Experiment 1

a) Toss two equal coins 20 times and note the outcomes in this table.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Tally of 20 throws</th>
<th>Pupil Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>H H</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>H and T</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>T T</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

(e.g. (20) \( n = \text{total number of tosses} \)

b) Collect the data for the whole class and fill in the table.

c) What do you notice about the results?

Write a sentence about it.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Class Totals</th>
<th>Relative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>H H</td>
<td>123</td>
<td>0.246 → 24.6%</td>
</tr>
<tr>
<td>H and T</td>
<td>253</td>
<td>0.506 → 50.6%</td>
</tr>
<tr>
<td>T T</td>
<td>124</td>
<td>0.248 → 24.8%</td>
</tr>
</tbody>
</table>

(e.g.)

- Relative frequencies of 'HH' and 'TT' are almost equal and are about half of the relative frequency for 'H and T'.
- Relative frequency of 'HH' and of 'TT' is about 25% or \( \frac{1}{4} \), and relative frequency of 'a Head and a Tail' is about 50% or \( \frac{1}{2} \).

Experiment 2

a) Toss three equal coins 40 times and note the outcomes in this table.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Tally of 40 throws</th>
<th>Pupil Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>H H H</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>1 H and 2 T</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>2 H and 1 T</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>T T T</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

(e.g. (40) \( n = \text{total number of tosses} \)

b) Collect the data for the whole class and fill in the table.

c) What do you notice about the results?

Write a sentence about it.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Class Totals</th>
<th>Relative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>H H H</td>
<td>127</td>
<td>0.127 → 12.7%</td>
</tr>
<tr>
<td>1 H and 2 T</td>
<td></td>
<td>0.373 → 37.3%</td>
</tr>
<tr>
<td>2 H and 1 T</td>
<td></td>
<td>0.376 → 37.6%</td>
</tr>
<tr>
<td>T T T</td>
<td>124</td>
<td>0.124 → 12.4%</td>
</tr>
</tbody>
</table>

(e.g.)

- The relative frequencies of 'HHH' and 'TTT' are almost equal and are about 1 third of the relative frequency for '1 Head and 2 Tails' and for '2 Heads and 1 Tail'.
- The relative frequency of 'HHH' and of 'TTT' is between 12% and 13%, and the relative frequency of 'a Head and 2 Tails' and of '2 Heads and a Tail' is each between 37% and 38%.
1

Throw two equal dice 72 times and write the data in the table.

**Example.** For a class of 30 pupils:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Tally of 72 throws</th>
<th>Pupil Total</th>
<th>Relative frequency</th>
<th>Class Total</th>
<th>Relative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 1</td>
<td>1</td>
<td>1</td>
<td>$\frac{1}{72}$</td>
<td>63</td>
<td>$\approx 0.0292$</td>
</tr>
<tr>
<td>1 and 2</td>
<td>5</td>
<td>5</td>
<td>$\frac{5}{72}$</td>
<td>118</td>
<td>$\approx 0.0546$</td>
</tr>
<tr>
<td>1 and 3</td>
<td>3</td>
<td>3</td>
<td>$\frac{3}{72}$</td>
<td>120</td>
<td>$\approx 0.0556$</td>
</tr>
<tr>
<td>1 and 4</td>
<td>4</td>
<td>4</td>
<td>$\frac{4}{72}$</td>
<td>123</td>
<td>$\approx 0.0569$</td>
</tr>
<tr>
<td>1 and 5</td>
<td>4</td>
<td>4</td>
<td>$\frac{4}{72}$</td>
<td>117</td>
<td>$\approx 0.0542$</td>
</tr>
<tr>
<td>1 and 6</td>
<td>2</td>
<td>2</td>
<td>$\frac{2}{72}$</td>
<td>121</td>
<td>$\approx 0.0560$</td>
</tr>
<tr>
<td>2 and 2</td>
<td>3</td>
<td>3</td>
<td>$\frac{3}{72}$</td>
<td>58</td>
<td>$\approx 0.0269$</td>
</tr>
<tr>
<td>2 and 3</td>
<td>6</td>
<td>6</td>
<td>$\frac{6}{72}$</td>
<td>116</td>
<td>$\approx 0.0537$</td>
</tr>
<tr>
<td>2 and 4</td>
<td>4</td>
<td>4</td>
<td>$\frac{4}{72}$</td>
<td>121</td>
<td>$\approx 0.0560$</td>
</tr>
<tr>
<td>2 and 5</td>
<td>3</td>
<td>3</td>
<td>$\frac{3}{72}$</td>
<td>120</td>
<td>$\approx 0.0556$</td>
</tr>
<tr>
<td>2 and 6</td>
<td>5</td>
<td>5</td>
<td>$\frac{5}{72}$</td>
<td>118</td>
<td>$\approx 0.0546$</td>
</tr>
<tr>
<td>3 and 3</td>
<td>2</td>
<td>2</td>
<td>$\frac{2}{72}$</td>
<td>59</td>
<td>$\approx 0.0273$</td>
</tr>
<tr>
<td>3 and 4</td>
<td>4</td>
<td>4</td>
<td>$\frac{4}{72}$</td>
<td>121</td>
<td>$\approx 0.0560$</td>
</tr>
<tr>
<td>3 and 5</td>
<td>3</td>
<td>3</td>
<td>$\frac{3}{72}$</td>
<td>121</td>
<td>$\approx 0.0560$</td>
</tr>
<tr>
<td>3 and 6</td>
<td>4</td>
<td>4</td>
<td>$\frac{4}{72}$</td>
<td>120</td>
<td>$\approx 0.0556$</td>
</tr>
<tr>
<td>4 and 4</td>
<td>0</td>
<td>0</td>
<td>$\frac{0}{72}$</td>
<td>60</td>
<td>$\approx 0.0278$</td>
</tr>
<tr>
<td>4 and 5</td>
<td>5</td>
<td>5</td>
<td>$\frac{5}{72}$</td>
<td>120</td>
<td>$\approx 0.0556$</td>
</tr>
<tr>
<td>4 and 6</td>
<td>4</td>
<td>4</td>
<td>$\frac{4}{72}$</td>
<td>119</td>
<td>$\approx 0.0550$</td>
</tr>
<tr>
<td>5 and 5</td>
<td>3</td>
<td>3</td>
<td>$\frac{3}{72}$</td>
<td>61</td>
<td>$\approx 0.0282$</td>
</tr>
<tr>
<td>5 and 6</td>
<td>4</td>
<td>4</td>
<td>$\frac{4}{72}$</td>
<td>124</td>
<td>$\approx 0.0574$</td>
</tr>
<tr>
<td>6 and 6</td>
<td>3</td>
<td>3</td>
<td>$\frac{3}{72}$</td>
<td>60</td>
<td>$\approx 0.0278$</td>
</tr>
</tbody>
</table>

\[ n = 72 \quad \text{and} \quad n = 2160 \]

2

Using the class data in Question 1, fill in this table where we deal with the sum of the two numbers thrown.

**Example.** Sample table for a class of 30 pupils:

<table>
<thead>
<tr>
<th>Sum</th>
<th>0</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>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>0</td>
<td>0</td>
<td>63</td>
<td>118</td>
<td>178</td>
<td>239</td>
<td>297</td>
<td>362</td>
<td>299</td>
<td>240</td>
<td>180</td>
<td>124</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Relative frequency</td>
<td>0</td>
<td>0</td>
<td>2.9%</td>
<td>5.5%</td>
<td>8.2%</td>
<td>11.1%</td>
<td>13.8%</td>
<td>16.8%</td>
<td>13.8%</td>
<td>11.1%</td>
<td>8.3%</td>
<td>5.7%</td>
<td>2.8%</td>
<td>0</td>
</tr>
<tr>
<td>Probability</td>
<td>0</td>
<td>0</td>
<td>$\frac{1}{36}$</td>
<td>$\frac{2}{36}$</td>
<td>$\frac{3}{36}$</td>
<td>$\frac{4}{36}$</td>
<td>$\frac{5}{36}$</td>
<td>$\frac{6}{36}$</td>
<td>$\frac{5}{36}$</td>
<td>$\frac{4}{36}$</td>
<td>$\frac{3}{36}$</td>
<td>$\frac{2}{36}$</td>
<td>$\frac{1}{36}$</td>
<td>0</td>
</tr>
</tbody>
</table>

What do you notice about the table? e.g.

- The relative frequencies are very close to the probabilities.
- The frequencies and relative frequencies for a sum of 2 and a sum of 12, (and for 3 and 11, 4 and 10, 5 and 9, 6 and 8) are very similar.)
Using the class data in Question 1 on page 142, fill in this table where we deal with the product of the numbers thrown. Calculate in your exercise book.

Sample table for a class of 30 Ps, each throwing 2 dice 72 times:

\[ n = 2160 \]

<table>
<thead>
<tr>
<th>Product</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>12</th>
<th>15</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>24</th>
<th>25</th>
<th>30</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>63</td>
<td>118</td>
<td>120</td>
<td>181</td>
<td>117</td>
<td>237</td>
<td>121</td>
<td>59</td>
<td>120</td>
<td>239</td>
<td>121</td>
<td>60</td>
<td>120</td>
<td>120</td>
<td>119</td>
<td>61</td>
<td>124</td>
<td>60</td>
</tr>
<tr>
<td>Relative frequency</td>
<td>0.29</td>
<td>0.55</td>
<td>0.56</td>
<td>0.84</td>
<td>0.54</td>
<td>1.10</td>
<td>0.56</td>
<td>0.27</td>
<td>0.56</td>
<td>1.10</td>
<td>0.56</td>
<td>0.28</td>
<td>0.56</td>
<td>0.56</td>
<td>0.28</td>
<td>0.28</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Probability</td>
<td>0.56</td>
<td>0.56</td>
<td>0.56</td>
<td>0.56</td>
<td>0.56</td>
<td>0.56</td>
<td>0.56</td>
<td>0.28</td>
<td>0.56</td>
<td>0.56</td>
<td>0.56</td>
<td>0.28</td>
<td>0.56</td>
<td>0.56</td>
<td>0.28</td>
<td>0.28</td>
<td>0.28</td>
<td>0.28</td>
</tr>
</tbody>
</table>

What is the probability of these events happening?

a) i) Red wins. \( \left( \frac{2}{6} = \frac{1}{3} \right) \)

ii) Red or green wins. \( \left( \frac{4}{6} = \frac{2}{3} \right) \)

iii) Green does not win. \( \left( \frac{4}{6} = \frac{2}{3} \right) \)

iv) Neither green nor red wins. \( \left( \frac{2}{6} = \frac{1}{3} \right) \)

b) i) Red wins. \( \left( \frac{2}{6} = \frac{1}{3} \right) \)

Red or green wins. \( \left( \frac{3}{6} = \frac{1}{2} \right) \)

ii) Green does not win. \( \left( \frac{5}{6} \right) \)

iv) Neither green nor red wins. \( \left( \frac{3}{6} = \frac{1}{2} \right) \)

A cuboid which measured 1.5 cm by 2 cm by 2.5 cm was used as a dice. The cuboid was thrown 1000 times and the frequency of each outcome was noted in the table.

- Calculate the relative frequency for each outcome and complete the table.
- If the sum of the numbers on any two opposite faces is 7, which numbers are written on the two:
  - largest faces \( 3 \) and \( 4 \)
  - smallest faces? \( 1 \) and \( 6 \)

What is the relative frequency of each of the 3 sizes of face?

\[ \begin{array}{ccc}
\text{largest} & \text{middle-sized} & \text{smallest} \\
37.5\% & 33\% & 29.5\% \\
\end{array} \]
1 If the wheel is spun, what is the probability of these outcomes? Complete the table.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>At least 5</th>
<th>At most 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>$\frac{1}{6}$</td>
<td>$\frac{1}{6}$</td>
<td>$\frac{1}{6}$</td>
<td>$\frac{1}{6}$</td>
<td>$\frac{1}{6}$</td>
<td>$\frac{2}{6} = \frac{1}{3}$</td>
<td>$\frac{5}{6}$</td>
<td></td>
</tr>
</tbody>
</table>

2 A marble is dropped into this maze and has an equal chance of falling to the left or to the right.

   a) In how many ways can the marble come out at:

   - A: 1
   - B: 5
   - C: 10
   - D: 10
   - E: 5
   - F: 1

   b) How many routes are there altogether? 32

   c) What is the probability of each outcome?

3 Sue used this hexagon-based pyramid as a dice. It has 7 written on its hexagon base and 1, 2, 3, 4, 5 and 6 written on its triangular faces.

   Top view          Side view          Bottom view

Sue threw the dice 100 times and noted the numbers it landed on. She wrote how many times (frequency) the dice landed on each number (outcome) in this table.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>Relative frequency</td>
<td>$\frac{11}{100}$</td>
<td>$\frac{12}{100}$</td>
<td>$\frac{13}{100}$</td>
<td>$\frac{10}{100}$</td>
<td>$\frac{12}{100}$</td>
<td>$\frac{14}{100}$</td>
<td>$\frac{28}{100}$</td>
</tr>
</tbody>
</table>

   a) Fill in the bottom row of the table to show the ratio of the number of times a number was landed on to the total number of throws (relative frequency).

   b) How many times did Sue throw: i) at least a 4 64

       ii) at most a 4? 46
A bag of sweets contains 8 mints, 6 toffees and 2 boiled fruits, all wrapped in foil and all the same size and shape.

You take one sweet from the bag with your eyes closed. What is the probability that it is:

- a) a mint \( \frac{1}{2} \)
- b) a toffee \( \frac{3}{8} \)
- c) a boiled fruit \( \frac{1}{8} \)
- d) not a mint \( \frac{1}{2} \)
- e) not a toffee \( \frac{5}{8} \)
- f) a mint or a toffee? \( \frac{7}{8} \)

If the wheel is spun, what is the probability of each outcome? Complete the table.

<table>
<thead>
<tr>
<th>Outcome</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>( \leq 4 )</th>
<th>prime number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{1}{8} )</td>
</tr>
</tbody>
</table>

N.B. 1 is not a prime number as it has only one factor, 1.
A prime number has 2 factors, itself and 1.

A dice is thrown 100 times and a tally is kept of the numbers thrown.
The table shows the number of times (frequency) that each number (outcome) is thrown.

<table>
<thead>
<tr>
<th>Outcome</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>( \leq 4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>12</td>
<td>11</td>
<td>14</td>
<td>13</td>
<td>26</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative frequency</td>
<td>( \frac{12}{100} )</td>
<td>( \frac{11}{100} )</td>
<td>( \frac{14}{100} )</td>
<td>( \frac{13}{100} )</td>
<td>( \frac{26}{100} )</td>
<td>( \frac{24}{100} )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) Fill in the bottom row of the table to show the relative frequency.

b) Do you think that the dice is biased or unbiased? Biased
Give a reason for your answer.
If it was a fair dice we would expect each outcome to have the same frequency but 5 and 6 were thrown almost twice as often.

A bag contains 100 balls, each marked with a natural number from 1 to 100. You take out a ball with your eyes closed. What is the probability that it is:

- a) an even number \( \frac{1}{2} \)
- b) a multiple of 3 \( \frac{33}{100} \)
- c) not a multiple of 3 \( \frac{67}{100} \)
- d) a multiple of 10 \( \frac{10}{100} = \frac{1}{10} \)
- e) not a multiple of 10 \( \frac{9}{10} \)
- f) a square number? \( \frac{10}{100} = \frac{1}{10} \)
Three equal coins are tossed. 
Draw a graph to show the probability of each outcome.

Two equal dice are thrown. 
Draw a graph to show the probability of each possible sum of the two numbers thrown. 
(Use the probability data from Question 2, page 142)

Paul is walking from A to B and Mike from B to A. The graph shows their positions during that time.

a) Who started first? 
   Paul, 1 min before Mike

b) Who arrived first? 
   Mike, 1 min before Paul

c) How long did:
   i) Paul take 15 mins
   ii) Mike take 13 mins

d) What happened during the 7th and 8th minutes? 
   They met and stopped.
1. Write in the table how many pupils in your class have birthdays in each month. 
   
   e.g. For a class of 30 pupils:

<table>
<thead>
<tr>
<th>Month</th>
<th>Number of Birthdays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan.</td>
<td>2</td>
</tr>
<tr>
<td>Feb.</td>
<td>1</td>
</tr>
<tr>
<td>Mar.</td>
<td>6</td>
</tr>
<tr>
<td>Apr.</td>
<td>3</td>
</tr>
<tr>
<td>May</td>
<td>1</td>
</tr>
<tr>
<td>Jun.</td>
<td>2</td>
</tr>
<tr>
<td>Jul.</td>
<td>4</td>
</tr>
<tr>
<td>Aug.</td>
<td>0</td>
</tr>
<tr>
<td>Sep.</td>
<td>7</td>
</tr>
<tr>
<td>Oct.</td>
<td>3</td>
</tr>
<tr>
<td>Nov.</td>
<td>0</td>
</tr>
<tr>
<td>Dec.</td>
<td>1</td>
</tr>
</tbody>
</table>

   b) Show the data in a graph.
   c) Write the data in increasing order.

   e.g.

   d) What are these values? e.g.
   i) Mode: 1
   ii) Median: 2
   iii) Mean: 2.5

2. Show in a graph the probability of each possible product when 2 dice are thrown.
   (Use the probability data from Question 1, page 143.)

3. Henry cannot make up his mind which cinema, B or C, to go to from his house at A.
   a) Which cinema **did** Henry go to? **B**
   b) When did he change his mind? **at 3 min and 9 min**
   c) When did he start to run? **at 11 min**

The graph shows what Henry did.
Two groups of pupils are in a competition to see which of them does better in a maths test out of 8 marks.
Both groups contain 8 pupils but their marks are similar. They need one overall mark for each group to make the comparison easier and decide to use the mean value.
Calculate the mean mark for each group and compare them.
Fill in the missing sign.

Group A: 8, 8, 7, 5, 6, 8, 6, 7 (marks)

Mean: \[
\frac{8 + 8 + 7 + 5 + 6 + 8 + 6 + 7}{8} = \frac{55}{8} = 6.875
\]

Group B: 6, 6, 6, 7, 6, 7, 8, 8

Mean: \[
\frac{6 + 6 + 6 + 7 + 6 + 7 + 8 + 8}{8} = \frac{54}{8} = 6.75
\]

Solve the problem in your exercise book and write the answer here.

Two groups of children collected blackberries. There were 6 children in Group A and 8 children in Group B.
The members of Group A collected these amounts of blackberries:
1.2 kg, 0.8 kg, 1.6 kg, 2.4 kg, 0.6 kg, 0.9 kg
The members of Group B collected these amounts of blackberries:
0.9 kg, 1.4 kg, 1.2 kg, 0.6 kg, 2 kg, 1 kg, 0.45 kg, 0.7 kg
Which group worked harder?

Mean of Group A:
\[
\frac{1.2 + 0.8 + 1.6 + 2.4 + 0.6 + 0.9}{6} = \frac{7.5}{6} = 1.25 \text{ (kg)}
\]

Mean of Group B:
\[
\frac{0.9 + 1.4 + 1.2 + 0.6 + 2 + 1 + 0.45 + 0.7}{8} = \frac{8.25}{8} = 1.03125 \approx 1.03 \text{ kg}
\]

Answer: The children in Group A worked harder as they gathered more blackberries per person on average than those in Group B.

Draw graphs to show the data from Question 2.

Draw a red horizontal line at each mean.
The ages of the members of the *Cabbage* family are:

1 year, 3 years, 33 years, 34 years and 65 years

The ages of the members of the *Parsnip* family are:

10 years, 12 years, 19 years, 21 years, 42 years and 43 years.

a) Calculate the mean age of each family.

*Cabbage* family: \[
\frac{1 + 3 + 33 + 34 + 65}{5} = \frac{136}{5} = 27.2 \text{ (years)}
\]

*Parsnip* family: \[
\frac{10 + 12 + 19 + 21 + 42 + 43}{6} = \frac{147}{6} = 24.5 \text{ (years)}
\]

b) Both families are working in their gardens. Which family do you think will be able to do more work? Give a reason for your answer.

The *Parsnip* family would be able to do more work in the garden because all of them can work.

---

One summer's day in Budapest, the temperature was noted every two hours and recorded in this table.

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature °C</td>
<td>10.6</td>
<td>10.0</td>
<td>9.5</td>
<td>11.1</td>
<td>15.2</td>
<td>20.9</td>
<td>25.0</td>
<td>28.3</td>
<td>29.0</td>
<td>26.1</td>
<td>21.0</td>
<td>17.4</td>
<td>13.0</td>
</tr>
</tbody>
</table>

a) Calculate the mean of the temperatures on that day from the given data.

Mean: \[
\frac{237.1}{13} \approx 18.2 \text{ (°C)}
\]

b) Write the data in increasing order then find the mode and median.

9.5, 10.0, 10.6, 11.1, 13.0, 15.2, 17.4, 20.9, 21.0, 25.0, 26.1, 28.3, 29.0

Mode: Any or all of these temperatures (as each occurs once)

Median: 17.4 °C

---

One winter's day in Budapest, the temperature was noted every two hours and recorded in this table.

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature °C</td>
<td>–10</td>
<td>–11</td>
<td>–11</td>
<td>–10</td>
<td>–8</td>
<td>–3</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>–4</td>
<td>–8</td>
</tr>
</tbody>
</table>

a) Calculate the mean of the temperatures on that day from the given data.

Mean: –4 °C

b) Write the data in increasing order then find the mode and median.

–11, –11, –10, –10, –8, –8, –4, –3, 0, 1, 2, 4, 5

Mode: –11 or –10 or –8

Median: –4 °C
Mike is growing two different varieties of tomato plants in his greenhouse. During one week, he keeps a record of the number of tomatoes he picks from each type of plant and notes the data in a table.

<table>
<thead>
<tr>
<th>Day</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variety A</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Variety B</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>

a) For Variety A, what is the:
   i) Mode: 5
   ii) Median: 4
   iii) Mean: \( \frac{22}{7} = 3 \frac{1}{7} \)

b) For Variety B, what is the:
   i) Mode: 3
   ii) Median: 5
   iii) Mean: \( \frac{36}{7} = 5 \frac{1}{7} \)

c) Compare the two sets of data. Which variety do you think is best and why?
   Variety B is best, as it produces more tomatoes per day on average.

A group of pupils took tests in 4 subjects: English, Mathematics, History and Geography. Each test was out of 10 marks. The teacher wrote the results in this table.

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Mathematics</th>
<th>History</th>
<th>Geography</th>
<th>Mean mark per pupil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Brenda</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Claire</td>
<td>9</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Darren</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Ella</td>
<td>10</td>
<td>9</td>
<td>5</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Freddy</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>7.25</td>
</tr>
<tr>
<td>Graham</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Mean mark per subject</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

a) Complete the table by calculating:
   i) the mean mark per pupil
   ii) the mean mark per subject.

b) Which pupil did best overall? Claire

c) Which subject did the pupils find:
   i) easiest Pupils found the Mathematics test easiest.
   ii) most difficult? Pupils found History and Geography equally most difficult.
Write in the **missing** numbers.

a) \((4 \times 3) + \underline{5} = 17\)  
   [1 mark]

b) \((5 \times 5) - \underline{3} = 22\)  
   [1 mark]

Calculate \(459 \times 6\)  
[1 mark]

\[
459 \times 6 = 2400 + 300 + 54 = 2754 \quad \text{or} \quad \frac{459}{6} = \frac{2754}{35}
\]

Write the number that is the nearest to 5000 which uses all the digits 4, 5, 6 and 8.  
[1 mark]

Practise calculation.

a)

\[
\begin{array}{c}
20817 \\
4053 \\
+ 50517 \\
\hline
17954
\end{array}
\]

b)

\[
\begin{array}{c}
20817 \\
- 67092 \\
\hline
12108
\end{array}
\]

c)

\[
\begin{array}{c}
83605 \\
\times 14 \\
\hline
1170470
\end{array}
\]

We have 80 books altogether. They are arranged on 3 shelves.

If we moved 7 books from the top shelf to the middle shelf and took 8 books away from the bottom shelf, there would be an equal number of books on each shelf.

How many books are on each shelf?

\[
\begin{align*}
\text{e.g.} & \\
\text{Number of books:} & 80 & \text{Number of books to be moved:} & 7 \\
\text{Number of books to be taken away completely:} & 8 & \text{Number of books left:} & 80 - 8 = 72 \\
\text{Number of books on each of 3 shelves if equal:} & 72 \div 3 = 24 & \text{Actual number of books on:} & \begin{aligned} 
\text{top shelf:} & 24 + 7 = 31 \\
\text{middle shelf:} & 24 - 7 = 17 \\
\text{bottom shelf:} & 24 + 8 = 32 \\
\end{aligned} \\
\text{Answer:} & \text{There are 31 books on the top shelf, 17 books on the middle shelf and 32 books on the bottom shelf.}
\end{align*}
\]
Circle **two** numbers which add up to 160.

- 63 + 97, 64 + 96, 65 + 95, 66 + 94, 67 + 93,
- 73 + 87, 74 + 86, 75 + 85, 76 + 84, 77 + 83

[1 mark]

A shop sells these flowers.

<table>
<thead>
<tr>
<th>Daisies</th>
<th>Roses</th>
</tr>
</thead>
<tbody>
<tr>
<td>99 p a bunch</td>
<td>50 p each</td>
</tr>
</tbody>
</table>

**a)** John buys 4 bunches of daisies. How much does he pay altogether?

\[99 \text{ p} \times 4 = 100 \text{ p} - 4 \text{ p} = 396 \text{ p} = £3.96\]

or \[£1 \times 4 = 4 \text{ p} = £4 - 4 \text{ p} = £3.96\]

*Answer: John paid £3.96 for 4 bunches of daisies.*

**b)** Karpal has £5.00 to spend on roses. How many roses can she buy for £5.00?

\[£5 \div 50 \text{ p} = 500 \text{ p} \div 50 \text{ p} = 50 \text{ p} \div 5 \text{ p} = 10 \text{ (times)}\]

*Answer: Karpal can buy 10 roses.*

\[\frac{3}{4} + \frac{2}{4} + \frac{1}{4} = \left(\frac{6}{4} = \frac{3}{2} = \frac{1}{2}\right)\]

**b)** \[2\frac{4}{5} - 1\frac{1}{5} = \left(\frac{13}{5}\right)\]

**c)** \[3\frac{2}{3} + 1\frac{1}{6} = \left(\frac{34}{6} + \frac{1}{6} = \frac{35}{6}\right)\]

**d)** \[\frac{7}{8} - \frac{1}{5} = \left(\frac{35 - 8}{40} = \frac{27}{40}\right)\]

**e)** \[\frac{2}{7} \cdot 3 = 6 \frac{6}{7}\]

**f)** \[\frac{8}{9} \div 4 = \left(\frac{2}{9}\right) \text{ (or) } \frac{8}{36} = \frac{2}{9}\]

Circle the **two** numbers which add up to 1.

- 0.11 ✔ 0.85 ✔ 0.9 ✔ 0.25 ✔ 0.15 ✔ [1 mark]

**a)**

10 3 4 5
16 2 9 7
1 7 6 6 2

**b)**

3 6 8 2
- 1 4 5 9
2 2 2 3
3 0 1

**c)**

4 3
4 6 8

**d)**

4 7

In this addition, different letters stand for different digits and the same letters stand for the same digits. A is **not less** than 3.

**a)** Which digit could each letter stand for? Find different solutions in your exercise book.

**b)** What is: i) the smallest 43 ✔ ii) the greatest 98 ✔ possible sum?
Practise addition.

a) i) \( 3 + 2 = 5 \)  
   ii) \( 3 + 0 = 3 \)  
   iii) \( 3 + (– 2) = 1 \)  
   iv) \( 3 + (– 4) = – 1 \)  
   v) \( 3 + (– 6) = – 3 \)  

b) i) \( – 3 + (– 2) = – 5 \)  
   ii) \( – 3 + 0 = – 3 \)  
   iii) \( – 3 + 2 = – 1 \)  
   iv) \( – 3 + 4 = 1 \)  
   v) \( – 3 + 6 = 3 \)  

c) i) \( 25 + (– 41) + 12 + (– 10) = – 15 \)  
   ii) \( – 100 + (– 30) + 78 + (– 48) = – 100 \)  
   iii) \( 5000 + (– 2000) + (– 3000) = 0 \)  
   iv) \( – 85000 + (– 15000) + (– 20000) = 100000 + (– 20000) = – 120000 \)  
   v) \( – 236700 + 0 = – 236700 \)  

Write an operation and calculate the answer.

a) Ian had £1500 in cash and was £400 in debt, then £300 of his debt was cancelled. What is his balance now?
   
   Plan: \( 1500 + (– 400) – (– 300) = 1500 + (– 100) = 1400 \)
   
   Answer: Ian’s balance is £1400.

b) Lucy had £1500 in cash and was £400 in debt. She went on holiday and spent £1200. What is her balance now?
   
   Plan: \( 1500 + (– 400) + (– 1200) = 300 + (– 400) = – 100 \)
   
   Answer: Lucy’s balance is – £100.

Practise calculation.

a) i) \( 20 – (+ 14) = 6 \)  
   b) i) \( 20 + (– 14) = 6 \)  
   ii) \( 20 – (+ 36) = – 16 \)  
   ii) \( 20 + (– 36) = – 16 \)  
   iii) \( 40 – (+ 40) = 0 \)  
   iii) \( 40 + (– 40) = 0 \)  
   iv) \( 35 – (– 20) = 55 \)  
   iv) \( 35 + (+ 20) = 55 \)  
   v) \( – 30 – (– 10) = – 20 \)  
   v) \( – 30 + (+ 10) = – 20 \)  
   vi) \( – 30 – (+ 30) = 0 \)  
   vi) \( – 30 + (+ 30) = 0 \)  
   vii) \( – 20 – (– 50) = 30 \)  
   vii) \( – 20 + (+ 50) = 30 \)  
   viii) \( – 20 – (+ 30) = – 50 \)  
   viii) \( – 20 + (– 30) = 30 \)

What is the smallest possible, 3-digit, positive integer which fulfils these conditions?

- If it is multiplied by 3, the result is also a 3-digit number.
- If it is multiplied by 4, the result is a 4-digit number.

\[ 250 \]
Practise rounding:

<table>
<thead>
<tr>
<th></th>
<th>a) to nearest 10</th>
<th>b) to nearest 100</th>
<th>c) to nearest tenth</th>
</tr>
</thead>
<tbody>
<tr>
<td>6208</td>
<td>6210</td>
<td>6200</td>
<td>62.08</td>
</tr>
<tr>
<td>14 035</td>
<td>14 040</td>
<td>14 000</td>
<td>140.35</td>
</tr>
<tr>
<td>90 455</td>
<td>90 460</td>
<td>90 500</td>
<td>904.55</td>
</tr>
<tr>
<td>83</td>
<td>380</td>
<td>400</td>
<td>3.83</td>
</tr>
<tr>
<td>9 999</td>
<td>10 000</td>
<td>10 000</td>
<td>99.99</td>
</tr>
</tbody>
</table>

Calculator not allowed

KS2A 1999 Q.9

e.g. 538 – 396 = 238 – 96 = 148 – 6 ≠ 442
or 542 – 400 = 142 (Adding equal amounts to reductant and subtrahend does not change the difference.)

[1 mark]

KS2B 1999 Q.5

Write in the four missing digits.

Put one digit in each box. 9 9 + 9 9 = 198

[1 mark]

KS2A 1999 Q.20

Here is a graph.

a) The points A, B and C are equally spaced.
   What are the coordinates of the point B?
   \[(5, 5)\]
   [1 mark]

b) Point D is directly below point C.
   What are the coordinates of the point D?
   \[(10, 0)\]
   [1 mark]

In a race, the runners are started 1 minute after each other. The first runner covers 174 m each minute and the second runner covers 182 m each minute.

What distance will be between the two runners:

a) 10 minutes after the first runner started
   \[174 \text{ m} \times 10 – 182 \text{ m} \times 9\]
   \[= 1740 \text{ m} – 1638 \text{ m} = 102 \text{ (m)}\]

b) 30 minutes after the first runner started?
   \[174 \text{ m} \times 30 – 182 \text{ m} \times 29\]
   \[= 5220 \text{ m} – 5278 \text{ m} = -58 \text{ m}\]
1. Practise calculation.
   a) \[ \frac{3}{5} + \frac{4}{5} + \frac{7}{10} = 2 \frac{1}{10} \]
   b) \[ \frac{3}{8} + \frac{1}{7} = \frac{29}{56} \]
   c) \[ 3 \frac{3}{4} + \frac{3}{8} = 4 \frac{1}{8} \]
   d) \[ \frac{5}{7} - \frac{3}{7} = \frac{2}{7} \]
   e) \[ 1 \frac{5}{6} - \frac{2}{3} = 1 \frac{1}{6} \]
   f) \[ \frac{7}{9} - \frac{1}{3} - \frac{1}{9} = \frac{1}{3} \]

2. Practise calculation.
   a) \[ \frac{2}{3} \times 4 = \frac{2}{3} \]
   b) \[ \frac{3}{4} \times 8 = 6 \]
   c) \[ \frac{3}{8} \times 5 = 1 \frac{7}{8} \]
   d) \[ \frac{1}{3} \div 2 = \frac{1}{6} \]
   e) \[ \frac{6}{7} \div 3 = \frac{2}{7} \]
   f) \[ \frac{5}{9} \div 5 = \frac{1}{9} \]

3. a) \[ \begin{array}{c}
            3 \ 7 \ 0 \ 2 \\
          + \ 1 \ 4 \ 9 \ 4 \\
         \hline
            2 \ 5 \ 5 \ 6
        \end{array} \]
   b) \[ \begin{array}{c}
            7 \ 8 \ 3 \ 9 \\
          - \ 4 \ 9 \ 5 \ 3 \\
         \hline
            2 \ 8 \ 8 \ 6
        \end{array} \]
   c) \[ \begin{array}{c}
            2 \ 7 \\
          \times \ 9 \\
         \hline
            6 \ 4 \ 5 \ 0
        \end{array} \]
   d) \[ \begin{array}{c}
            7 \ 5 \ 1 \\
          \end{array} \]

4. What is the largest possible, 3-digit, positive integer which fulfils both conditions?
   - If it is multiplied by 3, the result is also a 3-digit number. \( 999 \div 3 = 333 \) (3 digits)
   - If it is multiplied by 4, the result is a 4-digit number. \( \frac{333 \times 4}{1} = 1332 \) (4-digits)
   
   Largest possible number which fulfils both conditions is 333.

5. In a school the ratio of boys to girls in Year 5 is \( 5 : 7 \). There are 12 more girls than boys in Year 5. How many pupils are in Year 5?
   \[ \boxed{72} \] pupils

6. What is the smallest possible natural number that has a remainder of 1 when divided by 2, 3, 4, 5 or 6 but which can be divided by 7 exactly?
   \[ \boxed{301} \]

7. What are the four consecutive odd numbers which add up to 80?
   \[ \boxed{17} \quad \boxed{19} \quad \boxed{21} \quad \boxed{23} \]
Practise calculation.

a) \(37 - 80 + 43 + 64 - 44 = 20\)
b) \(3.7 - 8 + 4.3 + 6.4 - 4.4 = 2\)
c) \(5 \times 31 \times 25 \times 20 \times 4 = 310,000\)
d) \(2 \times 50 \div 4 \times 27 = 675\)

Practise calculation.

a) \(30 - 16 \div 4 + 9 \times 5 + 15 = 86\)
b) \(72 \div 8 - 20 \times 6 \div 5 + 300 \div 100 = -12\)
c) \(20 \div 8 \times 6 + 3 \times 12 \div 9 + 15 \div 5 - 5 = 17\)

Do each calculation in two different ways.

a) \(650 - (450 + 120) = 650 - 570 = 80\)
    \(\text{or } 650 - 450 - 120 = 200 - 120 = 80\)

b) \(650 - (450 - 120) = 650 - 330 = 320\)
    \(\text{or } 650 - 450 + 120 = 200 + 120 = 320\)

c) \(50 \times (12 + 38) = 50 \times 50 = 2500\)
    \(\text{or } 50 \times 12 + 50 \times 38 = 600 \times 1900 = 2500\)

d) \((200 - 180) \times 7 = 20 \times 7 = 140\)
    \(\text{or } 200 \times 7 - 180 \times 7 = 1400 - 1260 = 140\)

e) \((90 + 72) \div 18 = 162 \div 18 = 81 \div 9 = 9\)
    \(\text{or } 90 \div 18 + 72 \div 18 = 5 + 4 = 9\)

f) \(600 \div (25 \times 6) = 600 \div 150 = 60 \div 15 = 4\)
    \(\text{or } 600 \div 25 \div 6 = 100 \div 25 = 4\)

Which positive, whole numbers make all three inequalities true at the same time?

\[3 \times (5 + \square) < 35\]
\[8 + \square > 11\]
\[20 - 3 \times \square \leq 9\]

Possible numbers: \(\square: 4, 5, 6\)
1

**KS2A 1999 Q.17**

Calculator not allowed

Megan makes a sequence of numbers starting with 100. She **subtracts** 45 each time. Write the next **two** numbers in the sequence. [1 mark]

100, 55, 10, **−35, −80**. [1 mark]

2

**KS2A 1999 Q.16**

Calculator not allowed

Eggs are put in **trays of 12**. The trays are packed in boxes. Each box contains **180 eggs**. How many trays are in each box? **Show your working. You may get a mark.**

Plan: \(180 \div 12 = 30 \div 2 = 15\) or \(15 \times 12 = 180\)

Answer: There are 15 trays in each box. [2 marks]

3

**KS2B 1999 Q.19**

Calculator allowed

Calculate \(\frac{7}{8}\) of 7000. **Answer: 6125** [1 mark]

4

**KS2B 1999 Q.21**

Calculator allowed

Mr. Jones has two sizes of square paving stones. He uses them to make a path.

The path measures **1.55 metres by 3.72 metres**.

Calculate the **width** of a small paving stone. **Show your method. You may get a mark.**

0.62 m or 62 cm [2 marks]

5

**HMC 2002, II Age 10**

Some children and their Dads went on a journey by train. There were 10 Dads with 1 child each, 10 Dads with 2 children each and 10 Dads with 3 children each. The group took up the 3 coaches at the front of the train and each child was in the same coach as his or her father.

How could they sit so that the number of Dads and the number of children were the same in each of the 3 coaches?

**e.g.**

<table>
<thead>
<tr>
<th>Coach 1</th>
<th>Coach 2</th>
<th>Coach 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDDDDDD</td>
<td>DDDDDDD</td>
<td>DDDDDDD</td>
</tr>
<tr>
<td>CCCCCC</td>
<td>CCCCCC</td>
<td>CCCCCC</td>
</tr>
<tr>
<td>CCCCCC</td>
<td>CCCCCC</td>
<td>CCCCCC</td>
</tr>
<tr>
<td>5 × 3 + 5 × 1</td>
<td>5 × 3 + 5 × 1</td>
<td>10 × 2</td>
</tr>
</tbody>
</table>
Fill in the missing numbers and signs. 843 + 157 = 1000

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>843 + (157 + 36) = 1000 + 36</td>
<td>b</td>
</tr>
<tr>
<td>c</td>
<td>(843 + 41) + 157 = 1000 + 41</td>
<td>d</td>
</tr>
<tr>
<td>e</td>
<td>843 + (157 – 69) = 1000 – 69</td>
<td>f</td>
</tr>
<tr>
<td>g</td>
<td>(843 – 55) + 157 = 1000 – 55</td>
<td>h</td>
</tr>
<tr>
<td>i</td>
<td>(843 + 16) + (157 + 16) = 1000 + 32</td>
<td>j</td>
</tr>
<tr>
<td>k</td>
<td>(843 + 72) + (157 – 72) = 1000</td>
<td>l</td>
</tr>
</tbody>
</table>

Fill in the missing numbers and signs. 685 – 185 = 500

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>(685 + 15) – 185 = 500 + 15</td>
<td>b</td>
</tr>
<tr>
<td>c</td>
<td>685 – (185 + 23) = 500 – 23</td>
<td>d</td>
</tr>
<tr>
<td>e</td>
<td>(685 – 45) – 185 = 500 – 45</td>
<td>f</td>
</tr>
<tr>
<td>g</td>
<td>685 – (185 – 30) = 500 + 30</td>
<td>h</td>
</tr>
<tr>
<td>i</td>
<td>(685 + 51) – (185 + 51) = 500</td>
<td>j</td>
</tr>
<tr>
<td>k</td>
<td>(685 + 4) – (185 – 4) = 500 + 8</td>
<td>l</td>
</tr>
<tr>
<td>m</td>
<td>(685 – 10) – (185 + 10) = 500 – 20</td>
<td>n</td>
</tr>
</tbody>
</table>

Calculator allowed

**KS2B 1999 Q.13**

**Rakes** £7.70 each  **Spades** £9.55 each  **Flowerpots** £11.75 each

Nicola has £50. She buys 3 flowerpots and a spade.
How much money does she have left?

£5.20  [2 marks]

Seeds are £1.49 for a packet. Stephen has £10 to spend on seeds.
What is the greatest number of packets he can buy?

6  [1 mark]

How many positive 3-digit numbers less than 500 are there in which the middle digit is half of the sum of the two outside digits?
1. Fill in the missing numbers and signs. \(60 \times 20 = 1200\)

a) \((60 \times 3) \times 20 = 1200 \times 3\)  
b) \((60 \times n) \times 20 = 1200 \times n\)

c) \(60 \times (20 \times 4) = 1200 \times 4\)  
d) \(60 \times (20 \times m) = 1200 \times m\)

e) \((60 ÷ 3) \times 20 = 1200 ÷ 3\)  
f) \((60 ÷ s) \times 20 = 1200 ÷ s\)

g) \(60 \times (20 ÷ 4) = 1200 ÷ 4\)  
h) \(60 \times (20 ÷ t) = 1200 ÷ t\)

i) \((60 \times 2) \times (20 ÷ 2) = 1200 \times 4\)  
j) \((60 \times u) \times (20 \times u) = 1200 \times u \times u\)

k) \((60 ÷ 4) \times (20 ÷ 4) = 1200 ÷ 16\)  
l) \((60 ÷ v) \times (20 \div v) = 1200 ÷ v \times v\)

m) \((60 \times 5) \times (20 ÷ 5) = 1200\)  
n) \((60 \times a) \times (20 \div a) = 1200\)

2. Fill in the missing numbers and signs. \(1500 ÷ 30 = 50\)

a) \((1500 \times 2) ÷ 30 = 50 \times 2\)  
b) \((1500 \times a) ÷ 30 = 50 \times a\)

c) \(1500 ÷ (30 \times 2) = 50 ÷ 2\)  
d) \(1500 ÷ (30 \times a) = 50 ÷ a\)

e) \((1500 ÷ 2) ÷ 30 = 50 ÷ 2\)  
f) \((1500 ÷ a) ÷ 30 = 50 ÷ a\)

g) \(1500 ÷ (30 ÷ 2) = 50 \times 2\)  
h) \(1500 ÷ (30 ÷ a) = 50 \times a\)

i) \((1500 \times 2) ÷ (30 ÷ 2) = 50 \times 4\)

j) \((1500 \times a) ÷ (30 ÷ a) = 50 \times a \times a\)

k) \((1500 ÷ 2) ÷ (30 \times 2) = 50 ÷ 4\)

l) \((1500 ÷ a) ÷ (30 \times a) = 50 ÷ a \times a\)

m) \((1500 \times 2) ÷ (30 \times 2) = 50 ÷ a \times a\)

n) \((1500 \times a) ÷ (30 \times a) = 50 ÷ a \times a\)

o) \((1500 ÷ 2) ÷ (30 ÷ 2) = 50 ÷ a \times a\)

p) \((1500 ÷ a) ÷ (30 ÷ a) = 50 ÷ a \times a\)

3. Calculator not allowed

KS2A 1999 Q.23

Calculate \(286 \times 53\)

Show your working. You may get a mark.

\[
\begin{array}{c}
2 & 8 & 6 \\
\times & 5 & 3 \\
\hline
8 & 5 & 8 \\
1 & 4 & 3 & 0 & 0 \\
1 & 5 & 1 & 5 & 8 \\
\hline
15158
\end{array}
\]

[2 marks]

4. What is the greatest 3-digit natural number in which the **product** of its digits is 108?

\[
962
\]
1. Do each calculation in two different ways.
   a) \(720 - (320 + 150) = 720 - 320 - 150 = 400 - 150 = 250\)
      or \(= 720 - 470 = 250\)
   b) \(720 - (320 - 150) = 720 - 320 + 150 = 400 + 150 = 550\)
      or \(= 720 - 170 = 550\)
   c) \(40 \times (11 + 29) = 40 \times 1 + 40 \times 29 = 440 + 1160 = 1600\)
      or \(= 40 \times 40 = 1600\)
   d) \((300 - 270) \times 7 = 300 \times 7 - 270 \times 7 = 2100 - 1890 = 210\)
      or \(= 30 \times 7 = 210\)
   e) \((90 + 60) \div 15 = 90 \div 15 + 60 \div 15 = 6 + 4 = 10\)
      or \(= 150 \div 15 = 10\)
   f) \(500 \div (20 \times 5) = 500 \div 20 \div 5 = 25 \div 5 = 5\)
      or \(= 500 \div 100 = 5\)

2. Compare the amounts. Fill in the missing signs. (<, > or =)
   a) \(\frac{1}{2}\) of 60 \(=\) 50% of 60
   b) 40% of 50 m \(=\) 20% of 100 m
   c) \(\frac{3}{4}\) of £100 \(>\) 70% of £100
   d) 30% of 90 kg \(<\) 20% of 150 kg
   e) 20% of 5 km \(=\) \(\frac{2}{10}\) of 5 km
   f) \(\frac{3}{5}\) of £70 \(<\) 60% of £75
   g) 75% of 2 litres \(<\) 1.75 litres
   h) \(\frac{1}{10}\) of 42 km \(>\) 0.42 km
   i) 105% of 10 litres \(<\) \(\frac{1}{5}\) of 10 litres \(>\) 10.5 litres

3. What is the greatest 3-digit, natural number in which the product of its digits is 72?
   Check: 942

4. In a **magic square**, the sum of the numbers in each row, column and diagonal is the same. Complete these magic squares.
   a) \[
   \begin{array}{ccc}
   6 & 11 & 7 \\
   9 & 8 & 7 \\
   9 & 5 & 10 \\
   \end{array}
   \]
   b) \[
   \begin{array}{ccc}
   10 & 3 & 8 \\
   5 & 7 & 9 \\
   6 & 11 & 4 \\
   \end{array}
   \]
   c) \[
   \begin{array}{ccc}
   14 & 7 & 12 \\
   9 & 11 & 13 \\
   10 & 15 & 8 \\
   \end{array}
   \]

Page 160
These are the times when letters are collected from a post box.

<table>
<thead>
<tr>
<th>Day</th>
<th>Monday to Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9 am</td>
<td>11.30 am</td>
<td>No collection</td>
</tr>
<tr>
<td></td>
<td>2 pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.30 pm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is the latest time that letters are collected on **Wednesdays**? **6.30 pm** [1 mark]

Carla posts a letter at **10 a.m. on Monday**. How **long** will it be before it is collected?

Gareth posts a letter on **Saturday at 4 p.m.**. When will it be collected from the post box? **Monday at 9 am** [1 mark]

This diagram shows the distances of different towns from Birmingham.

Write the name of a town which is between **30 and 50 miles** from Birmingham.

**Derby or Stoke** [1 mark]

Use the diagram to estimate the distance in **miles** from Birmingham to Mansfield.

**e.g. 62 miles** [1 mark]

Emma parks her car at **9.30 am**. She collects the car at **1.20 pm**. How much does she pay?

**£1.70** [1 mark]

Dan and Mark both use the car park.

Dan says, 'I paid exactly twice as much as Mark but I only stayed 10 minutes longer.'

In your exercise book, explain how Dan could be correct.

**e.g.** 'Mark could have parked for 1 hour 54 minutes and paid 50 p, and Dan could have parked for 2 hours 4 minutes and paid £1.00.' [1 mark]

Here is a sketch of a triangle. It is not drawn to scale.

Draw the full size triangle **accurately**. Use an angle measurer (**protractor**) and a ruler.

**[2 marks]**
1

KS2A 1999
Q 2

The line on the grid is one side of a square.
On the grid, draw the other three sides of the square.
Use a ruler.

[1 mark]

2

Group these plane shapes by listing their numbers.

<table>
<thead>
<tr>
<th>Triangles</th>
<th>Quadrilaterals</th>
<th>Has at least 1 right angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 6, 8, 12</td>
<td>1, 3, 4, 5, 7, 10, 11, 14</td>
<td>4, 6, 7, 8, 10, 13, 14</td>
</tr>
</tbody>
</table>

3

Decide whether the statements are true or false, then list their letters below.

a) All rectangles are quadrilaterals. True: a, d, f, h, i
b) All quadrilaterals are rectangles. False: b, c, e, g, j
c) Every quadrilateral is a rectangle but not every rectangle is a quadrilateral. False: f
d) The diagonals of a rectangle are equal in length. True: T
e) The adjacent sides of any rectangle are equal to each other. False: F
f) The opposite sides of any rectangle are equal and parallel to each other. True: T
g) Every trapezium has only 1 pair of parallel sides. False: F
h) Every quadrilateral which has parallel sides is a trapezium. True: T
i) All quadrilaterals with equal angles are rectangles. True: a, d, f, h, i
j) There is a trapezium with equal sides which is not a rhombus. False: b, c, e, g, j

4

KS2B 1999
Q 6

Here are five shapes on a square grid.

Write in the missing letters.

Shape C has 2 pairs of parallel sides. [1 mark]
Shape A is a pentagon. [1 mark]
Shape E has reflective symmetry. [1 mark]
Use a ruler to draw the reflection of this shape in the mirror line.
You may use a mirror or tracing paper.

2 marks

Draw mirror lines on the diagrams which have reflective symmetry.

Draw the reflection of each shape in its mirror line.

Following the instructions:

A (1, 1); B (3, 1)
C (3, 5); D (1, 3)

a) A' (1, -1); B' (3, -1)
C' (3, -5); D' (1, -3)

b) A'' (-1, -1); B'' (-3, -1)
C'' (-3, -5); D'' (-1, -3)

c) A''' (7, -1); B''' (5, -1)
C''' (5, -5); D''' (7, -3)

d) A* (-1, 1); B* (-1, 3)
C* (-5, 3); D* (-3, 1)
Fill in the missing coordinates.

A (1, 1)  A' (2, 2)
B (5, 1)  B' (10, 2)
C (3, 3)  C' (6, 6)
D (1, 3)  D' (2, 6)

What do you notice about the shapes? e.g.
- A'B'C'D' ≅ A''B''C''D'', ABCD ~ A'B'C'D' ~ A''B''C''D''
- ABCD has been enlarged by 2 times and then translated by 1 unit to the right and 1 unit up to form A'B'C'D'.
- A'B'C'D' has been rotated by 180° to form A''B''C''D'' or A'B'C'D' has been reflected in the origin to form A''B''C''D''

2

Calculator allowed

KS2B
1999
Q.14

What is the length of the model? Give your answer in centimetres, correct to one decimal place.

8.7 cm [1 mark]

The height of the model is 2.9 centimetres. The height of the real car is 50 times the height of the model. What is the height of the real car? Give your answer in metres.

Show your method. Height of real car 2.9 cm × 50 = 29 cm × 5 = 145 cm = 1.45 m

You may get a mark.

1.45 m [2 marks]

Solve the problem in your exercise book.

The lengths of the sides of a rectangle are whole centimetres. The perimeter of the rectangle is 20 cm.

a) How many different such rectangles are possible? 5 Give the length of their sides.

P = 2 × (a + b) = 20 cm, so a + b = 20 cm ÷ 2 = 10 cm

b) Which of them has the smallest and greatest areas and what are these areas?

i) Smallest possible area: a = 1 cm, b = 9 cm

A = 1 cm × 9 cm = 9 cm²

ii) Greatest possible area: a = 5 cm, b = 5 cm

A = 5 cm × 5 cm = 25 cm²
1

Decide whether the statements are **true** or **false**. Write T or F in the boxes.

a) All squares are rectangles.   **T**  
b) All squares are parallelograms.   **T**  
c) The diagonals of any parallelogram are not equal in length.    **F**  
d) Every parallelogram which has perpendicular diagonals is a square.    **F**  
e) Not every parallelogram with equal sides is a square.    **T**  
f) A parallelogram with equal sides and equal angles is a square.    **T**

2

Follow these instructions.

a) to c)

![Graph with points A, B, C, D, E, F, G, H, I, J and distances between them.]

d) Which single transformation will take shape 1 to shape 3?

*Rotation by 180° around the origin*  or  *Reflection in the origin*

3

A travelling salesman is planning his weekly trip to all the towns on this map.

On the map, the letters are the towns, the lines are the roads and the numbers are the distances in km between towns.

The salesman must start and finish at A and must visit every town at least once.

a) Several possible routes:

   e.g. visiting every town apart from A only once:  **ABFDEHIJGCA**

   Total distance:
   
   \[26 + 24 + 11 + 10 + 9 + 22 + 25 + 18 + 27 + 14 = 186 \text{ km}\]

b) Shortest possible distance:

   **ABEDFIJGHECA**

   Total distance:
   
   \[26 + 20 + 10 + 11 + 12 + 25 + 18 + 13 + 9 + 19 + 14 = 177 \text{ km}\]

   (This route visits E twice but is valid as the salesman must visit every town at least once.)
1

Draw **one line** from each shape to the rectangle which has the **same area**.

![Diagram of shapes with one line drawn to the rectangle](image)

[2 marks]

2

On the grid, draw a **triangle** which has the **same area** as the shaded rectangle.

![Diagram of triangles](image)

[1 mark]

3

Lindy has 4 triangles, all the same size. She uses them to make a star.

![Diagram of star](image)

Calculate the **perimeter** of the star. **Show your method. You may get a mark.**

\[
P = 7 + 13 + 7 + 13 + 7 + 13 + 7 + 13 \\
= 4 \times (7 + 13) \\
= 4 \times 20 \\
= 80 \text{ cm}
\]

[2 marks]

4

The numbers represented by the square must be even and greater than 6. List all the numbers which make the inequality true.

\[
24 < (\square \div 2 - 3) \times 2 < 50
\]

\[
: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54
\]
1

**KS2A 1999 Q.13**

**Calculator not allowed**

This cuboid is made from centimetre cubes. It is 4 cm by 3 cm by 2 centimetres. What is the **volume** of the cuboid?

| 24 cm³ | **[1 mark]** |

Another cuboid is made from centimetre cubes. It has a volume of **30 cubic centimetres**. What could the **length**, **height** and **width** be?

| length: 2 cm | height: 5 cm | width: 3 cm | **[1 mark]** |

2

**a)** Draw the net of a cuboid with sides 4 cm, 3 cm, and 2 cm.

**e.g.**

**b)** Calculate its surface area.

\[
A = 2 \times (4 \times 3 + 2 \times 3 + 4 \times 2) = 2 \times (12 + 6 + 8) = 2 \times 26 = 52 \text{ (cm}^2\text{)}
\]

3

**HMC 2002, II Age 10**

Use each of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 **only once** to make **five** whole numbers, so that one number is twice, another number is three times, another number is four times and the last number is five times the smallest number.

| 18, 36, 54, 72, 90 | **Check:** | 18 \times 2 = 36  |
| 18 \times 3 = 54  |
| 18 \times 4 = 72  |
| 18 \times 5 = 90  | ✔ |

Page 167
1. **Calculator not allowed**

This table shows the cost of sending a letter.

Paul is sending a letter.

It costs **38 p second class**.

How much would it cost him to send it **first class**?

<table>
<thead>
<tr>
<th>Mass</th>
<th>First class</th>
<th>Second class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 60 g</td>
<td>26</td>
<td>20</td>
</tr>
<tr>
<td>61 g to 100 g</td>
<td>39</td>
<td>31</td>
</tr>
<tr>
<td>101 g to 150 g</td>
<td>49</td>
<td>38</td>
</tr>
<tr>
<td>151 g to 200 g</td>
<td>60</td>
<td>45</td>
</tr>
<tr>
<td>201 g to 250 g</td>
<td>70</td>
<td>55</td>
</tr>
</tbody>
</table>

Jenny has a letter with a mass of **170 g**.

What does it cost to send it **first class**?

![Cost Chart]

2. **Calculator not allowed**

Five children collect money to plant trees.

Here is a bar chart of the amounts they have raised so far.

Their target is **£40 altogether**.

How much **more** money do they need to reach the target?

Show your **working** in your exercise book.

![Bar Chart]

3. **Tom, Amy and Helen want to go on a boat trip. There are three boats.**

![Boats]

**Lark**
- 50 minute trip
- Tickets £2.75 each

**Heron**
- 70 minute trip
- Tickets £3.50 each

**Kestrel**
- 90 minute trip
- Tickets £4.20 each

How much does it cost altogether for **three** people to go on the **Lark**?

![Tickets]

Tom and Amy go on the **Heron**. They leave at **2.15 pm**.

At what **time** do they return?

Helen goes on the **Kestrel** and gets back at **4.15 pm**.

At what time did the boat leave?

![Boat]

4. **The inner ring on this spinner is divided into 12 equal sections.**

a) On which number is the pointer most likely to stop?

Explain your answer in your exercise book.

![Spinner]

b) What is the probability of getting an even number?
1

Rob has some number cards. He holds up a card. He says, ‘If I multiply the number on this card by 5, the answer is 35.’

What is the number on the card?

He holds up a different card. He says, ‘If I divide the number on this card by 6, the answer is 4.’

What is the number on the card?

2

August 1998

<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
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<tr>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
</tr>
</tbody>
</table>

Here is the calendar for August 1998.

Simon's birthday is on **August 20th**.

In 1998 he had a party on the **Sunday after** his birthday.

What was the **date** of his party?

Tina's birthday is on **September 9th**.

On what **day of the week** was her birthday in 1998? **Wednesday**

3

The same number is missing from each box. Write the missing numbers in the boxes.

\[ 11 \times 11 \times 11 = 1331 \]  

[1 mark]

4

Parveen buys **3 small bags of peanuts**. She gives the shopkeeper £2 and gets **80 p** change. What is the cost in **pence** of one bag of peanuts?

*Show your working in your exercise book.*

[2 marks]

5

Kalid makes a sequence of numbers. The first number is 2. The last number is 18. His rule is to add the **same amount** each time. Write in the missing numbers.

[1 mark]

6

In the year 2002, a man's age in years was equal to the sum of the digits of the year in which he was born. How old was he in 2002?

[1 mark]
1. On the grid, draw 3 different rectangles which have the same area as the shaded triangle. Calculate the **perimeter** of each rectangle.

![Grid with shaded triangle and rectangles](image)

What are the lengths of the sides of the rectangle which has the shortest possible perimeter? 

\[ a = \boxed{5}, \quad b = \boxed{2} \]

or vice versa

\[ P = 14 \text{ units} \]

2. The numbers represented by the square must be a multiple of 3 and greater than 12. List all the natural numbers which make the inequality true.

\[ 11 < (\square \div 3 - 4) \times 3 < 31 \]

\[ \square : 24, 27, 30, 33, 36, 39, 42 \quad \text{(multiples of 3)} \]

3. How many triangles can you see in each of these diagrams?

a) ![Triangle with 1 triangle](image)  
b) ![Triangle with 8 triangles](image)  
c) ![Triangle with 27 triangles](image)

How many triangles do you think will be in the next triangle in the sequence? **64** triangles

4. Which of the numbers 1 to 9 should be written in each square so that the **sum** of the four 2-digit numbers formed (two across and two down) is 67? (You may repeat a digit.)

![Number grid with 1, 1, 2, 7](image)

5. Continue the sequence in both directions. Write the rule.

a) \[ 0.01, 0.05, 0.25, 1.25, 6.25, 31.25, 156.25, 781.25 \quad [\text{Rule: } \times 5] \]

b) \[ 0.01, 0.03, 0.09, 0.27, 0.81, 2.43, 7.29, 21.87 \quad [\text{Rule: } \times 3] \]
Milly and Ryan play a number game: *What's my number?*

**Milly**

- *Is it under 20?* Yes
- *Is it a multiple of 3?* Yes
- *Is it a multiple of 5?* Yes

**Ryan**

- *What is the number?* 15

Milly and Ryan play the game again.

**Ryan**

- *Is it under 20?* No
- *Is it under 25?* Yes
- *Is it odd?* Yes
- *Is it a prime number?* Yes

**Milly**

- *What is the number?* 23

Here are two bags.

Each bag has **3 white balls** and **one black ball** in it.

A ball is taken from **one of the bags** without looking.

What is the probability that it is a **black ball**?

Give your answer as a fraction.

All the balls from both bags are now mixed together in a new bag.

Put a **cross** (x) on this line to show the probability of taking a **black ball** from the new bag.

\[ p(\text{black}) = \frac{2}{8} = \frac{1}{4} \]

Write the positive whole numbers which are not greater than 20 in the Venn diagram.

List the whole numbers greater than 500 and less than 900 in which the digits are increasing. Try it out in your exercise book first.

- 567, 568, 569, 578, 579, 589; 678, 679, 689; 789 (10)

When we add two numbers from four natural numbers, the sums are: 3, 3, 4, 5, 6 and 6. What are the four numbers? 1, 2, 2, 4
Extra questions

1. Factorise 172 and list its positive factors.

\[ 172 = 2 \cdot 86 = 2 \cdot 2 \cdot 43 \]

Positive factors: 1, 2, 4, 43, 86, 172

2. The digits of a 4-digit number greater than 5000 follow each other in increasing order. Another 4-digit number has those digits too, but in decreasing order. A third 4-digit number has those digits too.

What are the three numbers if we know that their sum is 26352?

\[
\begin{array}{cccc}
5678 & 5679 & 5689 & 5789 \\
8765 & 9785 & 9865 & 9875 \\
+ 9 & + 8 & + 8 & + 9687 \\
26352 & 26352 & 26352 & 26352 \\
\end{array}
\]

3. We want to place 12 spotlights in the ceiling so that they are in 6 straight lines and there are 4 spotlights in each line. Draw different arrangements.

- e.g.

4. The edges of a cube are to be coloured either red or blue so that each face has at least one red edge. What is the least number of edges which should be coloured red?

Draw a diagram to show your answer.

3 edges coloured red are enough.

5. Each diagram is the map of a field in which there are 4 wells. Show how the field could be divided into 4 congruent parts so that each part has exactly one well.

(Only the grid lines shown on the diagrams are to be used.)

(a) (b)
1 Fill in the missing numbers so that the product of any two adjacent numbers is the number directly above them.

\[
\begin{array}{ccc}
9000 & 60 & 150 \\
6 & 10 & 15 \\
3 & 2 & 5 & 3
\end{array}
\]

2 Sannir spins a fair coin and records the results. In the first four spins, 'heads' comes up each time.
Sannir says, 'A head is more likely than a tail.'
Is he correct? Circle Yes or No.
Give a reason for your answer.
e.g. He is not correct because there are 2 possible outcomes, a head or a tail, and as the coin is fair, each outcome is equally likely.

3 A shop sells sheets of sticky labels.
On each sheet there are 36 rows and 18 columns of labels.
How many labels are there altogether in 45 sheets?
Show your method. You may get a mark.

Plan: \(36 \times 18 \times 45 = 29160\)
on each sheet
C:
\[
\begin{array}{c}
36 \times 18 \times 45 = 29160
\end{array}
\]

29160 labels on 45 sheets

4 Harry has six tins of soup.
The labels have fallen off.
Here are the labels and tins.

Harry chooses a tin.
What is the probability that it is a tin of Pea Soup?
Give your answer as a fraction.
What is the probability that the tin he chooses is not a tin of Tomato Soup? Give your answer as a fraction.

\[
\begin{array}{c}
\frac{2}{6} = \frac{1}{3}
\end{array}
\]  

\[
\begin{array}{c}
\frac{4}{6} = \frac{2}{3}
\end{array}
\]
Factorise 174 and list its positive factors.

\[ 174 = 2 \cdot 3 \cdot 29 \]

Positive factors: 1, 2, 3, 6, 29, 58, 87, 174

Freddy Fox decided that from that day forward he would always tell the truth on Mondays, Wednesdays and Fridays but he would always tell lies on the other days of the week.

One day he said, 'Tomorrow I will tell the truth.'

On which day of the week do you think he said this? Saturday

Two barrels of equal size contain oil. One of the barrels is full and the other is half full. Their masses are 86 kg and 53 kg.

What is the mass of an empty barrel?

20 kg

Andy, Betty, Cindy and Danny are walking down a mountain and need to go through a narrow, dark tunnel but have to overcome these difficulties.

- They have a torch which has only 12 minutes of power left.
- Andy is able to walk through the tunnel in 1 minute, Betty in 2 minutes, Cindy in 4 minutes and Doris in 5 minutes.
- They are all scared of the dark, so each of them will need the torch.
- The tunnel is so narrow that only 2 of them can walk through it at the same time.

Is it possible for them all to get through the tunnel?

Yes, they could all get through the tunnel.

A + B go through at the same time (2 minutes)
A returns with the torch. (1 minute)
C + D go through at the same time. (5 minutes)
B returns with the torch. (2 minutes)
A and B go through together. (2 minutes)

Total time: 12 mins

Write the natural numbers from 1 to 9 into a 3 by 3 grid so that:

- the sum of the 3-digit numbers formed in the top and middle rows is equal to the 3-digit number in the bottom row;
- the sum of the 3-digit numbers formed in the left and middle columns is equal to the 3-digit number formed in the right column.

\[
\begin{array}{ccc}
1 & 5 & 7 \\
4 & 8 & 2 \\
6 & 3 & 9 \\
\end{array} \quad \begin{array}{ccc}
7 & 1 & 8 \\
2 & 3 & 6 \\
9 & 5 & 4 \\
\end{array}
\]

e.g.
Use each of the natural numbers from 1 to 16 only **once** to form 8 pairs of numbers so that the sum of each pair is a **square** number.

For example, \( (2, 14) \) is a possible pair, as \( 2 + 14 = 16 = 4 \cdot 4 \)

\[
(16, 9), \quad (15, 10), \quad (14, 11), \quad (13, 12), \quad (8, 1), \quad (7, 2), \quad (6, 3), \quad (5, 4)
\]

[All sum to 25 = \( 5^2 \)]

[All sum to 9 = \( 3^2 \)]

2. A group of boys and girls were all brothers and sisters from the same family. Each boy had as many sisters as he had brothers. Each girl had half as many sisters as she had brothers.

How many girls and boys were in the group?

<table>
<thead>
<tr>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

3. A school had a class reunion. Five old friends, *Amy, Bill, Carrie, Dan* and *Eddie* met up again for the first time since they had left school and found out that:

- they lived in different countries: Finland, Greece, Holland, Ireland and Japan;
- they had different jobs: engineer, lawyer, teacher, doctor and model;
- one had 4 children, one had 3 children, one had 2 children, one had 1 child and one had no children.

During the conversation, they also found out that:

- The lawyer was living in Japan.
- *Bill* was living in Greece and had 2 children.
- *Amy* had no children.
- The doctor lived in Finland and had some children.
- *Dan* was an engineer living in Holland.
- *Eddie* did not have 4 children.
- *Carrie* was a model and had one child.

Use the information to answer these questions.

a) How many children had the person living in Holland? 4

b) Where was *Eddie* living? Finland

c) What was the name of the lawyer? *Amy*

d) How many children did the doctor have? 3

e) What was *Bill*'s job? Teacher

4. A lock on a safe needs a 6-letter code to open it. The code uses each of the letters A to F only once. Jim tried to guess the code. Here are his guesses.

If we know that each of the 6 letters is in the correct place once in Jim's guesses and that the code starts with A, what is the code?

**Jim's guesses**

- CBADFE  (1 letter is correct)
- AEDCBF  (2 letters are correct)
- EDFACB  (3 letters are correct)

**Code:** A E F D C B