Mathematics test

Paper 2
Calculator allowed

First name ________________________________

Last name ________________________________

School ________________________________

Remember
- The test is 1 hour long.
- You may use a calculator for any question in this test.
- You will need: pen, pencil, rubber, ruler and a scientific or graphic calculator.
- 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.
## Instructions

**Answers**

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

**Calculators**

You **may** 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. The diagram shows a right-angled triangle.

P, Q and R are the **midpoints** of the sides of the triangle.

Work out the coordinates of P, Q and R.

- P is (_____ , _____)  
- Q is (_____ , _____)  
- R is (_____ , _____)
2. The table shows information about the rainfall in two places in South America.

<table>
<thead>
<tr>
<th>Place</th>
<th>Season</th>
<th>Mean rainfall</th>
<th>Number of months</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Dry</td>
<td>10 cm per month</td>
<td>8</td>
<td>Jan to Aug</td>
</tr>
<tr>
<td></td>
<td>Wet</td>
<td>20 cm per month</td>
<td>4</td>
<td>Sept to Dec</td>
</tr>
<tr>
<td>B</td>
<td>Dry</td>
<td>5 cm per month</td>
<td>10</td>
<td>July to Apr</td>
</tr>
<tr>
<td></td>
<td>Wet</td>
<td>50 cm per month</td>
<td>2</td>
<td>May to June</td>
</tr>
</tbody>
</table>

Which of the places has more rainfall on average over the whole year?

Show working to explain your answer.

Tick (✓) your answer.

A   B

2 marks
3. The distance needed for a car to stop depends on how fast the car is travelling.

This distance can be calculated by adding the thinking distance and the braking distance.

For example: at 30 miles per hour

\[
\begin{align*}
\text{thinking distance} & = 30 \text{ feet} \\
\text{braking distance} & = 45 \text{ feet} \\
\text{total stopping distance} & = 75 \text{ feet}
\end{align*}
\]

Here are the formulae to work out the thinking distance and the braking distance for a car travelling at \( V \) miles per hour.

\[
\begin{align*}
\text{Thinking distance} & = V \text{ feet} \\
\text{Braking distance} & = \frac{V^2}{20} \text{ feet}
\end{align*}
\]

(a) A car is travelling at 70 miles per hour.

What is the total stopping distance for this car?

\[
\text{total stopping distance} = \quad \text{feet}
\]

2 marks

(b) A different car is travelling so that its braking distance is 125 feet.

How fast is the car travelling?

\[
\text{miles per hour} = \quad \text{miles per hour}
\]

1 mark
4. Shape A and shape B are each made from five identical squares.

The perimeter of shape A is 72 cm.

Work out the perimeter of shape B.

---

5. In one year, 2 million tonnes of glass bottles and jars were thrown away in the UK.

38% of these bottles and jars were recycled.

How many tonnes of the bottles and jars were recycled?

---
6. (a) Look at the equilateral triangle.
   Each angle in an equilateral triangle is 60°
   Explain why.

(b) Now look at this shape.
   Work out the sizes of angles $a$, $b$ and $c$

\[
\begin{align*}
a &= \_\_\_\_\_\_° \\
b &= \_\_\_\_\_\_° \\
c &= \_\_\_\_\_\_°
\end{align*}
\]
7. A teacher has five bags containing only red and blue counters. The table shows how many red and blue counters are in each bag.

<table>
<thead>
<tr>
<th>Bag</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red counters</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Blue counters</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

The teacher is going to take a counter at random from each bag.

Match each bag with the correct probability of taking a blue counter below. The first one is done for you.

<table>
<thead>
<tr>
<th>Bag</th>
<th>Probability of taking a blue counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$\frac{1}{4}$</td>
</tr>
<tr>
<td>B</td>
<td>$\frac{1}{3}$</td>
</tr>
<tr>
<td>C</td>
<td>$\frac{1}{2}$</td>
</tr>
<tr>
<td>D</td>
<td>$\frac{5}{11}$</td>
</tr>
<tr>
<td>E</td>
<td>$\frac{2}{5}$</td>
</tr>
</tbody>
</table>
8. In a survey, pupils were asked if they owned a bicycle.

Results:

- \(\frac{3}{8}\) of the pupils said ‘Yes’.
- \(\frac{5}{8}\) of the pupils said ‘No’.

46 more pupils said ‘No’ than said ‘Yes’.

Altogether, how many pupils were in the survey?
9. In this question you will need the following information about hens’ eggs.

Approximate mass, in grams, is given by:

\[ \text{Mass} = \frac{\pi y^3}{10} \times 1.15 \]

The length, \( y \), of an egg is **5.5cm**.

Use the formula to find the grade of the egg.

You **must** show your working.

<table>
<thead>
<tr>
<th>Mass of egg</th>
<th>Grade of egg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 53g</td>
<td>Small</td>
</tr>
<tr>
<td>53g up to 63g</td>
<td>Medium</td>
</tr>
<tr>
<td>63g up to 73g</td>
<td>Large</td>
</tr>
<tr>
<td>73g or more</td>
<td>Extra large</td>
</tr>
</tbody>
</table>

Grade _______________  

2 marks
10. A shop sells rings of different sizes.

The diagram shows the diameters of the different sizes.

<table>
<thead>
<tr>
<th>Size</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>15.7 mm</td>
</tr>
<tr>
<td>6</td>
<td>16.5 mm</td>
</tr>
<tr>
<td>7</td>
<td>17.3 mm</td>
</tr>
<tr>
<td>8</td>
<td>18.2 mm</td>
</tr>
<tr>
<td>9</td>
<td>18.9 mm</td>
</tr>
</tbody>
</table>

(a) What is the circumference of a size 8 ring?

```
  mm
```

(b) Rachel wants to buy a ring for her middle finger.

That finger has a circumference of \(51\text{ mm}\).

What size ring should she buy?

Show working to explain your answer.

Tick (✓) your answer.

[ ] size 5  [ ] size 6  [ ] size 7  [ ] size 8  [ ] size 9
11. Look at this calculation.

\[ 3^5 + 10^2 = 7^x \]

Find the value of \( x \).

You must show your working.

\[ x = \text{__________} \]

2 marks

12. The table below shows the number of schools and the number of pupils in England.

<table>
<thead>
<tr>
<th>Number of schools</th>
<th>Total number of pupils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>17,642</td>
</tr>
<tr>
<td>Secondary</td>
<td>3,385</td>
</tr>
</tbody>
</table>

Show that, on average, a secondary school has about **four times** as many pupils as a primary school.

2 marks
13. The cuboid container below holds **12 litres** of water when full.

One litre is 1000cm³

The inside length and width of the cuboid are **40cm** and **20cm**.

What is the inside **height** of the cuboid?

[Diagram of a cuboid with labels 40cm and 20cm for length and width]

Height = __________ cm

2 marks
### 14. nth term expressions

The first three terms of a sequence are shown in the box.

\[ 5, \ 16, \ 27, \ \ldots \]

Look at each expression below.

Write ‘No’ if it could **not** be the \(n\)th term expression for this sequence.

Write ‘Yes’ if it could be the \(n\)th term expression for this sequence and then work out the 4th term.

The first one is done for you.

<table>
<thead>
<tr>
<th>Expression</th>
<th>Could it be the (n)th term expression?</th>
<th>If ‘Yes’, work out the 4th term</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5n)</td>
<td>No</td>
<td>[\times]</td>
</tr>
<tr>
<td>(n + 11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(11n - 6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n^2(6 - n))</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. There are 6 units in an exam course.

Each unit is marked out of 100

To get grade A, the mean mark of all six units must be at least 80

Tom has taken five units. His mean mark is 78

To get grade A, how many marks must he get on the last unit?
16. (a) The grid shows a straight line.

The equation of the line is \( y = x \)

Two of the equations below also describe the straight line \( y = x \)

Put rings round the correct equations.

\[
\begin{align*}
  x &= y \\
  y &= -x \\
  yx &= 0 \\
  x - y &= 0 \\
  x + y &= 0
\end{align*}
\]

(b) Write the coordinates of two points that have an \( x \) coordinate that is one less than the \( y \) coordinate.

\[
\begin{align*}
  ( \_, \_ ) & \quad ( \_, \_ )
\end{align*}
\]

What would be the equation of the straight line through these two points?
17. In 2004 a newspaper published this incorrect report:

Houses cost £60 000 one year ago.

They now cost £80 000

This is a 25% increase.

Write the missing numbers below to make each statement correct.

(a) Houses cost £60 000 one year ago.
   \[\text{They now cost £} \underline{\phantom{0}}\]
   This is a 25% increase.

(b) Houses cost £60 000 one year ago.
   \[\text{They now cost £}80 000\]
   This is a \underline{25}\% increase.

(c) \[\text{Houses cost £} \underline{\phantom{0}} \text{ one year ago.}\]
   \[\text{They now cost £}80 000\]
   This is a 25% increase.
18. Here are some number cards with the values written in standard form.

\[ 2 \times 10^4 \quad 2 \times 10^6 \quad 2 \times 10^8 \]
\[ 2.5 \times 10^4 \quad 2.5 \times 10^6 \quad 2.5 \times 10^8 \]

Two of the number cards multiply to give \( 5 \times 10^{16} \).
Write them in the calculation below.

\[ \_ \times \_ = 5 \times 10^{16} \]
19. (a) Look at this equation:

\[ c + 3 = d - 4 \]

Which of \( c \) and \( d \) is greater, and by how much?

\[ \underline{\text{_________}}, \text{ by } \underline{\text{_________}} \]  

1 mark

(b) Look at this equation:

\[ 3 - e = 4 - f \]

Which of \( e \) and \( f \) is greater, and by how much?

\[ \underline{\text{_________}}, \text{ by } \underline{\text{_________}} \]  

1 mark
20. Look at this information from January 2005.

546,400, or 98% of all 3-year-old children in England go to play school or nursery, or have some other type of education.

To the nearest thousand, how many 3-year-old children were there in England?
21. The diagram shows a right-angled triangle.

What is the value of $h$?

$h =$ ___________

2 marks
22. A town in the south of England has the lowest ratio of men to women in England. There were only 87 men for every 100 women.

<table>
<thead>
<tr>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>87</td>
<td>100</td>
</tr>
</tbody>
</table>

For every 100 men, how many women were there?

Give your answer to the nearest integer.

<table>
<thead>
<tr>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>_____</td>
</tr>
</tbody>
</table>
The numbers of petals that daisies have can vary.

The box plot shows information about the petals for a sample of daisies.

(a) For the sample of daisies, what is the median number of petals?

(b) For the sample of daisies, what is the inter-quartile range of the number of petals?

(c) What percentage of the daisies in the sample has fewer than 30 petals?
24. Here is a trapezium.

Use Pythagoras’ theorem to find the value of $k$.

$$k = \phantom{0000}$$

2 marks
25. A booklet is made from 6 rectangular pieces of paper. Each piece of paper measures 297mm by 420mm. The mass of the paper is 80g per m².

Calculate the mass of the booklet. Give your answer correct to 2 significant figures.
26. This table gives some information about a solid sphere.

<table>
<thead>
<tr>
<th>Radius</th>
<th>Volume</th>
<th>Surface area</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r )</td>
<td>( \frac{4}{3} \pi r^3 )</td>
<td>( 4 \pi r^2 )</td>
</tr>
</tbody>
</table>

The solid sphere is cut in half to produce a solid hemisphere.

Complete the table below for the solid hemisphere.
Write your answers as simply as possible.

<table>
<thead>
<tr>
<th>Radius</th>
<th>Volume</th>
<th>Surface area</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
END OF TEST
END OF TEST