Mathematics test

Paper 1
Calculator not allowed

Please read this page, but do not open your booklet until your teacher tells you to start. Write your name and the name of your school in the spaces below.

First name _____________________________
Last name ______________________________
School _________________________________

Remember
▪ The test is 1 hour long.
▪ You must not use a calculator for any question in this test.
▪ You will need: pen, pencil, rubber, ruler and a pair of compasses.
▪ Some formulae you might need are on page 2.
▪ This test starts with easier questions.
▪ Try to answer all the questions.
▪ Write all your answers and working on the test paper – do not use any rough paper. Marks may be awarded for working.
▪ Check your work carefully.
▪ Ask your teacher if you are not sure what to do.

________________________________________________________________________
For marker’s use only

Total marks ___________________________
Instructions

Answers
This means write down your answer or show your working and write down your answer.

Calculators
You must not use a calculator to answer any question in this test.

Formulae

You might need to use these formulae

Trapezium

Area = \( \frac{1}{2} (a + b)h \)

Prism

Volume = area of cross-section \( \times \) length
1. (a) P is the **midpoint** of line AB.

What are the coordinates of point P?

P is ( , )

1 mark

(b) Q is the **midpoint** of line MN.

The coordinates of Q are (30, 50)

What are the coordinates of points M and N?

M is ( , )

N is ( , )

1 mark
The diagram shows a square.

Two straight lines cut the square into four rectangles.

The area of one of the rectangles is shown.

Work out the area of the rectangle marked A.

………………. cm² 2 marks
3. (a) Look at this information.

Two numbers **multiply** to make zero.

One of the statements below is true. Tick (✓) the true statement.

- Both numbers must be zero.
- At least one number must be zero.
- Exactly one number must be zero.
- Neither number can be zero.

(b) Now look at this information.

Two numbers **add** to make zero.

If **one** number is **zero**, what is the other number?

If **neither** number is **zero**, give an example of what the numbers could be.
4. I join six cubes face to face to make each 3-D shape below.

Then I join the 3-D shapes to make a **cuboid**.

Draw this cuboid on the grid below.
5. How many eighths are there in one quarter?

Now work out \[\frac{3}{4} \div \frac{1}{8}\]

6. Solve this equation.

\[75 + 2t = 100 - 2t\]
7. This shape has been made from two congruent isosceles triangles.

What is the size of angle $p$?

$p = \ldots \ldots \degree$

2 marks
8. Bumps are built on a road to slow cars down.

The stem-and-leaf diagrams show the speed of 15 cars before and after the bumps were built.

<table>
<thead>
<tr>
<th>Key:</th>
<th>2</th>
<th>3 means 23mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td></td>
<td>After</td>
</tr>
<tr>
<td>2</td>
<td>7 8</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0 2 4</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>5 6 8 9</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>1 3 4 4 4</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

(a) Use the diagrams to write the missing numbers in these sentences.

**Before** the bumps:

The maximum speed was ............... mph, and

................. cars went at more than 30mph.

**After** the bumps:

The maximum speed was ............... mph, and

................. cars went at more than 30mph.

(b) Show that the median speed fell by 10mph.
9. The graph shows the straight line with equation \( y = 3x - 4 \)

(a) A point on the line \( y = 3x - 4 \) has an \( x \)-coordinate of 50.
What is the \( y \)-coordinate of this point?

(b) A point on the line \( y = 3x - 4 \) has a \( y \)-coordinate of 50.
What is the \( x \)-coordinate of this point?

(c) Is the point \((-10, -34)\) on the line \( y = 3x - 4 \)?

[ ] Yes [ ] No

Show how you know.
10. Here is an equation.

\[ x^y = 64 \]

Give four different pairs of values that satisfy this equation.

<table>
<thead>
<tr>
<th>First pair</th>
<th>( x = )</th>
<th>( y = )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second pair</td>
<td>( x = )</td>
<td>( y = )</td>
</tr>
<tr>
<td>Third pair</td>
<td>( x = )</td>
<td>( y = )</td>
</tr>
<tr>
<td>Fourth pair</td>
<td>( x = )</td>
<td>( y = )</td>
</tr>
</tbody>
</table>

3 marks
11. A teacher said to a pupil:

To the nearest per cent, \( \frac{1}{6} \) is 17%.

The pupil said:

So, to the nearest per cent, \( \frac{2}{6} \) must be 34%.

Show that the pupil is wrong.
12. Car tyres are checked for safety by measuring the tread.

The tread on a tyre and the distance travelled by that tyre were recorded for a sample of tyres. The scatter graph shows the results.

Tyres with a tread of less than 1.6mm are illegal.

Suppose the government changes this rule to less than 2.5mm.

(a) How many of these tyres would now be illegal?

(b) About how many fewer kilometres would you expect a tyre to last before it was illegal?
13. (a) In which triangle below does \( a^2 + b^2 = c^2 \)?

Tick (✓) the correct triangle.

For the other triangle, write an equation linking \( a, b \) and \( c \)

(b) In which triangle below does \( a^2 + b^2 = c^2 \)?

Tick (✓) the correct triangle.

For the other triangle, explain why \( a^2 + b^2 \) does not equal \( c^2 \).
14. Meg and Ravi buy sweet pea seeds and grow them in identical conditions.

**Meg’s results:**

<table>
<thead>
<tr>
<th>Number of packets</th>
<th>Number of seeds in each packet</th>
<th>Number of seeds that germinate from each packet</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>20</td>
<td>18, 17, 17, 18, 19</td>
</tr>
</tbody>
</table>

**Ravi’s results:**

<table>
<thead>
<tr>
<th>Number of packets</th>
<th>Number of seeds in each packet</th>
<th>Total number of seeds that germinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>20</td>
<td>170</td>
</tr>
</tbody>
</table>

(a) Using Meg’s results and Ravi’s results, calculate two different estimates of the probability that a sweet pea seed will germinate.

Using Meg’s results: .......................... 1 mark

Using Ravi’s results: .......................... 1 mark

(b) Whose results are likely to give the better estimate of the probability?

[ ] Meg’s  [ ] Ravi’s

Explain why. 1 mark
15. A three-digit number is multiplied by a two-digit number. How many digits could the answer have?

Write the minimum number and the maximum number of digits that the answer could have.

You must show your working.

minimum number of digits ...............  
maximum number of digits ...............  
2 marks
16. Solve these simultaneous equations using an algebraic method.

\[ 4x + 3y = 21 \]
\[ 2x + y = 8 \]

You must show your working.

\[ x = \ldots \ldots \ldots \ldots \ldots \ldots \]
\[ y = \ldots \ldots \ldots \ldots \ldots \ldots \]

3 marks
17. In the diagram, lines AB and AC are straight lines.

Using compasses and a straight edge, construct the angle bisector of angle BAC.

You must leave in your construction lines.
18. The diagram shows two shapes that are mathematically similar.

(a) What is the value of \( k \)?

(b) I want to draw another shape that is mathematically similar to the ones in the diagram, but of a different size.
   Give the length and width of a shape I could draw.

\[
\begin{align*}
\text{length} & \quad \text{cm} \\
\text{width} & \quad \text{cm}
\end{align*}
\]
19. The diagram shows the straight line with equation \( y = 4(x - 2) \)

(a) Work out the coordinates of the points marked A and B.

A is (\_\_\_\_, \_\_\_\_) \hspace{1cm} 1 mark

B is (\_\_\_\_, \_\_\_\_) \hspace{1cm} 1 mark

(b) A different straight line goes through the points (0, 0) and (3, 6)
Write the equation of this line.

\( y = \) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_}
20. Two groups of pupils collected a sample of acorns from the same oak tree.

The box plots summarise the two sets of results.

(a) Explain how the box plots show the median of group B is 3 mm more than the median of group A.

(b) Which group has the bigger inter-quartile range?

A  B

Explain your answer.

(c) The results from the two groups of pupils are very different.

Give a reason why the results might have been different.
21. (a) Show that \((4 \times 10^8) \times (8 \times 10^4) = 3.2 \times 10^{13}\)

(b) What is \((4 \times 10^8) \div (8 \times 10^4)\)?
   Write your answer in standard form.
22. Here is information about a data set.

There are 100 values in the set.
The median is 90
The mean is 95

I increase the highest value in the data set by 200

Now what are the median and the mean of the data set?

\[
\text{median} = \ldots \ldots \ldots \quad \text{mean} = \ldots \ldots \ldots
\]

2 marks
23. The diagram shows a sketch of a rhombus, side length 8 cm.

The length of one diagonal is 10 cm.

Use compasses and a straight edge to make an accurate drawing of the rhombus.

You can use the 8 cm and 10 cm lines to set your compasses.

You must leave in your construction lines.

8 cm

10 cm
24. In this question, \( a \) and \( b \) are numbers where \( a = b + 2 \).

The sum of \( a \) and \( b \) is equal to the product of \( a \) and \( b \).

Show that \( a \) and \( b \) are not integers.

3 marks
25. To change temperatures measured in °C to °F you can use an exact formula or an approximate formula.

\[
\begin{align*}
\text{Exact formula} & \quad F = \frac{9C}{5} + 32 \\
\text{Approximate formula} & \quad F = 2C + 30
\end{align*}
\]

F is the temperature in °F
C is the temperature in °C

At what temperature in °C do these formulae give an equal value for F?
You must show an algebraic method.
END OF TEST