Mental Arithmetic Questions

1. What number is five cubed?

2. A circle has radius $r$. What is the formula for the area of the circle?

3. Jenny and Mark share some money in the ratio two to three. Jenny’s share is one hundred and ten pounds. How much is Mark’s share?

4. The net of a triangular prism is made from triangles and rectangles. How many of each shape are needed?

5. Multiply minus six by minus two.
**Percentage change**

(a) One calculation below gives the answer to the question

What is 70 increased by 9%?

Tick (√) the correct one.

- $70 \times 0.9$
- $70 \times 1.9$
- $70 \times 0.09$
- $70 \times 1.09$

1 mark

Choose one of the other calculations.

Write a question about percentages that this calculation represents.

Calculation chosen: .....................

Question it represents:

1 mark

Now do the same for one of the remaining two calculations.

Calculation chosen: .....................

Question it represents:

1 mark

(b) Fill in the missing decimal number.

To decrease by 14%, multiply by

1 mark

**Coffee**

A cup of coffee costs £1.75

The diagram shows how much money different people get when you buy a cup of coffee.

Cup of coffee costs £1.75

Retailers get 44p
Growers get 5p
Others get £1.26

(a) Complete the table to show what percentage of the cost of a cup of coffee goes to retailers, growers and others.

Show your working.

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retailers</td>
<td></td>
</tr>
<tr>
<td>Growers</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

2 marks
Mental Arithmetic Questions

1. What is one third of three-quarters of one hundred?

2. I’m thinking of a number. I call it n. I square my number and then add 4. Write an expression to show the result.

3. Twenty-one out of thirty-six pupils said they watched Top of the Pops. What angle on a pie chart would show this?

4. There are seven red and three blue balls in a bag. I am going to take a ball out of the bag at random. What is the probability that the ball will be blue?

5. Write a multiple of three that is bigger than one hundred.
Powers

(a) Write the values of $k$ and $m$.

\[ 64 = 8^2 = 4^k = 2^m \]

\[ k = \ldots \ldots \ldots \ldots \]

\[ m = \ldots \ldots \ldots \ldots \]

(b) Complete the following:

\[ 2^{15} = 32\,768 \]

\[ 2^{14} = \ldots \ldots \ldots \ldots \]

Squares

Some numbers are smaller than their squares.

For example: $7 < 7^2$

Which numbers are equal to their squares?
Mental Arithmetic Questions

1. I am thinking of a number. I call it \( n \).
   I double my number then I subtract three.
   Write an expression to show the result.

2. What percentage of fifty pounds is thirty-five pounds?

3. On average, the driest place on earth gets only nought point five millimetres of rain every year.
   In total, how much rain would it expect to get in twenty years?

4. To the nearest whole number, what is the square root of eighty-three point nine?

5. It takes me one and a half minutes to swim one length of the pool.
   How many lengths can I swim in fifteen minutes?
Pentagonal pyramid

The diagram shows the net for a right-pyramid with a regular pentagon as its base.

The net is constructed using five straight lines.

(a) Without measuring, explain why angle \( a \) must be 108°

(b) Calculate the size of angle \( b \).

You must show your working.

(c) On these nets, the point marked P lies on the perpendicular bisector of a side of the pentagon.

On side CD of the regular pentagon below, use compasses and a straight edge to construct the perpendicular bisector.

You must leave in your construction lines.
Mental Arithmetic Questions

1. Tariq won one hundred pounds in a maths competition. He gave two-fifths of his prize money to charity. How much of his prize money, in pounds, did he have left?

2. What is three point nine divided by two?

3. The instructions for a fruit drink say to mix one part blackcurrant juice with four parts water. I want to make one litre of this fruit drink. How much blackcurrant juice should I use? Give your answer in millilitres.

4. What is half of two-thirds?

5. The population of the United Kingdom is about fifty-nine million. Write this number in figures.
Running machine

Kali uses a running machine to keep fit.

The simplified distance-time graph shows how she used the machine during one run.

(a) Between 0930 and 0940, what was her speed in kilometres per hour?

…………… km/h 1 mark

(b) Throughout the run, for how many minutes did she travel at this speed?

………………… minutes 1 mark

(c) At 0940, she increased her speed.
By how many kilometres per hour did she increase her speed?

………………… km/h 1 mark

(d) On another day, Kali started running at 0935.
She ran for 24 minutes at a constant speed of 10 kilometres per hour.

Show this information on the graph on the opposite page.
Show any working in the space below. 2 marks
Mental Arithmetic Questions

1. What is three-fifths of forty pounds?

2. The longest bone in the human body is in the leg. The average length of this bone in a man is fifty centimetres. In a woman it is ten per cent less. What is the average length of this bone in a woman?

3. Using three as an approximation for pi, what is the area of a circle with radius five centimetres?

4. I am thinking of a two-digit number that is a multiple of eight. The digits add up to six. What number am I thinking of?

5. I am thinking of a number. I call it \( n \). I add five to my number. Write an expression to show the result.
**Loci**

The diagram below shows two points A and B that are 6 cm apart.

Around each point are six circles of radius 1 cm, 2 cm, 3 cm, 4 cm, 5 cm and 6 cm. Each circle has either A or B as its centre.

(a) On the diagram, mark with a cross any points that are 4 cm away from A and 4 cm away from B.

(b) Now draw the locus of all points that are the same distance from A as they are from B.

1 mark

**Rearrange**

The subject of the equation below is $p$

$$ p = 2(e + f) $$

Rearrange the equation to make $e$ the subject.

$$ e = $$

2 marks
Mental Arithmetic Questions

1. Five percent of a number is 8. What is the number?

2. A fair spinner has eight equal sections with a number on each section. Five of them are even numbers. Three are odd numbers. What is the probability that I spin an even number?

3. I can make a three-digit number from the digits two, three and four in six different ways. How many of these three-digit numbers are even?

4. What is the volume of a cuboid measuring five centimetres by six centimetres by seven centimetres?

5. What is the remainder when you divide three hundred by twenty-nine?
Evens or Odds

(a) \( m \) is an odd number.

Which of the numbers below must be even, and which must be odd?

Write 'odd' or 'even' under each one.

\[ \begin{array}{c|c|c|c}
2m & m^2 & 3m - 1 & (m - 1)(m + 1) \\
\hline
\text{odd} & \text{odd} & \text{odd} & \text{odd} \\
\end{array} \]

(b) \( m \) is an odd number.

Is the number \( \frac{m + 1}{2} \) odd, or even, or is it not possible to tell?

Tick (✓) the correct box.

\[ \begin{array}{c|c|c}
\text{odd} & \text{even} & \text{not possible to tell} \\
\end{array} \]

Explain your answer.

Factors again

(a) Ring the expression below that is the same as \( y^2 + 8y + 12 \)

\[ \begin{array}{c|c}
(y + 3)(y + 4) & (y + 7)(y + 1) \\
(y + 2)(y + 6) & (y + 1)(y + 12) \\
(y + 3)(y + 5) & \\
\end{array} \]

(b) Multiply out the expression \((y + 9)(y + 2)\)

Write your answer as simply as possible.

\[ \begin{array}{c}
\text{odd} & \text{even} & \text{not possible to tell} \\
\end{array} \]

Explain your answer.
Mental Arithmetic Questions

1. Twenty-five per cent of a number is seven. What is the number?

2. There are fourteen girls and thirteen boys in a class. What is the probability that a pupil chosen at random will be a girl?

3. The first even number is two. What is the hundredth even number?

4. The mean of two numbers is 8. One of the numbers is two. What is the other number?

5. How many edges are there on a square based pyramid?
**Television**

A headteacher wants to choose a pupil from year 7, 8 or 9 to appear on television.

The headteacher gives each pupil one ticket.

Then she will select the winning ticket at random.

The table shows information about the ticket used.

<table>
<thead>
<tr>
<th>Colour of the ticket</th>
<th>Numbers used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 7</td>
<td>red</td>
</tr>
<tr>
<td></td>
<td>1 to 80</td>
</tr>
<tr>
<td>Year 8</td>
<td>blue</td>
</tr>
<tr>
<td></td>
<td>1 to 75</td>
</tr>
<tr>
<td>Year 9</td>
<td>yellow</td>
</tr>
<tr>
<td></td>
<td>1 to 90</td>
</tr>
</tbody>
</table>

(a) What is the probability that the winning ticket will be blue?

(b) What is the probability that the winning ticket will show number 39?

(c) The headteacher selects the winning ticket at random. She says:

‘The winning ticket number is 39’.

What is the probability that this winning ticket is blue?

---

**Angles**

This pattern has rotation symmetry of order 6

(a) What is the size of angle $w$?

Show your working.

(b) Each quadrilateral in the pattern is made from two congruent isosceles triangles.

What is the size of angle $y$? Show your working.
Mental Arithmetic Questions

1. Multiply 8.7 by 2

2. A bat flies at an average speed of 32 kilometres an hour. At this speed, how far will it fly in 15 minutes?

3. Multiply the brackets \((2x +1) (x – 1)\)

4. I’m thinking of a number. I call it \(t\). I half it and subtract five. Write an expression to show the result.

5. The first odd number is 1. What is the hundredth odd number?
Owls
Owls eat small mammals. They regurgitate the bones and fur in balls called pellets.

The table shows the contents of 62 pellets from long-eared owls.

<table>
<thead>
<tr>
<th>Number of mammals found in the pellet</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>9</td>
<td>17</td>
<td>24</td>
<td>6</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

(a) Show that the total number of mammals found is 170

(b) Calculate the mean number of mammals found in each pellet.
Show your working and give your answer correct to 1 decimal place.

(c) There are about 10,000 long-eared owls in Britain. On average, a long-eared owl regurgitates 1.4 pellets per day. Altogether, how many mammals do the 10,000 long-eared owls eat in one day? Show your working and give your answer to the nearest thousand.

---

Rectangle rest

The diagram shows a rectangle that just touches an equilateral triangle.

(a) Find the size of the angle marked \( x \) 
Show your working.

(b) Now the rectangle just touches the equilateral triangle so that \( ABC \) is a straight line.

Not drawn accurately

\( x \)

\( 20^\circ \)

\( A \quad B \quad C \)

Show that triangle BDE is isosceles.
Mental Arithmetic Questions

1. Add four to minus five.

2. What number should you add to minus three to get the answer five?

3. How many nought point fives are there in ten?

4. On average, the driest place on earth gets only nought point five millimetres of rain every year. In total, how much rain would it expect to get in twenty years?

5. What is the sum of the angles in a rhombus?
True or false

(a) Pupils started to solve the equation $6x + 8 = 4x + 11$ in different ways.

For each statement below, tick (✓) True or False.

<table>
<thead>
<tr>
<th>6x + 8 = 4x + 11</th>
<th>6x + 8 = 4x + 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>so 14x = 15x</td>
<td>so 6x + 4x = 11 + 8</td>
</tr>
<tr>
<td>✓ True</td>
<td>✓ True</td>
</tr>
<tr>
<td>□ False</td>
<td>□ False</td>
</tr>
</tbody>
</table>

3 marks

(b) A different pupil used trial and improvement to solve the equation $6x + 8 = 4x + 11$

Explain why trial and improvement is not a good method to use.

1 mark

Giraffe

A book gives this information:

A baby giraffe was born that was 1.58 metres high. It grew at a rate of 1.3 centimetres every hour.

Suppose the baby giraffe continued to grow at this rate.

About how many days old would it be when it was 6 metres high? Show your working.

... days old

3 marks
Mental Arithmetic Questions

1. It takes someone one and a half minutes to swim the length of the pool. How many lengths can I swim in 15 minutes?

2. Multiply minus eight by minus three.

3. If $4x + 3 = 23$, what is the value of $x$?

4. I have a fair eight-sided dice numbered 12 to 19. What is the probability that I will throw a prime number?

5. What must I multiply $n$ squared by to get $n$ cubed?
An animal has a body length of 228 mm, and foot length of 22 mm.

Is this animal likely to be one of these species of rodents?

Tick (✓) Yes or No.

[ ] Yes [ ] No

Explain your answer.

---

People who live to be 100 years old are called centenarians.

In 1998 there were 135,000 centenarians.

The ratio of male to female was 1 : 4

How many female centenarians were there in 1998?

Show your working.

---

What does the scatter graph tell you about the **type of correlation** between the body length and foot length for these rodents?

**Type of correlation**:

(a) **What does the scatter graph tell you about the type of correlation** between the body length and foot length for these rodents?

(b) **Draw a line of best fit** on the scatter graph.

(c) If body length increased by 50 mm, by approximately how many millimetres would you expect foot length to increase?

Ring the correct value below.

2 7 15 50

---

1 mark