADHE, EFGH, BCGF, ABFE, CDHG

e  Which edges meet at vertex A?
AB, AD, AE

f  Which edges meet at vertex B?
BA, BC, BF

g  Which edges meet at vertex G?
CG, FG, HG

h  Name the edges that intersect.
AE intersects CD, EF intersects CG

③ Complete the table.

<table>
<thead>
<tr>
<th>Objects</th>
<th>Number of faces</th>
<th>Number of vertices</th>
<th>Number of edges</th>
<th>Examples found in your town or classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square-based pyramid</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>Roof of house</td>
</tr>
<tr>
<td>Cube</td>
<td>6</td>
<td>8</td>
<td>12</td>
<td>Dice</td>
</tr>
<tr>
<td>Cuboid</td>
<td>6</td>
<td>8</td>
<td>12</td>
<td>Book</td>
</tr>
<tr>
<td>Cylinder</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>Tin can</td>
</tr>
<tr>
<td>Triangular prism</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>Toblerone chocolate</td>
</tr>
<tr>
<td>Cone</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>Ice cream cone</td>
</tr>
</tbody>
</table>

⑤ Draw a skeleton view and a net of a square-based pyramid.
**Worked example**

a In \( \frac{3}{4}x \), \( \frac{3}{4} \) is the coefficient of \( x \).

b In \( 2 \frac{2}{3}a \), \( \frac{2}{3} \) is the coefficient of \( a \) (since \( 2 \frac{2}{3} = \frac{8}{3} \)).

c In \( \frac{z}{5} \), \( \frac{1}{5} \) is the coefficient of \( z \).

1. If \( 5a = 5 \times a = a + a + a + a + a \), then 5 is the coefficient of \( a \). What are the coefficients in these?

   a. \( 7y \) __7 of \( y \)__

   b. \( 23z \) __23 of \( z \)__

   c. \( 14a \) __14 of \( a \)__

   d. \( \frac{1}{4}b \) __\( \frac{1}{4} \) of \( b \)__

   e. \( \frac{c}{2} \) __\( \frac{1}{2} \) of \( c \)__

   f. \( \frac{5d}{6} \) __\( \frac{5}{6} \) of \( d \)__

2. Simplify.

   a. \( 3x + 5x = \) \( 8x \) ___

   b. \( 7a + 5a = \) \( 12a \) ___

   c. \( 9b + 2b = \) \( 11b \) ___

   d. Can you simplify \( 5c + 4d \)? Explain:

      no, because they have different terms (\( c \) and \( d \))


   a. \( 9e - 4e = \) \( 5a \) ___

   b. \( 15f - 7f = \) \( 8f \) ___

   c. \( 13g - 8g = \) \( 5g \) ___

4. Simplify.

   a. \( 7a + 15a - 10a = \) \( 12a \) ___

   b. \( 12b + 13b - 4b = \) \( 21b \) ___

   c. \( 7c + c + c + 5c - 2c = \) \( 12c \) ___

   d. \( 8d - 4d + 3d = \) \( 7d \) ___

   e. \( 5e - 2e + 9e = \) \( 12e \) ___
f  \( f - 12f + 14f = \)  

\[ f \]

\[ \underline{\text{Simplify where possible.}} \]

a  \( 2b + 7 + 5c - 3 + 7b - 3c = \)  

\[ 9b + 4 \]

b  \( 12h - 20g + 17 + 52g - 11 - 3h = \)  

\[ 9h + 32g - 6 \]

c  \( 3x - 5x - 7y + 9 - 2 + 3x + 10y = \)  

\[ x + 3y + 7 \]

d  \( 24a + 19b + 36 - (12a + 17b + 10) = \)  

\[ 12a + 2b + 26 \]
Worked example

Measure the size of the obtuse angle PÔQ in the figure below. Calculate the size of reflex angle PÔQ.

Place the protractor on the angle with its centre on O and its base line on OP or OQ.

obtuse PÔQ = 125° (by measurement)
reflex PÔQ = 360° – 125° = 235°

1. Estimate the size of each angle. Write your answers in the table in question 2.

2. Measure each angle in question 1. Complete the table.

<table>
<thead>
<tr>
<th></th>
<th>Estimated size</th>
<th>Actual size</th>
<th>Type of angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>STUDENTS</td>
<td>120°</td>
<td>obtuse</td>
</tr>
<tr>
<td>b</td>
<td>ESTIMATE</td>
<td>41°</td>
<td>acute</td>
</tr>
<tr>
<td>c</td>
<td>ANSWERS</td>
<td>90°</td>
<td>right</td>
</tr>
<tr>
<td>d</td>
<td></td>
<td>180°</td>
<td>straight</td>
</tr>
<tr>
<td>e</td>
<td></td>
<td>192°</td>
<td>reflex</td>
</tr>
</tbody>
</table>
3. Use a protractor and ruler to draw these angles.
   a. An acute angle
      ![Diagram of an acute angle]
   b. An obtuse angle
      ![Diagram of an obtuse angle]
   c. An acute angle
      ![Diagram of an acute angle]
   d. A right angle
      ![Diagram of a right angle]
Label the angles you drew in question 3 using capital letters such as A, B, C, etc. Remember the angle is at the vertex.

Write the name of each angle you drew and labelled, for example DÊF:

a  

b  

c  

d  

Measure the angles in each triangle. Then complete the table.

<table>
<thead>
<tr>
<th>Shape</th>
<th>Number of sides</th>
<th>Names of sides</th>
<th>Number of angles</th>
<th>Names of angles</th>
<th>Size of angles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td>3</td>
<td>e.g. AB</td>
<td>3</td>
<td>e.g. CÂB</td>
<td>28°</td>
</tr>
<tr>
<td>ABC</td>
<td>BC</td>
<td></td>
<td>BCA</td>
<td></td>
<td>124°</td>
</tr>
<tr>
<td></td>
<td>AC</td>
<td></td>
<td>AÊBC</td>
<td></td>
<td>28°</td>
</tr>
<tr>
<td>Rectangle</td>
<td>4</td>
<td>PS</td>
<td>4</td>
<td>PQR</td>
<td>72°</td>
</tr>
<tr>
<td>PQRS</td>
<td>SR</td>
<td></td>
<td>PÊS</td>
<td></td>
<td>64°</td>
</tr>
<tr>
<td></td>
<td>QR</td>
<td></td>
<td>SÊPQ</td>
<td></td>
<td>119°</td>
</tr>
<tr>
<td></td>
<td>PQ</td>
<td></td>
<td>SÊRQ</td>
<td></td>
<td>105°</td>
</tr>
</tbody>
</table>
Worked example

Write the following as decimal numbers.

a \[ \frac{23}{1000} \]  

\[ \frac{23}{1000} = 23 \div 1000 = 23 \div 103 = 0.023 \]

b \[ 120 \div 100000 \]

\[ 120 \div 100000 = 120 \div 105 = 0.00120 \]

\[ = 0.0012 \]

It is not necessary to write zeros to the right of a decimal fraction. For example, 0.200 000 is just the same as 0.2.

1. Write these percentages as fractions.

a 7\% \[ \frac{7}{100} \]

b 17\% \[ \frac{17}{100} \]

c 29\% \[ \frac{29}{100} \]

d 37\% \[ \frac{37}{100} \]

e 51\% \[ \frac{51}{100} \]

f 63\% \[ \frac{63}{100} \]

2. Write these percentages as fractions. Then convert them to their simplest terms.

a 10\% \[ \frac{10}{100} = \frac{1}{10} \]

b 25\% \[ \frac{25}{100} = \frac{1}{4} \]

c 50\% \[ \frac{50}{100} = \frac{1}{2} \]

d 90\% \[ \frac{90}{100} = \frac{9}{10} \]

3. Complete the table.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Fraction with denominator of 100</th>
<th>Decimal</th>
<th>Fraction with denominator &gt; 100</th>
<th>Fraction with denominator &lt; 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>75%</td>
<td>[ \frac{75}{100} ]</td>
<td>0.75</td>
<td>[ \frac{150}{200} ]</td>
<td>[ \frac{3}{4} ]</td>
</tr>
<tr>
<td>50%</td>
<td>[ \frac{50}{100} ]</td>
<td>0.5</td>
<td>[ \frac{150}{300} ]</td>
<td>[ \frac{1}{2} ]</td>
</tr>
<tr>
<td>25%</td>
<td>[ \frac{25}{100} ]</td>
<td>0.25</td>
<td>[ \frac{50}{200} ]</td>
<td>[ \frac{1}{4} ]</td>
</tr>
<tr>
<td>50%</td>
<td>[ \frac{50}{100} ]</td>
<td>0.5</td>
<td>[ \frac{100}{200} ]</td>
<td>[ \frac{25}{50} ]</td>
</tr>
<tr>
<td>35%</td>
<td>[ \frac{35}{100} ]</td>
<td>0.35</td>
<td>[ \frac{70}{200} ]</td>
<td>[ \frac{7}{20} ]</td>
</tr>
</tbody>
</table>
Convert these fractions to decimals. Write them in under the correct column:

\[
\begin{array}{cccccc}
\text{a} & \frac{4}{5} & \frac{8}{10} & \text{T} & 0 & \text{h} \\
\text{b} & \frac{18}{200} & \frac{9}{100} & \text{T} & 0 & \text{h} \\
\text{c} & \frac{9}{20} & \frac{45}{100} & \text{T} & 0 & \text{h} \\
\text{d} & \frac{12}{25} & \frac{48}{100} & \text{T} & 0 & \text{h}
\end{array}
\]

Change these fractions to percentages by multiplying them by 100.

\[
\begin{array}{cccc}
\text{a} & \frac{17}{25} & 17 \times 4 = 68\% \\
\text{b} & \frac{49}{50} & 49 \times 2 = 98\% \\
\text{c} & \frac{66}{150} & \frac{66}{3} \times 2 = 44\%
\end{array}
\]

Calculate.

\[
\begin{array}{cccc}
\text{a} & 1.39 + 2.564 & 3.954 \\
\text{b} & 7.05 – 3.879 & 3.171 \\
\text{c} & 2.06 \times 17.3 & 35.638 \\
\text{d} & 8.73 \div 0.9 & 9.7
\end{array}
\]

Write these fractions as recurring decimals.

\[
\begin{array}{cccc}
\text{a} & \frac{1}{3} & 0.3333\ldots \\
\text{b} & \frac{4}{9} & 0.4444\ldots \\
\text{c} & \frac{7}{11} & 0.636363\ldots
\end{array}
\]

Aisha and Cerena both got good marks for their Mathematics test.

\[
\begin{array}{cccc}
\text{a} & \text{Work out their percentages if Aisha got } & \frac{24}{30} & \text{and Cerena got } \frac{30}{40}. \\
& \text{Aisha got 80\%.} & \text{Cerena got 75\%.}
\end{array}
\]

\[
\begin{array}{cccc}
\text{b} & \text{Find the difference in their percentages.} & 5\%
\end{array}
\]

Write these percentages as fractions and as decimals.

\[
\begin{array}{cccc}
\text{a} & 73\% & \frac{73}{100} & 0.73 \\
\text{b} & 99\% & \frac{99}{100} & 0.99 \\
\text{c} & 45\% & \frac{45}{100} & 0.45
\end{array}
\]
Worked example

A girl is 14 years old. How old will she be in \(x\) years' time?

Use 2 and 10 instead of \(x\):

In 2 years' time the girl will be \(14 + 2\) years old (16 years old).

In 10 years' time the girl will be \(14 + 10\) years old (24 years old).

So, in \(x\) years' time the girl will be \(14 + x\) years old. \(14 + x\) will not simplify.

The girl will be \(14 + x\) years old.

1. Find the value of the alphabetical letters.
   
   a. \(b + 19 = 26\) \(\quad b = 7\)
   
   b. \(43 - c = 11\) \(\quad c = 32\)
   
   c. \(9 \times d = 72\) \(\quad d = 8\)
   
   d. \(132 + e = 11\) \(\quad e = 12\)

2. Solve.
   
   a. A boy has 7 marbles. He gets \(z\) more. How many does he have altogether?
      \(7 + z\)
   
   b. There are 100 cm in 1 m. How many cm in \(b\) m?
      \(100b\)
   
   c. A woman bakes \(c\) biscuits and shares them among her 3 children. How many biscuits does each child get?
      \(\frac{c}{3}\)
   
   d. A man buys 10 fruit trees. He gives \(d\) to his brother. How many trees does he have left?
      \(10 - d\)

3. a. A triangle has two sides each \(g\) mm long, and a third side 15 mm long. What is the perimeter of the triangle?
      \(2g + 15\) mm
   
   b. A rectangle has sides \(b\) cm wide and \(j\) cm long. The perimeter is 90 cm. What are the lengths of the two sides?
      \(2b + 2j = 90\) cm so \(2b = 90 - 2j\) and \(b = \frac{(90 - 2j)}{2}\)
   
   c. A farm is divided into small plots. Each plot is 1 acre and the farm is \(k\) acres. How many plots can the farm be divided into?
      \(\frac{k}{1}\) plots
4. A school period is $m$ minutes long. There are 12 periods in a school day.
   a. How many minutes are there in the school day?
      \[12m\text{ minutes}\]
   b. How many hours are there in the school day?
      \[\frac{12m}{60}\text{ hours}\]

5. A woman is three times as old as her daughter and half the age of her mother. The daughter is $n$ years old.
   a. How old is the woman?
      \[3n\text{ years old}\]
   b. How old is her mother?
      \[2 \times 3n\text{ years old}\]

6. A farmer has $q$ hens. Each hen lays 1 egg a day.
   a. How many eggs will be laid in 10 days?
      \[10q\text{ eggs}\]
   b. If $r$ eggs are broken, how many will be left?
      \[10q - r\text{ eggs}\]

7. A man wants to tile his veranda. The veranda is 15 m by 12 m in size. Each tile is $v$ cm by $v$ cm.
   a. What is the area of the veranda in metres?
      \[12\text{ m} \times 15\text{ m} = 180\text{ sq.m}\]
   b. What is the area of the veranda in centimetres?
      \[1200\text{ cm} \times 1500\text{ cm} = 1800000\text{ sq.cm}\]
   c. What is the area of each tile?
      \[v \times v\text{ sq.cm}\]
   d. How many tiles will the man need to tile the veranda?
      \[\frac{1800000}{v^2}\text{ tiles}\]

8. A boy is 1.3 m tall. His brother is $x$ cm taller and his sister is $y$ cm shorter than he is.
   a. How tall is the brother?
      \[130 + x\text{ cm}\]
   b. How tall is the sister?
      \[130 - y\text{ cm}\]
   c. What is the difference in height between the brother and sister of the boy?
      \[(130 + x) - (130 - y)\]
   d. If the boy grows 1 cm, what will the differences be then?
      His brother will be $131 + x$ cm tall. His sister will be $131 - y$ cm tall.
      So, the difference is $(131 + x) - (131 - y)$
Study these plane shapes. Then complete the table.

1. a) square  b) triangle  c) circle  d) pentagon  e) hexagon  f) octagon
<table>
<thead>
<tr>
<th>Name of shape</th>
<th>Number of sides</th>
<th>Number of angles</th>
<th>Length of sides</th>
<th>Size of angles</th>
</tr>
</thead>
<tbody>
<tr>
<td>a rectangle</td>
<td>4</td>
<td>4</td>
<td>54 mm 31 mm</td>
<td>90°</td>
</tr>
<tr>
<td>b equilateral triangle</td>
<td>3</td>
<td>3</td>
<td>41 mm</td>
<td>60°</td>
</tr>
<tr>
<td>c pentagon</td>
<td>5</td>
<td>5</td>
<td>22 mm</td>
<td>108°</td>
</tr>
<tr>
<td>d isosceles triangle</td>
<td>3</td>
<td>3</td>
<td>44 mm 22 mm</td>
<td>67°, 46°</td>
</tr>
<tr>
<td>e parallelogram</td>
<td>4</td>
<td>4</td>
<td>52 mm 27 mm</td>
<td>103°, 77°</td>
</tr>
<tr>
<td>f square</td>
<td>4</td>
<td>4</td>
<td>36 mm</td>
<td>90°</td>
</tr>
</tbody>
</table>

2. Use the plane shapes in question 1 to complete this table.

<table>
<thead>
<tr>
<th>Name of shape</th>
<th>Sum of angles</th>
<th>Relationship of sides e.g. opposite sides are equal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a rectangle</td>
<td>360°</td>
<td>opposite sides are equal</td>
</tr>
<tr>
<td>b equilateral triangle</td>
<td>180°</td>
<td>all sides are equal</td>
</tr>
<tr>
<td>c pentagon</td>
<td>540°</td>
<td>all sides are equal</td>
</tr>
<tr>
<td>d isosceles triangle</td>
<td>180°</td>
<td>two sides are equal</td>
</tr>
<tr>
<td>e parallelogram</td>
<td>360°</td>
<td>opposite sides are equal</td>
</tr>
<tr>
<td>f square</td>
<td>360°</td>
<td>all sides are equal</td>
</tr>
</tbody>
</table>

3. What do you notice about the following?
   a. The sum of 3 angles of any triangle.
      equals 180°

   b. The sum of 4 angles of any rectangle.
      equals 360°

   c. The sum of 5 angles of any pentagon.
      equals 540°

4. a. What do you call a closed shape with 3 or more straight sides?
   polygon

   b. What do you call a closed shape with 6 straight and equal sides?
   hexagon

   c. What do you call a closed shape with 8 straight and equal sides?
   octagon
5. a. Draw a square 6 cm by 6 cm.
   
b. Label the square ABCD.
   
c. Join AC and BD. Mark the point where AC and BD intersect E.
   
d. Draw a circle with E as the centre and EA as the length of the radius.
   
e. Draw the diameter FG of the circle through E.
   
f. Draw a radius EH of the circle.
   
g. Label the circumference, the diameter, the radius, a semi-circle and a sector of the circle.

5. a. Draw a square ABCD with sides 4 cm long.
   
b. Draw diagonals AC and BD on the square.
   
c. Draw an equilateral triangle EFG with sides 4 cm long.
   
d. Draw three lines of symmetry on the triangle.
Directed numbers: Addition and subtraction

**Worked example**

- **a** Use a number line to complete $1 + 4 = \underline{\hspace{1cm}}$.
- **b** Use a number line to complete $6 - 2 = \underline{\hspace{1cm}}$.

**a** This number line shows the addition.

Follow the arrows. Start at 1. Move four places to the right. Finish at 5.
$1 + 4 = 5$

**b** This number line shows the subtraction.

Follow the arrows. Start at 6. Move two places to the left. Finish at 4.
$6 - 2 = 4$

1. **a** Fill in the missing numbers on the number line.

![Number Line](image)

-6 -5 -4 -3 -2 -1 0 +1 2 3 4 5 6

**b** Use arrows on the number line to calculate the following.

i) $1 + 3 - 7 = \underline{\hspace{1cm}}$

ii) $-2 + 2 - 5 = \underline{\hspace{1cm}}$

2. Use the number line to calculate the answer.

![Number Line](image)

-20 cm -15 cm -10 cm -5 cm 0 cm 5 cm 10 cm 15 cm 20 cm

A boy and his sister are playing on the beach. He digs a hole 15 cm deep (negative number). She builds a castle 20 cm high. What is the measurement from the bottom of the hole to the top of the castle?

35 cm

3. Draw a number line to help you calculate.

A kite is flying 5 m above the surface of the sea. A child is snorkling 3 m below the surface. How far is the child from the kite?

$3 + 5 = 8$

8 m
4. Draw number lines to help you calculate.
   a. A treasure chest is buried 4 m below the ground (negative number). A pole 7 m high is planted to mark the spot (positive number). What is the distance from the treasure chest to the top of the pole?

   ![Number line for question 4a]

   \[ 4 + 7 = 11 \]

   11 m

   b. The lowest temperature recorded in the Antarctic is \(-89^\circ C\) and the highest is \(14.6^\circ C\). What is the difference between these temperatures?

   ![Number line for question 4b]

   \[ 89 + 14.6 = 103.6 \]

   103.6 \(^\circ C\)

   c. In Ajuba, January is the driest month with an average of 9 mm of rain recorded. June is the wettest month with 173 mm of rain recorded. What is the difference between highest and lowest recorded rainfall?

   ![Number line for question 4c]

   \[ 173 - 9 = 164 \]

   164 mm

5. The school bell rings 5 minutes early, and your watch is 7 minutes slow. Your teacher tells you the correct time is 8:15. What time will your watch show and what time will the school clock show?

   School clock: 8:15 + 5 min = 8:20
   Watch: 8:15 – 7 min = 8:08

6. Place the correct sign ( =, > or <) between the numbers to make the sentence true.
   a. \(7 \quad \underline{\quad} \quad 3\)
   b. \(-7 \quad \underline{\quad} \quad 3\)
   c. \(7 \quad \underline{\quad} \quad -3\)
   d. \(-7 \quad \underline{\quad} \quad -3\)
   e. \(23 \quad \underline{\quad} \quad -4\)
   f. \(-23 \quad \underline{\quad} \quad -4\)

7. Calculate without using a number line.
   a. \(7 + 5 = \underline{12}\)
   b. \(-7 + 5 = \underline{-2}\)
   c. \(27 - 50 = \underline{-23}\)
   d. \(-13 - 5 = \underline{-18}\)
   e. \(243 - 342 = \underline{-99}\)
   f. \(-77 + 42 = \underline{-35}\)

8. Simplify.
   a. \(34 + (-45) = \underline{-11}\)
   b. \((-2) + (-5) = \underline{-7}\)
   c. \((+7) - (-9) = \underline{16}\)
Worked example

Calculate the perimeter of a football field that measures 80 m by 50 m.

Perimeter of field = \(2(l + b)\)
\[= 2 \times (80 + 50) \text{ m}\]
\[= 2 \times 130 \text{ m}\]
\[= 260 \text{ m}\]

① Use a ruler to measure the sides of the irregular shape PQRS. Fill in the measurements in the table.

<table>
<thead>
<tr>
<th>Sides</th>
<th>Length in mm</th>
<th>Length in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>PQ</td>
<td>22 mm</td>
<td>2.2 cm</td>
</tr>
<tr>
<td>QR</td>
<td>45 mm</td>
<td>4.5 cm</td>
</tr>
<tr>
<td>RS</td>
<td>35 mm</td>
<td>3.5 cm</td>
</tr>
<tr>
<td>SP</td>
<td>59 mm</td>
<td>5.9 cm</td>
</tr>
<tr>
<td>Add sides to find perimeter</td>
<td>161 mm</td>
<td>16.1 cm</td>
</tr>
</tbody>
</table>

② Use a ruler measure the perimeter of the following.

a  The cover of your text book in mm.
   Example: perimeter = \(2(l + b)\) = \(2(250 + 200) \text{ mm}\) = \(2(450) \text{ mm}\) = \(900 \text{ mm}\)

b  The top of your desk in cm.
   Example: perimeter = \(2(l + b)\) = \(2(60 + 50) \text{ cm}\) = \(2(110) \text{ cm}\) = \(220 \text{ cm}\)

c  The door of your classroom in metres.
   Example: perimeter = \(2(l + b)\) = \(2(2 + 1) \text{ m}\) = \(2(3) \text{ m}\) = \(6 \text{ m}\)

We don’t need to measure all the sides to find the perimeter of a regular shape such as a square. For example, if a square has sides of 10 m, perimeter = \(4 \times 10 \text{ m}\) = \(40 \text{ m}\).
3) Find the perimeters of these regular shapes. Then complete the table.

a) Square ABCD

b) Parallelogram EFGH

c) Hexagon MNOPQR

d) Isosceles triangle EFG

e) Shape | Sides | Calculate | Perimeter in mm | Perimeter in cm
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>square</td>
<td>4</td>
<td>$4s$</td>
<td>124 mm</td>
<td>12.4 cm</td>
</tr>
<tr>
<td>parallelogram</td>
<td>4</td>
<td>$2(l + b)$</td>
<td>144 mm</td>
<td>14.4 cm</td>
</tr>
<tr>
<td>hexagon</td>
<td>6</td>
<td>$6s$</td>
<td>102 mm</td>
<td>10.2 cm</td>
</tr>
<tr>
<td>isosceles triangle</td>
<td>3</td>
<td>$s + s + s$</td>
<td>101 mm</td>
<td>10.1 cm</td>
</tr>
</tbody>
</table>

4) Use string or wool to measure the perimeter (circumference) of the circle in cm.

Perimeter = \[ \frac{99 \text{ mm}}{2} \]

To calculate the perimeter of a regular quadrilateral, we use the formula: \[ P = 2(l + b). \]
5. a Calculate the perimeter of your classroom in metres.
   Example: perimeter = 2(l + b) = 2(12 + 12) m = 2(24) m = 48 m

   b Calculate the perimeter of a soccer field.
   Example: perimeter = 2(l + b) = 2(100 + 80) m = 2(180) m = 360 m

6. a A rectangular carpet has a perimeter of 240 cm and a breadth of 50 cm. What is its length?
   \[ 240 - 50 \times 2 \times 2 \times 50 = \frac{140}{2} = 70 \text{ cm} \]

   b A square blanket has a perimeter of 6 m. What does each side measure?
   \[ \frac{6 \text{ m}}{4} = 1.5 \text{ m} \]

   c A vegetable garden is 90 cm wide and 1.2 m long. What is the perimeter in cm and in m?
   \[ P = 2(90 + 120) \text{ cm} = 2(210) \text{ cm} = 420 \text{ cm} \text{ or } 4.2 \text{ m} \]

7. Find the perimeter (circumference) of these circles using the formula: \( 2\pi r \), where \( \pi = \frac{22}{7} \).
   Complete the table.

<table>
<thead>
<tr>
<th>Radius</th>
<th>Diameter</th>
<th>Circumference</th>
</tr>
</thead>
<tbody>
<tr>
<td>a 7 cm</td>
<td>14 cm</td>
<td>44 cm</td>
</tr>
<tr>
<td>b 7 cm</td>
<td>14 cm</td>
<td>44 cm</td>
</tr>
<tr>
<td>c 21 cm</td>
<td>42 cm</td>
<td>132 cm</td>
</tr>
<tr>
<td>d 14 cm</td>
<td>28 cm</td>
<td>88 cm</td>
</tr>
<tr>
<td>e 35 cm</td>
<td>70 cm</td>
<td>220 cm</td>
</tr>
</tbody>
</table>
### Worked example

**a** Calculate the area of a rectangle 6 cm by 3.5 cm.

**b** The area of a rectangle is 224 cm². If its length is 16 cm, calculate the breadth.

<table>
<thead>
<tr>
<th></th>
<th>Area of rectangle = $6 \text{ cm} \times 3.5 \text{ cm} = 21 \text{ cm}^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Breadth $= \frac{224 \text{ cm}^2}{16 \text{ cm}} = 14 \text{ cm}$</td>
</tr>
</tbody>
</table>

1. Use a sheet of squared paper.

   **a** Draw the following shapes on the paper:
   
   i) A square 6 blocks by 6 blocks; call it A.
   
   ii) A rectangle 2 blocks by 5 blocks; call it B.
   
   iii) A right-angled triangle with base 3 blocks and perpendicular 4 blocks; call it C.

   iv) A square 4 blocks by 4 blocks; draw a diagonal line across this square. Call it D.

   v) A circle with radius of 3.5 blocks; Call it E.

   **b** Suppose each block represents 1 cm, so 1 block = 1 cm². Add the blocks together to find how many there are in each shape. Write the answers in the table.

<table>
<thead>
<tr>
<th>Shapes</th>
<th>Length or base in cm</th>
<th>Breadth or height in cm</th>
<th>Estimated area in cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6 cm</td>
<td>6 cm</td>
<td>36 cm²</td>
</tr>
<tr>
<td>B</td>
<td>5 cm</td>
<td>2 cm</td>
<td>10 cm²</td>
</tr>
<tr>
<td>C</td>
<td>3 cm</td>
<td>4 cm</td>
<td>about cm²</td>
</tr>
<tr>
<td>D</td>
<td>4 cm</td>
<td>4 cm</td>
<td>16 cm²</td>
</tr>
<tr>
<td>1/2 of D</td>
<td>4 cm</td>
<td>4 cm</td>
<td>about 8 cm²</td>
</tr>
<tr>
<td>E</td>
<td>Radius 3.5 cm</td>
<td>Radius 3.5 cm</td>
<td>about 38 cm²</td>
</tr>
</tbody>
</table>

2. Calculate the area of each shape in question 1 using the correct formula:

   Area of regular rectangle $= l \times b$

   Area of a right-angled triangle $= \frac{1}{2} \text{ base} \times \text{ height}$

   Area of a circle $= \pi r^2$ where $\pi = \frac{22}{7}$
Use your calculations to complete the table.

<table>
<thead>
<tr>
<th>Shapes</th>
<th>Length or base in cm</th>
<th>Breadth or height in cm</th>
<th>Formula</th>
<th>Calculated area in cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6 cm</td>
<td>6 cm</td>
<td>$l \times b$</td>
<td>36 cm²</td>
</tr>
<tr>
<td>B</td>
<td>5 cm</td>
<td>2 cm</td>
<td>$l \times b$</td>
<td>10 cm²</td>
</tr>
<tr>
<td>C</td>
<td>3 cm</td>
<td>4 cm</td>
<td>$\frac{1}{2}bh$</td>
<td>6 cm²</td>
</tr>
<tr>
<td>D</td>
<td>4 cm</td>
<td>4 cm</td>
<td>$l \times b$</td>
<td>16 cm²</td>
</tr>
<tr>
<td>$\frac{1}{2}$ of D</td>
<td>4 cm</td>
<td>4 cm</td>
<td>$\frac{1}{2}bh$</td>
<td>8 cm²</td>
</tr>
<tr>
<td>E</td>
<td>Radius 3.5 cm</td>
<td>Radius 3.5 cm</td>
<td>$\pi r^2$</td>
<td>38.5 cm²</td>
</tr>
</tbody>
</table>

3. If $l \times b = \text{area}$, work out the following formulae:
   a. breadth = \( \frac{\text{area}}{\text{length}} \)
   b. length = \( \frac{\text{area}}{\text{breadth}} \)

4. Use the formulae you calculated in question 3 to find the following.
   a. A square has an area of 16 m². Find the length and the breadth of the square. Draw a sketch to help you calculate the answer.

   If $l \times b = 16$ m² and the shape is square, then $l = b$ so,
   $l = \sqrt{16} = 4$ m and $b = \sqrt{16} = 4$ m

   b. A rectangle has an area of 15 m². Find the length and the breadth of the rectangle. Draw a sketch to help you calculate the answer.

   If $l \times b = 15$ m² and the shape is a rectangle, then $l \neq b$ so, $5 \times 3 = 15$ m².
   Length = 5 m and breadth = 3 m

5. If the radius of a circle = 21 m, find the following.
   a. diameter of the circle = Diameter of a circle = $2 \times \text{radius} = 2 \times 21$ m = 42 m
   b. area of the circle = \( Area = \pi r^2 = \frac{22}{7} \times (21 \times 21) = 1386 \text{ m}^2 \)
6 Complete the table.

<table>
<thead>
<tr>
<th>Radius</th>
<th>Diameter</th>
<th>Formula and circumference</th>
<th>Formula and area</th>
</tr>
</thead>
<tbody>
<tr>
<td>a 70 mm</td>
<td>140 mm</td>
<td>$2\pi r = 440$ mm</td>
<td>$\pi r^2 = 15 400$ mm$^2$</td>
</tr>
<tr>
<td>b 35 mm</td>
<td>70 mm</td>
<td>$2\pi r = 220$ mm</td>
<td>$\pi r^2 = 3 850$ mm$^2$</td>
</tr>
<tr>
<td>c 14 cm</td>
<td>28 cm</td>
<td>$2\pi r = 88$ cm</td>
<td>$\pi r^2 = 616$ cm$^2$</td>
</tr>
<tr>
<td>d 70 mm</td>
<td>140 mm</td>
<td>$2\pi r = 440$ mm</td>
<td>$\pi r^2 = 15 400$ mm$^2$</td>
</tr>
<tr>
<td>e 21 m</td>
<td>42 m</td>
<td>$2\pi r = 132$ m</td>
<td>$\pi r^2 = 1 386$ m$^2$</td>
</tr>
<tr>
<td>f 21 mm</td>
<td>42 mm</td>
<td>$2\pi r = 132$ mm</td>
<td>$\pi r^2 = 1 386$ mm$^2$</td>
</tr>
<tr>
<td>g 2.8 m</td>
<td>5.6 m</td>
<td>$2\pi r = 17.6$ m</td>
<td>$\pi r^2 = 24.64$ m$^2$</td>
</tr>
<tr>
<td>h 2.45 m</td>
<td>4.9 m</td>
<td>$2\pi r = 15.4$ m</td>
<td>$\pi r^2 = 18.865$ m$^2$</td>
</tr>
</tbody>
</table>

7 Copy these shapes into your exercise book, using the exact measurements given.

a

b

c Complete the table based on your drawings.

<table>
<thead>
<tr>
<th>Diagram a Measurements of sides and radii</th>
<th>Diagram b Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangle ABCD</td>
<td>Triangle FGH</td>
</tr>
<tr>
<td>Side AB 3.5 cm</td>
<td>Side FG 80 mm</td>
</tr>
<tr>
<td>Side BC 5 cm</td>
<td>Side GH 40 mm</td>
</tr>
<tr>
<td>Side CD 3.5 cm</td>
<td>Side FH 90 mm</td>
</tr>
<tr>
<td>Side AD 5 cm</td>
<td>Lines KH and JH</td>
</tr>
<tr>
<td>Area 17.5 cm$^2$</td>
<td>KH = 4.5 mm</td>
</tr>
<tr>
<td></td>
<td>JH = 10 mm</td>
</tr>
<tr>
<td></td>
<td>Area 1 600 mm$^2$</td>
</tr>
<tr>
<td></td>
<td>Triangle EAD</td>
</tr>
<tr>
<td>Side AD 5 cm</td>
<td>Diameter 70 mm</td>
</tr>
<tr>
<td>Side ED 6 cm</td>
<td>Radius 35 mm</td>
</tr>
<tr>
<td>Side EA 3.5 cm</td>
<td>Area 3 850 mm$^2 + 2 = 1 925$ mm$^2$</td>
</tr>
<tr>
<td>Area 8.75 cm$^2$</td>
<td>Hemisphere from I to J</td>
</tr>
<tr>
<td></td>
<td>Hemisphere C to D</td>
</tr>
<tr>
<td>Diameter 3.5 cm</td>
<td></td>
</tr>
<tr>
<td>Radius 1.75 cm</td>
<td></td>
</tr>
<tr>
<td>Area 4.8125 cm$^2$</td>
<td></td>
</tr>
<tr>
<td><strong>Total area of diagram</strong> 31.0625 cm$^2**</td>
<td><strong>Total area of diagram</strong> 1 600 mm$^2**</td>
</tr>
</tbody>
</table>
### Worked example

<table>
<thead>
<tr>
<th>Simplify</th>
<th>Working</th>
<th>Result</th>
<th>We know the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2x \times 3$</td>
<td>$2 \times x \times 3 = 2 \times 3 \times x$</td>
<td>$= 6x$</td>
<td>$5 \times y = 5y$  ( z + z + z = 3z )</td>
</tr>
<tr>
<td>$5 \times 2y$</td>
<td>$5 \times 2 \times y = 10 \times y$</td>
<td>$= 10y$</td>
<td>$a - a = 0$  ( 6a + 2 = 3a )</td>
</tr>
<tr>
<td>$7a \times 3b$</td>
<td>$7 \times a \times 3 \times b$</td>
<td>$= 21ab$</td>
<td>$9ab + b$ can be simplified as $\frac{9ab}{b}$ and solved.</td>
</tr>
<tr>
<td>$6x \times 4x$</td>
<td>$6 \times x \times 4 \times x$</td>
<td>$= 24x^2$</td>
<td>We can write $2 \times a$ as $2a$ or $2(a)$.</td>
</tr>
</tbody>
</table>

1. Simplify.
   a) $7 \times 9 = \underline{63}$
   b) $7 \times a = \underline{7a}$
   c) $12a \times 4a = \underline{48a^2}$
   d) $5ab \times 2a = \underline{10a^2b}$
   e) $8b \div 2 = \underline{4b}$
   f) $21b \div 3 = \underline{7b}$
   g) $b^2 + b = \underline{b}$
   h) $9ab + b = \underline{9a}$

2. Simplify by writing these as fractions. Then solve.
   a) $\frac{24ab + 8a}{3b} = \underline{8a}$
   b) $\frac{ab^2 + b}{ab} = \underline{b + 1}$
   c) $\frac{75a^2b^3 + 25ab}{3ab^2} = \underline{25ab}$
   d) $\frac{18ab^3 + 2ab}{9b^2} = \underline{2b}$

3. Group the like terms. Use BODMAS to simplify and solve.
   a) $7a + 6b - 4 - 2a - 2b + 8 = \underline{5a + 4b + 4}$
   b) $5ab + 2b - 2ab + b + 15 = \underline{3ab + 3b + 15}$
   c) $7ab - 1 + 3ab + 2 - 8ab = \underline{2ab + 1}$
   d) $9(a + b) - 3(a + b) = \underline{6a + 6b}$
4. Simplify.
   a. $7(a + 4) = 7a + 28$
   b. $5a(2a + 3a) = 10a^2 + 15a^2 = 25a^2$
   c. $9a^3(a) - 8a^2(a) = 9a^3 - 8a^3 = a^3$

5. Write these without brackets.
   a. $4a(2a + 2b + 3) = 8a^2 + 8ab + 12a$
   b. $a(4a - 3b - 6) = 4a^2 - 3ab - 6a$
   c. $3a(3a + 3a) = 9a^2 + 9a^2$
   We can write $2a + 4$ as $2(a + 2)$.

6. Write these expressions as a product of two algebraic expressions. Insert the brackets.
   a. $6a + 3 = 3(2a + 1)$
   b. $15ab + 5a + a = a(15b + 5 + 1)$
   c. $24b^3 + 6b^2 - 3b = 3b(8b^2 + 2b - 1)$

7. Write these without brackets. Then simplify.
   a. $5a - (a + 5) = 5a - a - 5 = 4a - 5$
   b. $5a + 5a(a - 5) = 5a + 5a^2 - 25a$
   c. $(12a + 3b) + (2a + 2b) = 14a + 5b$
   d. $(15a - 3b) - (2a - 2b) = 13a - b$

8. Complete the table.

<table>
<thead>
<tr>
<th>Expression</th>
<th>Write without brackets</th>
<th>Simplify</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $15a - 3(a + 5)$</td>
<td>$15a - 3a + 15$</td>
<td>$12a - 15$</td>
</tr>
<tr>
<td>b. $36a + 4(a + 5)$</td>
<td>$36a + 4a + 20$</td>
<td>$40a + 20$</td>
</tr>
<tr>
<td>c. $5a(6a + 3a + 1)$</td>
<td>$30a^2 + 15a^2 + 5a$</td>
<td>$45a^2 + 5a$</td>
</tr>
<tr>
<td>d. $3a(4a + 5b + 2)$</td>
<td>$12a^2 + 15ab + 6a$</td>
<td>$12a^2 + 15ab + 6a$</td>
</tr>
<tr>
<td>e. $9a - 4(a - 5a)$</td>
<td>$9a - 4a + 20a$</td>
<td>$25a$</td>
</tr>
</tbody>
</table>

9. Write these as the product of two algebraic expressions.
   a. $ab + ac = a(b + c)$
   b. $ab - ac = a(b - c)$
   c. $ab^2 + cb^2 = b^2(a + c)$
   d. $ab^2 - cb^2 = b^2(a - c)$
Follow these instructions to calculate the volume of a cuboid (rectangular prism).

a. Calculate the area of the base 5 cm long × 3 cm broad.

\[
\text{Area} = l \times b = \text{cm}^2
\]

b. The height is 2 cm. Calculate the volume.

\[
\text{Volume} = \text{area} \times h, \text{ which is } l \times b \times h = \text{cm}^3
\]

Calculate the volume of this cube.

\[
\text{Volume} = l \times b \times h = 3 \times 3 \times 3 = 27 \text{ cm}^3
\]

Calculate the volume of a cube measuring 4 m × 4 m × 4 m.

\[
\text{Volume} = l \times b \times h = 4 \times 4 \times 4 = 64 \text{ cm}^3
\]

b. Calculate the volume of half of the cube in question 3a if you cut it into two equal right-angled prisms as in the diagram. Use the formula \( \frac{1}{2} (l \times b \times h) \) or \( \frac{1}{2} lbh \).

\[
\frac{1}{2} lbh = \frac{1}{2} \text{ of } 64 \text{ cm}^3 = 32 \text{ cm}^3
\]
4 A building brick has a volume of 1 280 cm³. The length of the brick is 20 cm and the breadth is 8 cm. What is the height of the brick?

If \( l \times b \times h = \text{volume} \) then \( h = \text{volume} \div (l \times b) \)

so \( h = 1 280 \text{ cm}^3 \div (20 \text{ cm} \times 8 \text{ cm}) \)

\[ = 1 280 \text{ cm}^3 \div 160 \text{ cm}^2 = 8 \text{ cm} \]

Remember that 1 ℓ = 1 000 cm³ and 1 kl = 1 m³ or 1 000 000 cm³.

5 Complete the table.

<table>
<thead>
<tr>
<th>Length of side of a cube</th>
<th>Formula for finding volume</th>
<th>Volume</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>a 10 cm</td>
<td>( l \times b \times h )</td>
<td>1 000 cm³</td>
<td>1 ℓ</td>
</tr>
<tr>
<td>b 1 m</td>
<td>( l \times b \times h )</td>
<td>1 m³</td>
<td>1 kl</td>
</tr>
<tr>
<td>c 100 cm</td>
<td>( l \times b \times h )</td>
<td>1 000 000 cm³</td>
<td>1 kl</td>
</tr>
</tbody>
</table>

6 A boy has three containers of juice. Each container is 10 cm × 10 cm × 10 cm.
   a What is the volume of each container?

   Each container has a volume of 1 000 cm³

   b What is the capacity of each container?

   Each container has a capacity of 1 ℓ

   c How many litres of juice does the boy have?

   He has 3 litres

7 A room is 4 m long, 3 m high and 5 m wide. What is its volume?

60 cm³

8 A rectangular container has a volume of 720 m³. If the length of the container is 10 m and the height is 9 m, what is its breadth?

8 m
A builder builds a brick wall 3 m high, 5 m long and 10 cm wide. (Remember: 100 cm = 1 m and 1 cm = 0.01 m.) He uses bricks 10 cm wide, 5 cm high and 20 cm long.

a What is the volume of the wall? Express the volume in cm³ and m³.

Volume of wall = 0.15 m³ or 1 500 000 cm³

b What is the volume of each brick? Express the volume in cm³ and m³.

Volume of brick = 0.001 m³ or 1 000 cm³
c How many bricks will he need to build the wall?

He will need 1 500 bricks

A swimming pool is 7 m long, 5 m wide and 2.5 m deep.

a What is the volume of the pool?

87.5 m³

b If the pool is filled with water 2 m deep, what is the volume of the water?

70 m³
c What is the difference in the volume of the water and the volume of the pool?

87.5 m³ – 70 m³ = 15 m³

Complete the table.

<table>
<thead>
<tr>
<th>Volume</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ml = 1 cm³</td>
<td>1 ml = 0.001 litres</td>
</tr>
<tr>
<td>1 ℓ = 1 000 cm³</td>
<td>1 ℓ</td>
</tr>
<tr>
<td>1 kl = 1 000 000 cm³ = 1 m³</td>
<td>1 kl = 1 000 ℓ</td>
</tr>
</tbody>
</table>

Convert from volume to capacity.

a 7 kl = \( \frac{7,000,000}{1} \) cm³
b 7 kl = \( \frac{7,000}{1} \) ℓ
c 19 ml = \( \frac{19}{1} \) cm³
d 999 ml = \( \frac{999}{1} \) ℓ
e 15 ℓ = \( \frac{15,000}{1} \) cm³
The table below shows the leading causes of death by age group in a country in East Africa.

<table>
<thead>
<tr>
<th>cause of death</th>
<th>0–4</th>
<th>5–14</th>
<th>15–59</th>
<th>60+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria/Fever</td>
<td>40%</td>
<td>61%</td>
<td>16%</td>
<td>26%</td>
</tr>
<tr>
<td>HIV &amp; AIDS/TB</td>
<td>4%</td>
<td>13%</td>
<td>56%</td>
<td>17%</td>
</tr>
<tr>
<td>Heart disease</td>
<td>n/s</td>
<td>n/s</td>
<td>6%</td>
<td>23%</td>
</tr>
<tr>
<td>Injury/Accident</td>
<td>32%*</td>
<td>17%</td>
<td>5%</td>
<td>n/s</td>
</tr>
</tbody>
</table>

n/s means not significant
*Most of these deaths are linked to childbirth.

Data like this might tell a Health Minister that more needs to be done about malaria for young people aged 0 to 14 years and that HIV & AIDS and TB need to be reduced in the 15–59 age range.

① The table shows data related to several Premier League Football Clubs in Nigeria. Collect information from newspaper, radio, television or friends to fill in data about at least three more football clubs. (You may use your school clubs or village clubs.)

<table>
<thead>
<tr>
<th>Club</th>
<th>Town or City</th>
<th>Home colours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abia Warriors Football Club</td>
<td>Umuahia</td>
<td>Red</td>
</tr>
<tr>
<td>Akwa United</td>
<td>Uyo</td>
<td>Blue</td>
</tr>
<tr>
<td>Bayelsa United</td>
<td>Yenegoa</td>
<td>Yellow</td>
</tr>
<tr>
<td>Kano Pillars Football Club</td>
<td>Kano</td>
<td>Green and yellow</td>
</tr>
</tbody>
</table>

② The table shows statistical data. Study the table carefully then answer the questions.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Gender</th>
<th>Enrolment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-primary</td>
<td>Boys</td>
<td>14.8%</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>13.8%</td>
</tr>
<tr>
<td>Primary</td>
<td>Boys</td>
<td>87.1%</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>79.3%</td>
</tr>
<tr>
<td>Literacy rate: Young people aged 15 to 24 years</td>
<td>Boys</td>
<td>75.6%</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>58%</td>
</tr>
</tbody>
</table>

a  What is the total percentage of boys and girls enrolled at pre-primary school?

28.6%

b  What is the total percentage of boys and girls enrolled at primary school?

Ave 82.3%
c What total percentage of Nigerian youth were literate (could read) in 2012?
133.6%

d What was the difference between the number of girls and boys who enrolled at pre-primary school?
14.8% – 13.8% = 1%

e What was the difference between the number of girls and boys who enrolled at primary school?
87.1% – 79.3% = 7.8%

f What was the difference between the number of girls and boys who were literate?
75.6% – 58% = 17.6%

3 Interview at least five pupils in your class. Use the data collected to complete the table.

<table>
<thead>
<tr>
<th>Place that interviews take place: Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Names</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>STUDENTS’ OWN ANSWERS</td>
</tr>
</tbody>
</table>

4 Many people believe that the number 7 is lucky and the number 13 is unlucky. Design a questionnaire based on these beliefs in your exercise book.

a Consider which questions you will include in your questionnaire. Make notes of some possible questions.

b Plan how many people you will interview.

c Plan who you are going to question. Make a list of people you might interview.

d How will you be sure the people you interview won’t influence one another? Note people who live close together.

e What if someone you interview answers, ‘I don’t know.’? Prepare an alternative question, for example: ‘Do you believe any numbers are lucky/unlucky?’

3 In your exercise book, draw up a questionnaire based on what you have worked on. Your questionnaire should allow for the following:

a Names of the people you interview.

b Their responses, negative or positive. Mark these with tallies.

c Allow a column to show the frequency (ƒ), which shows the total number of tallies recorded.

The plan should look a bit like this:

<table>
<thead>
<tr>
<th>Response</th>
<th>Tally</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Complete the graph by filling in the bars (columns) and the information you have gained.

STUDENTS DRAW A GRAPH BASED ON THE INFORMATION THEY COLLECTED
a A teacher gave his class marks out of ten for a test. Arrange them in rank order.

\[5, 7, 3, 5, 6, 9, 5, 7, 3, 4, 8, 5, 2, 8, 6, 6, 5, 8, 4, 5, 7, 3\]

\[2, 3, 3, 3, 4, 4, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 7, 7, 7, 8, 8, 8, 9\]

b Complete the table, using the marks.

<table>
<thead>
<tr>
<th>Marks out of ten</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>Number of pupils</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

c What was the lowest mark? 2 out of 10

d What was the highest mark? 9 out of 10

e What was the most common mark? 5 out of 10

f How many students got the highest mark? 1

g How many students got the lowest mark? 1

h What is the frequency \(f\) (number of times) of 4? 2

2 Study the pictograph. Then answer the questions.

<table>
<thead>
<tr>
<th>Number of pets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaliyah</td>
</tr>
<tr>
<td>Abasi</td>
</tr>
<tr>
<td>Abachu</td>
</tr>
</tbody>
</table>
a  How many pets does Aaliyah have? 3

b  How many pets does Abasi have? 4

c  How many pets does Abachu have? 1

d  How many pets do they have altogether? 8

e  Write one other question you can ask using the pictograph.
   Example: Who has the most pets?
   How many more is this than the one who has the least pets? etc.

f  Complete the diagram below to show the information on the pictogram.

<table>
<thead>
<tr>
<th>Aaliyah</th>
<th>Abasi</th>
<th>Abachu</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
</tbody>
</table>


g  Draw a bar graph based on the same information.
h  Draw a pie chart to show the same information. Use a pair of compasses to draw the circle.

i  Study the tally chart of sports meetings played and won by a local school’s teams during one term. Then answer the questions.

<table>
<thead>
<tr>
<th>Sports</th>
<th>Soccer</th>
<th>Hockey</th>
<th>Cricket</th>
<th>Netball</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>/////</td>
<td>///</td>
<td>//</td>
<td>/////</td>
</tr>
<tr>
<td>Number</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

a  Complete the table by writing in the number of tallies.

b  Which sports team played the most matches? Soccer and netball

c  Which sports team played the fewest matches? Cricket

d  How many matches were played altogether? 13
Interview 15 people. Ask which of the following Nigerian dishes they prefer. (You can substitute other dishes for these.)

<table>
<thead>
<tr>
<th>People asked</th>
<th>Jollof rice</th>
<th>Dodo or fried</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Fill in the results on the frequency table.

<table>
<thead>
<tr>
<th>Dishes</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jollof rice</td>
<td>STUDENTS' OWN ANSWERS</td>
</tr>
<tr>
<td>Dodo or fried plantain</td>
<td>STUDENTS COMPLETE TABLE BASED ON THEIR INFORMATION COLLECTED.</td>
</tr>
</tbody>
</table>

b. Draw a pictogram, a bar graph and a pie chart to show your results.
Choose a term from the box to complete these sentences.

unknown algebraic sentence equation equal sign open sentence

a. A letter or empty box in a number sentence (for example: 5 + [ ] = 7 or 5 + a = 7) is called a(n) variable.

b. The expression 5 + [ ] = 7 is called a(n) equation or formula.

c. A sentence that may be true or false is called a(n) algebraic expression.

d. In order for an algebraic sentence to be an equation, it must have a(n) variable or unknown value.

Complete the table by writing true or false.

<table>
<thead>
<tr>
<th>Open sentences</th>
<th>Value of unknown</th>
<th>True or False</th>
</tr>
</thead>
<tbody>
<tr>
<td>a + 15 = 19 if a = 4</td>
<td>true</td>
<td></td>
</tr>
<tr>
<td>b − 7 = 26 if b = 36</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>12c = 36 if c = 3</td>
<td>true</td>
<td></td>
</tr>
<tr>
<td>4d + 4 = 24 if d = 4</td>
<td>true</td>
<td></td>
</tr>
<tr>
<td>9e − 7 = 54 if e = 7</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>( \frac{25}{f} = 5 ) if ( f = 5 )</td>
<td>true</td>
<td></td>
</tr>
<tr>
<td>4 = ( \frac{24}{g} ) if ( g = 4 )</td>
<td>false</td>
<td></td>
</tr>
</tbody>
</table>
3) Solve these equations.
   a  \( x + 15 = 17 \)
      \( x = 2 \)
   b  \( y - 12 = 23 \)
      \( y = 35 \)
   c  \( 34 + z = 42 \)
      \( z = 8 \)
   d  \( 31 - a = 19 \)
      \( a = 12 \)
   e  \( \frac{b}{8} = 9 \)
      \( b = 72 \)
   f  \( 27 = 9 \)
      \( c = 3 \)
   g  \( 11d = 121 \)
      \( d = 11 \)
   h  \( 35 = 7e \)
      \( e = 5 \)

Remember the balance method of solving equations. What you do to the LHS you must do to the RHS.
Check your answers. For example: LHS  RHS  Check: 4 + 5 = 9

<table>
<thead>
<tr>
<th></th>
<th>LHS</th>
<th>RHS</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>( x + 9 = 27 )</td>
<td>( 2x + 9 - 9 = 27 - 9 )</td>
<td>( x = 9 )</td>
</tr>
<tr>
<td>b</td>
<td>( 5y - 15 = 10 )</td>
<td>( 5y - 15 + 15 = 10 + 15 )</td>
<td>( y = 5 )</td>
</tr>
<tr>
<td>c</td>
<td>( 24 + 2z = 30 )</td>
<td>( 24 - 24 + 2z = 30 - 24 )</td>
<td>( z = 3 )</td>
</tr>
<tr>
<td>d</td>
<td>( 40 - 11a = 18 )</td>
<td>( 40 - 40 - 11a = 18 - 40 )</td>
<td>( a = -2 )</td>
</tr>
<tr>
<td>e</td>
<td>( \frac{b}{10} = 3 )</td>
<td>( 10 \times \frac{b}{10} = 3 \times 10 )</td>
<td>( b = 30 )</td>
</tr>
<tr>
<td>f</td>
<td>( \frac{7}{e} = 7 )</td>
<td>( 7 \times \frac{7}{e} = 7 \times 7 )</td>
<td>( e = \frac{1}{7} )</td>
</tr>
<tr>
<td>g</td>
<td>( 12d = 96 )</td>
<td>( \frac{12d}{12} = \frac{96}{12} )</td>
<td>( d = 8 )</td>
</tr>
<tr>
<td>h</td>
<td>( 39 = 13e )</td>
<td>( \frac{39}{13} = \frac{13e}{13} )</td>
<td>( e = \frac{3}{13} )</td>
</tr>
<tr>
<td>i</td>
<td>( 9f + 6 = 60 )</td>
<td>( 9f + 6 - 6 = 60 - 6 )</td>
<td>( f = 6 )</td>
</tr>
<tr>
<td>j</td>
<td>( \frac{20}{4} + 8 = 20 )</td>
<td>( \frac{20}{4} + 8 - 4 = 20 - 4 )</td>
<td>( g = 4 )</td>
</tr>
</tbody>
</table>
Angles 2: Angles between lines; angles in a triangle

**Worked example**

Calculate the sizes of the lettered angles

\[
\begin{align*}
\text{a} & \quad x^\circ + 124^\circ = 180^\circ \quad \text{(adjacent angles on straight line MON)} \\
& \quad x^\circ = 180^\circ - 124^\circ \\
& \quad = 56^\circ \\
\text{b} & \quad y^\circ + 35^\circ + 210^\circ = 360^\circ \quad \text{(sum of angles at point O)} \\
& \quad y^\circ + 245^\circ = 360^\circ \\
& \quad y^\circ = 360^\circ - 245^\circ \\
& \quad = 115^\circ
\end{align*}
\]

1. Measure these angles. Write your measurements below the angles.

\[
\begin{align*}
\text{a} & \quad C\hat{A}B = \underline{100^\circ} \\
& \quad C\hat{A}D = \underline{80^\circ} \\

\text{b} & \quad B\hat{A}C = \underline{80^\circ} \\
& \quad C\hat{A}E = \underline{100^\circ} \\
& \quad E\hat{A}D = \underline{80^\circ} \\
& \quad D\hat{A}B = \underline{100^\circ}
\end{align*}
\]
c

\[ \angle ABC = 60° \]
\[ \angle BCA = 60° \]
\[ \angle CAB = 60° \]

d

\[ \angle BAC = 70° \]
\[ \angle EAF = 70° \]
\[ \angle CAD = 60° \]
\[ \angle DAE = 50° \]
\[ \angle FAB = 110° \]

e

\[ \angle BAC = 20° \]
\[ \angle DAB = 110° \]
\[ \angle CAB = 20° \]

f

\[ \angle BAG = 70° \]
\[ \angle CAG = 110° \]
\[ \angle BAE = 110° \]
\[ \angle DAE = 70° \]
\[ \angle FEA = 110° \]
\[ \angle DEH = 110° \]
\[ \angle FEH = 70° \]
g  Colour the angles in each diagram that are equal. For example, in question b, make a red dot in the angles BÂC and EÂD. Then mark the other two angles in another colour if they are equal. If angles are not equal, don’t mark them.

h  Say which angles are equal in each question and why. For example, are they opposite angles, corresponding angles? If they are not equal, say so.

a  No equal angles

b  BAC = EAD and DAB = CAE vertically opposite angles

c  Three angles of an equilateral triangle

d  BAF = CAE and BAC = EAF opposite angles

e  No equal angle

f  BAG = DEA = corresponding angles

   CAE = FEH = corresponding angles

   GAC = AEF = corresponding angles

   BAE = DEF = corresponding angles

   BAG = CEA = vertically opposite

   AED = FEH = vertically opposite

   GAC = BAE = vertically opposite

   AEF = DEH = vertically opposite
② Complete the table by filling in the spaces.

<table>
<thead>
<tr>
<th>Triangle</th>
<th>1st angle</th>
<th>2nd angle</th>
<th>3rd angle</th>
<th>Sum of angles</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC</td>
<td>60°</td>
<td>20°</td>
<td>80°</td>
<td>180°</td>
</tr>
<tr>
<td>DEF</td>
<td>113°</td>
<td>45°</td>
<td>22°</td>
<td>180°</td>
</tr>
<tr>
<td>GHI</td>
<td>69°</td>
<td>93°</td>
<td>18°</td>
<td>180°</td>
</tr>
<tr>
<td>JKL</td>
<td>54°</td>
<td>89°</td>
<td>37°</td>
<td>180°</td>
</tr>
<tr>
<td>MNO</td>
<td>93°</td>
<td>12°</td>
<td>75°</td>
<td>180°</td>
</tr>
</tbody>
</table>

③ Study the diagrams. Then answer the questions.

a

b


c Calculate the sizes of angles \(x\), \(y\) and \(z\) in \(\triangle ABC\).

\[x = 75° \quad y = 75° \quad z = 15°\]


d Calculate the sizes of angles \(x\), \(y\), \(z\) and \(q\) in \(\triangle EFH\).

\[x = 65° \quad y = 50° \quad z = 115° \quad q = 12°\]


e In \(\triangle ABC\) does \(x° = y°\)? Explain your answer.

In triangle \(ABC\), \(x = y\).

\(\triangle ABD\) and \(\triangle DBC\) share a common line \(BD\) and have lines \(AB\) and \(BC\) equal.

They each have a right angle and an angle of 15°.

This means the remaining angle in each triangle must be 75°.
1. Construct these figures using a ruler, set square, protractor and pair of compasses.

   a. Construct a line through C parallel to AB:

      \[ \text{A} \quad \ldots \quad \text{B} \]
      \[ \text{C} \quad \ldots \quad \]

   b. Construct parallelogram PQRS so that the base, QR = 6 cm, RS = 4 cm and the angle at R = 60°.

   \[ \text{P} \quad 6 \text{ cm} \quad \text{S} \]
   \[ 4 \text{ cm} \quad 4 \text{ cm} \]
   \[ \text{Q} \quad 6 \text{ cm} \quad \text{R} \quad 60° \]

   c. Construct a line through Z perpendicular to AB.

      \[ \text{A} \quad \ldots \quad \text{B} \quad \text{Z} \]
d  Construct quadrilateral MNOP so that the base, NO = 7 cm, MN = 5.5 cm and the angle at N = 45°. Draw MQ perpendicular to NO. MP = 6 cm and the angle at QMP = 70°. Join PO.

![Diagram of quadrilateral MNOP with dimensions and angles labeled]

e  Answer these questions about the rectangle you have constructed above. Measure to confirm.

i)  What is the length of MQ? 38 mm

ii) What is the length of PO? 30 mm

iii) Find angle MNQ. 45°

iv) Find angle MQN. 90°

v)  Find angle MQO. 90°

vi) Find angle QOP. 149°

vii) Find angle OPM. 53°

viii) What is the sum of the angles in triangle MNQ? 45° + 90° + 45° = 180°

ix) What is the sum of the angles in rectangle MNOP? 360°

x) What is the sum of the angles in rectangle MQOP? 360°

2) Join the points A, B, C and D to the point F.

Now draw a line from F perpendicular to the line PQ.

![Diagram of points A, B, C, D, F, P, and Q with line F perpendicular to PQ]
Construct parallelogram ABCD so that the base, BC = 6.5 cm, AB = 3.5 cm and the angle at B = 60°.

Measure or calculate to find the following.

a  Find the angle at D.  

b  Find the angle at A.  

c  Find the angle at C.  

d  What is the sum of the four angles of the parallelogram?  

360°  

e  Join AC.  

f  Which angle does the angle at BCA equal?  

B CA = CAD  

g  Which angle does the angle at BAC equal?  

B AC = ACD  

h  Give a reason for your answers to questions f and g.  

The angles in questions f and g are alternate angles, which are equal.
Study the table that shows how many people from a village went to the café on seven days of the week. Then answer the questions.

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>98</td>
<td>76</td>
<td>48</td>
<td>123</td>
<td>142</td>
<td>47</td>
</tr>
</tbody>
</table>

a. What is the average number of shoppers per day?

\[
\text{mean} = \frac{\text{sum of numbers in the set}}{n}
\]

\[
\frac{103 + 98 + 76 + 48 + 123 + 142 + 47}{7} = 91
\]

b. What is another word for average? mean

2. Calculate the mean of these sets of numbers.

a. 5, 10, 15, 20, 25; the mean is 15

b. 1, 9, 4, 5, 10; the mean is \( \frac{29}{5} = 5.8 \)

c. 7, 8, 9, 10, 11, 15; the mean is 12

3. Two pupils got these percentage results in six tests. Study the table. Then answer the questions.

<table>
<thead>
<tr>
<th>Subjects</th>
<th>English</th>
<th>Mathematics</th>
<th>History</th>
<th>Geography</th>
<th>Science</th>
<th>Art</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupil 1</td>
<td>60</td>
<td>74</td>
<td>84</td>
<td>76</td>
<td>78</td>
<td>54</td>
</tr>
<tr>
<td>Pupil 2</td>
<td>70</td>
<td>78</td>
<td>38</td>
<td>54</td>
<td>84</td>
<td>66</td>
</tr>
</tbody>
</table>

a. What was the highest mark obtained? 84

b. What was the lowest mark obtained? 38

c. What is the difference between the highest and the lowest marks? 46

d. What is the mean mark obtained by pupil 1? 71

e. What is the mean mark obtained by pupil 2? 65

f. What is the mode for pupil 1? There is no mode.
g. What is the mode for pupil 2? There is no mode.

h. What is the mode for both pupils? 54, 74, 84

i. What is the range of all the marks obtained by both pupils in increasing size? 38, 54, 54, 60, 66, 70, 74, 76, 78, 78, 84, 84

j. What is the mean mark obtained for all the marks? 68

k. What is the mode obtained for all the marks? 54, 74, 84

l. What is the median for all the marks? 72

4. The average mass of three children is 49 kg. The first child has a mass of 46 kg and the second a mass of 52 kg. What is the mass of the third child?

\[49 \times 3 = 147 \text{ kg}\]

\[147 \text{ kg} - (52 \text{ kg} + 46 \text{ kg}) = 49 \text{ kg}\]

5. The average age of all the pupils in Grade 7 is 13 years. There are 22 pupils in the class and 5 are 12 years old while 15 are 13 years old. How old are the last 2 pupils?

\[31 \div 2 = 15.5 \text{ years old}\]

6. Arrange these numbers in ascending order:

a. 45, 99, 9, 81, 27, 63, 18, 36, 90, 54, 72

9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99

b. Name the median.

54
What units (mass, distance or length, capacity) would you use to estimate these?

a. The amount of juice in a bottle _ capacity – litres

b. The distance from your home to school _ distance – kilometres

c. Your mass _ mass – kilograms

d. The radius of a small coin _ length – millimetres

e. The length of a soccer field _ length – metres

f. The distance to the Moon _ distance – kilometres

g. The water in a swimming pool _ capacity – litres

Estimate these quantities.

a. Water in a cup _ 250 ml

b. The distance from your home to your nearest shop _ Students’ own answers

c. The mass of your friend _ Students’ own answers

d. The radius of a dinner plate _ approx. 1.5 m

e. The length of a school desk _ approx. 12 cm

f. The distance to Lagos from your home _ mass – kilograms

g. The water in a bath _ Students’ own answers

Complete the table by rounding off the numbers as required.

<table>
<thead>
<tr>
<th>Numbers</th>
<th>Round off to the nearest 10</th>
<th>Round off to the nearest 100</th>
<th>Round off to the nearest 1 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>60</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>732</td>
<td>730</td>
<td>700</td>
<td>1 000</td>
</tr>
<tr>
<td>4 899</td>
<td>4 900</td>
<td>4 900</td>
<td>5 000</td>
</tr>
<tr>
<td>15 606</td>
<td>15 610</td>
<td>15 600</td>
<td>16 000</td>
</tr>
<tr>
<td>48 989</td>
<td>48 990</td>
<td>49 000</td>
<td>49 000</td>
</tr>
</tbody>
</table>
4. Complete the table by rounding off the numbers as required.

<table>
<thead>
<tr>
<th>Numbers</th>
<th>Round off to the nearest 100</th>
<th>Round off to the nearest 10</th>
<th>Round off to the nearest whole number</th>
<th>Round off to the nearest tenth</th>
</tr>
</thead>
<tbody>
<tr>
<td>83.45</td>
<td>100</td>
<td>80</td>
<td>83</td>
<td>83.5</td>
</tr>
<tr>
<td>3.45</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>183.43</td>
<td>200</td>
<td>180</td>
<td>183</td>
<td>183.4</td>
</tr>
<tr>
<td>18.05</td>
<td>0</td>
<td>20</td>
<td>18</td>
<td>18.1</td>
</tr>
<tr>
<td>83.01</td>
<td>100</td>
<td>80</td>
<td>83</td>
<td>83</td>
</tr>
</tbody>
</table>

Remember estimated and approximated have similar meanings. We show approximated results using the symbol \( \approx \).

5. A factory makes 789 pairs of shoes in a week and 1 084 pairs of slippers. Complete the table showing your approximated and calculated results.

<table>
<thead>
<tr>
<th>Approximate number of shoes</th>
<th>Approximate number of slippers</th>
<th>Sum of approximate numbers</th>
<th>Calculation of actual numbers</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>789 ( \approx 1000 )</td>
<td>1 084 ( \approx 1000 )</td>
<td>2 000</td>
<td>1 873</td>
<td>127</td>
</tr>
</tbody>
</table>

5. A box has a mass of 87 g and a packet has a mass of 49 g. Complete the table showing your approximated and calculated results.

<table>
<thead>
<tr>
<th>Approximate mass of box</th>
<th>Approximate mass of packet</th>
<th>Sum of approximate masses</th>
<th>Calculation of actual masses</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>87 g ( \approx 90 ) g</td>
<td>49 g ( \approx 50 ) g</td>
<td>140 g</td>
<td>136 g</td>
<td>4 g</td>
</tr>
</tbody>
</table>
Base two arithmetic

**Worked example**

Expand a \(25\,024_{\text{six}}\), b \(1\,001_{\text{two}}\) in powers of their bases.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Value of binary numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) (25,024_{\text{six}})\n(= 2 \times 6^4 + 5 \times 6^3 + 0 \times 6^2 + 2 \times 6^1 + 4 \times 1)</td>
<td>(b) (1,001_{\text{two}})\n(= 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 1)</td>
<td></td>
</tr>
</tbody>
</table>

1. **a** Base ten numbers are decimal numbers based on ten digits. List the ten digits in the base ten system.
   
   0, 1, 2, 3, 4, 5, 6, 7, 8, 9

   **b** Base two numbers are binary numbers based on two digits. List the two digits in the base two system.
   
   0, 1

2. **a** Complete the list of place values of the digits in the decimal system.
   
   Th, H, T, U, tenths, hundredths

   **b** Complete the list of place values of the digits in the binary system.
   
   Eights, fours, twos, units

3. Complete the table.

<table>
<thead>
<tr>
<th>Decimal numbers</th>
<th>Binary numbers</th>
<th>Values of binary numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>10 = 1 two and 0 ones</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>11 = 1 two and 1 one</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>100 = 1 four and 0 twos and 0 ones</td>
</tr>
<tr>
<td>5</td>
<td>101</td>
<td>101 = 1 four and 0 twos and 10 ones</td>
</tr>
<tr>
<td>6</td>
<td>110</td>
<td>110 = 1 four 1 two and 0 ones</td>
</tr>
<tr>
<td>7</td>
<td>111</td>
<td>111 = 1 four 1 two 1 one</td>
</tr>
<tr>
<td>8</td>
<td>1000</td>
<td>1000 = 1 eight 0 fours 0 twos and 0 ones</td>
</tr>
<tr>
<td>9</td>
<td>1001</td>
<td>1001 = 1 eight 0 fours 0 twos and 1 one</td>
</tr>
<tr>
<td>10</td>
<td>1010</td>
<td>1010 = 1 eight 0 fours 1 two and 0 ones</td>
</tr>
<tr>
<td>11</td>
<td>1011</td>
<td>1011 = 1 eight 0 fours 1 two and 1 ones</td>
</tr>
<tr>
<td>12</td>
<td>1100</td>
<td>1100 = 1 eight 1 fours 0 twos and 0 ones</td>
</tr>
<tr>
<td>13</td>
<td>1101</td>
<td>1101 = 1 eight 1 fours 0 twos and 1 one</td>
</tr>
<tr>
<td>14</td>
<td>1110</td>
<td>1110 = 1 eight 1 fours 1 two and 0 ones</td>
</tr>
<tr>
<td>15</td>
<td>1111</td>
<td>1111 = 1 eight 1 fours 1 two and 1 ones</td>
</tr>
<tr>
<td>16</td>
<td>10000</td>
<td>10000 = 1 sixteen 0 eights 0 fours 0 twos and 0 ones</td>
</tr>
</tbody>
</table>
4. Add these binary numbers.

\[
\begin{align*}
a & \quad 1010 \\
+ & \quad 1011 \\
\hline
& \quad 10101
\end{align*}
\]

\[
\begin{align*}
b & \quad 110 \\
+ & \quad 111 \\
\hline
& \quad 10101
\end{align*}
\]

5. Subtract these binary numbers.

\[
\begin{align*}
a & \quad 1101 \\
- & \quad 11 \\
\hline
& \quad 1010
\end{align*}
\]

\[
\begin{align*}
b & \quad 1011 \\
- & \quad 110 \\
\hline
& \quad 101
\end{align*}
\]

6. Multiply these binary numbers.

\[
\begin{align*}
a & \quad 101 \\
\times & \quad 10 \\
\hline
& \quad 1010
\end{align*}
\]

\[
\begin{align*}
b & \quad 1011 \\
\times & \quad 110 \\
\hline
& \quad 100010
\end{align*}
\]

7. Calculate in base two. Then check your answers in base ten.

\[
\begin{align*}
a & \quad 1011 \\
+ & \quad 1001 \\
\hline
& \quad 10100
\end{align*}
\]

Check: \(10 + 9 = 20\)

\[
\begin{align*}
b & \quad 10011 \\
+ & \quad 10111 \\
\hline
& \quad 100110
\end{align*}
\]

Check: \(19 + 19 = 38\)

\[
\begin{align*}
c & \quad 10111 \\
- & \quad 1101 \\
\hline
& \quad 1010
\end{align*}
\]

Check: \(23 - 13 = 10\)

\[
\begin{align*}
d & \quad 10101 \\
- & \quad 1001 \\
\hline
& \quad 1100
\end{align*}
\]

Check: \(21 - 9 = 12\)

\[
\begin{align*}
e & \quad 1011 \\
\times & \quad 101 \\
\hline
& \quad 110111
\end{align*}
\]

Check: \(11 \times 5 = 55\)

\[
\begin{align*}
f & \quad 11011 \\
\times & \quad 111 \\
\hline
& \quad 10111101
\end{align*}
\]

Check: \(27 \times 7 = 189\)