Mathematics test

Perceived competence and confidence is one thing. How would you do if actually put to the test? It really doesn't matter how well or how badly you do in the test now, you have lots of time to make up for the mathematics you have forgotten or never knew in the first place. The following pages explore your knowledge and understanding in the areas of mathematics identified in the self-audit in Part 3. Take as long as you need and try not to cheat too much by looking at the answers! The marking system is straightforward.

Number

1 Work out the following:

(i) 5×24 (ii) 25×72 (iii) 312×235

[3 MARKS]

2 Work out the following:

(i) $1760 \div 40$ (ii) $1638 \div 63$ (iii) $3335 \div 23$

[3 MARKS]

> **Key vocabulary** – algorithm, dividend, divisor, quotient, product

3 Using $p = \dfrac{2}{3}$, $q = \dfrac{1}{2}$, $r = 2\dfrac{4}{7}$ and $s = 1\dfrac{1}{5}$ find:

(i) $p + q$ (ii) $p + r$ (iii) $q + s$
(iv) $p - q$ (v) $r - q$ (vi) $r - s$
(vii) $p \times q$ (viii) $q \times s$ (ix) $r \times s$
(x) $p \div q$ (xi) $q \div p$ (xii) $q \div r$

[12 MARKS]

> **Key vocabulary** – fraction, numerator, denominator, mixed fraction, vulgar fraction, vinculum

4 Convert the following into decimal fractions:

(i) $\dfrac{5}{8}$ (ii) $\dfrac{7}{20}$ (iii) 65%   (iv) 0.1%

[4 MARKS]

5 Convert the following to vulgar fractions:

(i) 0.375   (ii) 0.28   (iii) 76%

[3 MARKS]

6 Express the following vulgar fractions in their simplest forms:

(i) $\dfrac{84}{96}$

(ii) $\dfrac{84}{91}$

[2 MARKS]

7 Convert the following to percentages:

(i) $\dfrac{5}{8}$

(ii) 0.375

(iii) $\dfrac{7}{20}$

[3 MARKS]

Key vocabulary – equivalence, equivalent fraction, vulgar fraction, decimal fraction

8 Prior to Christmas the cost of the latest computer game was increased by 20%. In the sales after Christmas it was reduced by 20%. How do the two prices compare?

[1 MARK]

9 As it was so desirable, the cost of the latest mobile phone was increased by 25%. A month later it was no longer fashionable and was reduced by 20%. How did the reduced price compare with the original price before the increase?

[1 MARK]

10 A school basketball team scored 24 points in one game and 30 points in the next. What was their percentage increase in the points scored?

[1 MARK]

11 Two children undertake a sponsored swim. In total they raise £160. The ratio of the contributions of Edward to Katherine was 2:3. How much did each child raise?

[2 MARKS]

12 A junior school shares out library books to year groups based on the ratio of the number of children in the year groups. 1000 books are to be distributed to Years 3, 4, 5 and 6. There are 52 children in Year 3, 68 in Year 4, 44 in Year 5 and 36 in Year 6. How many books does each year group get?

[4 MARKS]

Key vocabulary – percentage, ratio, proportion

13 Place these numbers in numerical order:

71%   5/7   18/25   √1/2   0.7

[3 MARKS]

14 0.33333… can be written as $0.\dot{3}$. Write the following recurring decimals using the same notation:

(i)   0.27272727…   (ii) 0.277777777…
(iii) 0.904904904904…   (iv) 18.181818…

[4 MARKS]

> **Key vocabulary**: rational number, irrational number, recurring decimal

15 Write these numbers in index form:

(i)   100 000   (ii) 0.1   (iii) 100

[3 MARKS]

16 Convert these numbers from standard form into ordinary form

(i) 6.6×10^3 (ii) 7.07×10^{-2}

[2 MARKS]

17 Write these numbers in standard form

(i)   523 000   (ii) 0.0606

[2 MARKS]

> **Key vocabulary**: index form, exponent, standard form

18 Put a tick in the box if the statement is **true** and a cross if the statement is **false**.

(i) $(24 + 8) \div 4 = (24 \div 4) + (8 \div 4)$ ☐

(ii) $32 \div (4 + 4) = (32 \div 4) + (32 \div 4)$ ☐

(iii) $12 \times (8 + 7) = (12 \times 8) + (12 \times 7)$ ☐

(iv) $(15 - 5) \times 10 = (15 \times 10) - (5 \times 10)$ ☐

(v) $(96 \div 12) \div 4 = 96 \div (12 \div 4)$ ☐

(vi) $(87 + 29) + 71 = 87 + (29 + 71)$ ☐

(vii) $40 - (30 - 10) = (40 - 30) - 10$ ☐

(viii) $(17 \times 4) \times 25 = 17 \times (4 \times 25)$ ☐

(ix)   17% of £50 = 50% of £17 ☐

(x) $(20 + 8) \times (30 + 9) = (20 \times 30) + (20 \times 9) + (8 \times 30) + (8 \times 9)$ ☐

[10 MARKS]

19 Find all the factors of each of the following numbers:

 (i) 24 (ii) 360

[2 MARKS]

20 (i) What are the factors of 49?

 (ii) In general, what can you say about the number of factors of a square number?

[2 MARKS]

21 Express the following numbers in terms of their prime factors – for example, $44 = 2 \times 2 \times 11$:

 (i) 48 (ii) 105 (iii) 36 (iv) 56

[4 MARKS]

22 Find the highest common factor of each of the following:

 (i) 36 and 48 (ii) 105 and 56
 (iii) a^2b^2 and a^3b (iv) abc and cd^3

[4 MARKS]

23 Write the following Roman numbers using Hindu-Arabic notation.

 (i) DCCCLXXXVIII
 (ii) MCMXCIX
 (iii) MMCCXX

[3 MARKS]

24 Express the following Hindu-Arabic numbers using Roman notation.

 (i) 333
 (ii) 444
 (iii) 2013

[3 MARKS]

25 Write the following numbers using numerals:

 (i) Thirty seven thousand two hundred and three
 (ii) Two hundred and three million one thousand and fifty
 (iii) Nine million and seventeen

[3 MARKS]

26 Write the following numbers in words

 (i) 40404040
 (ii) 70007007
 (iii) 300030003

[3 MARKS]

Algebra – patterns and relationships

1   If $a = 5$, $b = 15$, $c = 2$, $d = 3$, $de = 15$ and $df = 18$ find:

    (i) ab (ii) ac (iii) e

    (iv) f (v) $a(b + c)$ (vi) $d(e + f)$

    (vii) $a(b - c)$ (viii) $d(e - f)$ (ix) $2a^2b$

    (x) $2d^2e$ (xi) $\dfrac{1}{a}$ (xii) $\dfrac{1}{d}$

    [12 MARKS]

2   Liam is doing a mathematics investigation and obtains the results 1, 4, 9, 16, 25.

    (i)   What would be the next term in this sequence?

    [1 MARK]

    (ii)   The 10th term?

    [1 MARK]

    (iii) The nth term?

    [2 MARKS]

3   Winston is investigating the number of slabs that would be required to pave around a square garden pond as follows:
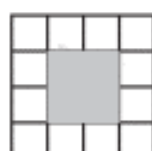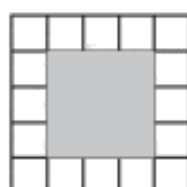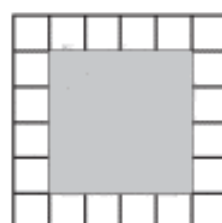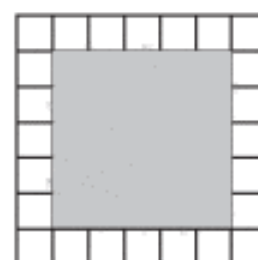

pond 1   pond 2   pond 3   pond 4   pond 5

    (i)   Write down the number pattern that he found.

    [1 MARK]

    (ii)   How many slabs would be needed to pave around the 10th pond?

    [1 MARK]

    (iii) What would be the nth term of this sequence?

    [2 MARKS]

4 Katy is doing a mathematics investigation and obtained the results 1, 2, 4, 8, 16, 32.

    (i)   What would be the next term in this sequence?
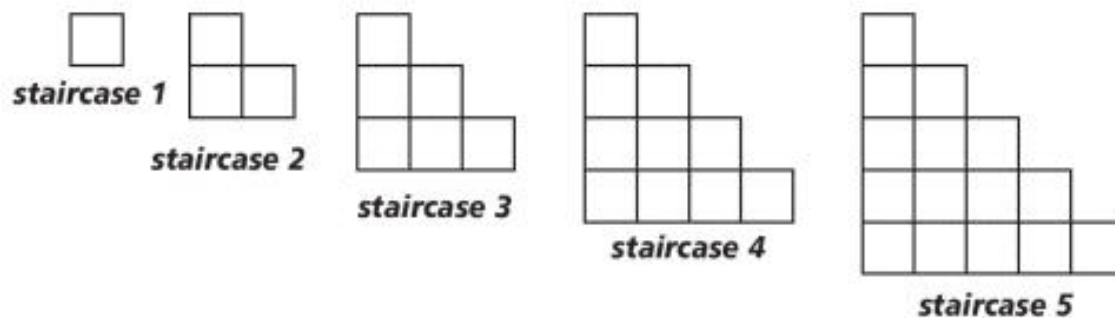
                    [1 MARK]

    (ii)   The 10th term?

                    [1 MARK]

    (iii) The nth term?

                    [2 MARKS]

5 Anoushka is investigating multilink staircases as follows:

staircase 1
staircase 2
staircase 3
staircase 4
staircase 5

    (i)   Write down the number pattern that she found.

                    [1 MARK]

    (ii)   How many cubes would be needed for the 10th staircase?

                    [1 MARK]

    (iii) What would be the nth term of this sequence?

                    [2 MARKS]

> **Key vocabulary**: generalise, nth term, number sequence, investigation, triangle numbers, square numbers, geometric series

6 Solve the following equations:

    (i) $\dfrac{1}{x+2} = 3$ (ii) $\dfrac{1}{5x-4} = \dfrac{1}{x}$

    (iii) $\dfrac{3}{1+b} = \dfrac{5}{b+3}$

                    [3 MARKS]

> **Key vocabulary**: solve, equation

7 Solve the following pairs of simultaneous equations. Find x and y in each case:

(i) $\begin{cases} y - 2x = 4 \\ y + x = 7 \end{cases}$

(ii) $\begin{cases} 2x - 3y = 2 \\ 4x + 6y = 4 \end{cases}$

(iii) $\begin{cases} 2x - y = 5 \\ 3x + 2y = 11 \end{cases}$

[6 MARKS]

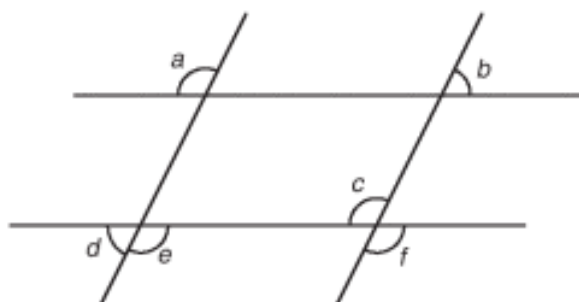**Key vocabulary**: simultaneous equations, imaginary number, real number, identity

8 Which of the following statements are true and which are false?

(i) If $x > 3$ then $x^2 > 9$

(ii) If $x < -4$ then $x^2 < 16$

(iii) If $3x > -12$ then $x > -4$

(iv) If $x/2 < 6$ then $x < 12$

(v) If $x > 2$ then $x^3 > 8$

(vi) If $x < -3$ then $x^3 < -27$

(vii) If $6 - x > 10$ then $x > 4$

[7 MARKS]

Shape and space

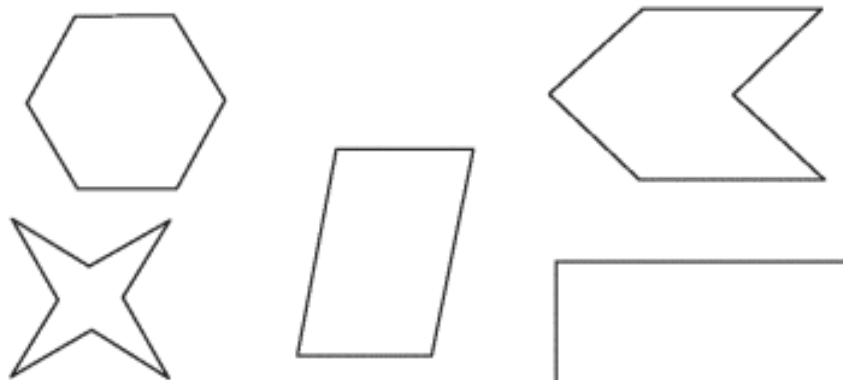**1** If angle a is $100°$, work out angles b, c, d, e and f.

[1 MARK]

2 If angle $a = 95°$, angle $b = 110°$ and angle $c = 105°$, what does angle d equal?
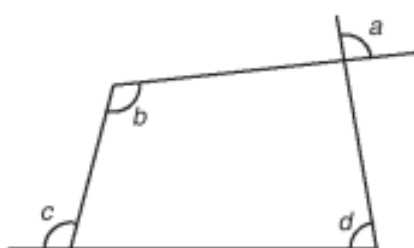
[1 MARK]

> **Key vocabulary**: opposite angles, complementary angles, supplementary angles, interior angles

3

(i) Identify the lines of symmetry of the shapes above.

[5 MARKS]

(ii) Identify the orders of rotational symmetry of the shapes above.

[5 MARKS]

> **Key vocabulary**: reflective symmetry, order of rotational symmetry

4 Identify which of the angles in the following shape are acute, obtuse, right or reflex.
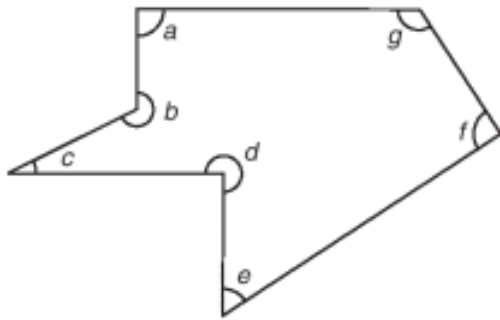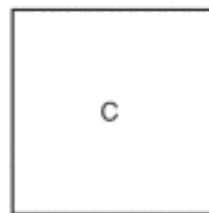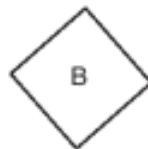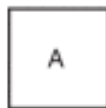

angle a:

angle b:

angle c:

angle d:

angle e:

angle f:

angle g:

[7 MARKS]

5

(i) Which of these shapes are congruent?

[2 MARKS]

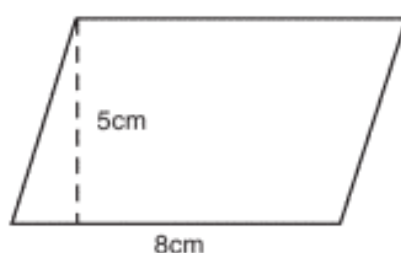(ii) Which of these shapes are similar to shape C?

[2 MARKS]

6 What is the area of this triangle?
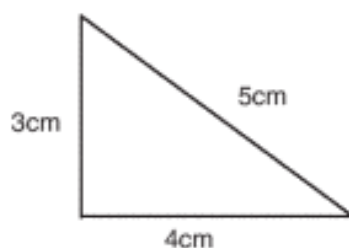
[1 MARK]

7 What is the area of this parallelogram?

[1 MARK]

8 What is the area of this trapezium?

5 cm

4 cm

8 cm
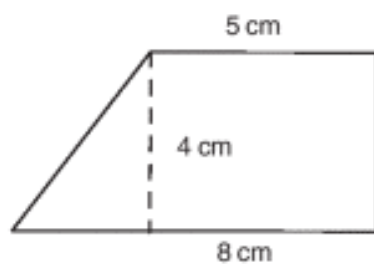
[1 MARK]

9 Work out the perimeter and area of the following shape:
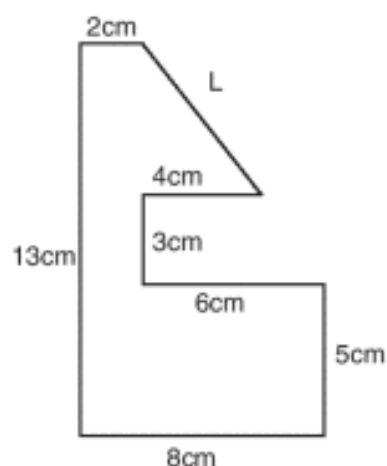
7cm

3cm

6cm

3cm
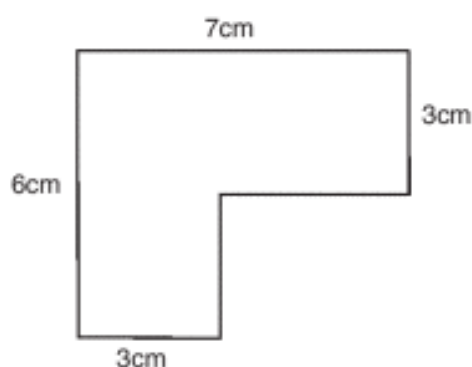
Perimeter =

Area =

[2 MARKS]

10 Work out the perimeter and area of the following shape (you will need to calculate *L* using Pythagoras' theorem).

2cm

L

4cm

3cm

13cm

6cm

5cm

8cm

L =

Perimeter =

Area =

[3 MARKS]

Key vocabulary: perimeter, area, parallelogram, trapezium, triangle

11 Find the circumference and area of a circle with a diameter of 10 cm.

[2 MARKS]

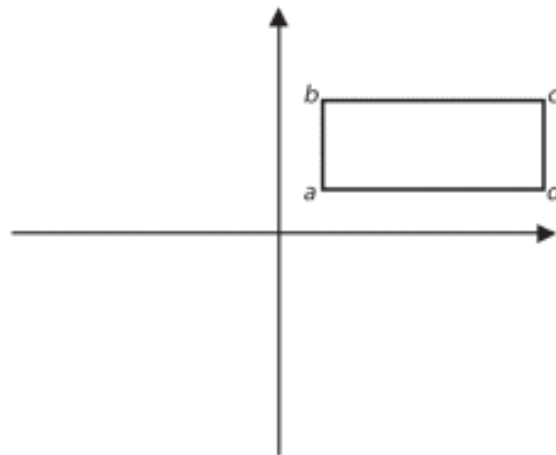> **Key vocabulary**: radius, diameter, circumference, area, sector, arc

12 This rectangle has the following coordinates:

a (1, 1)
b (1, 3)
c (5, 3)
d (5, 1)

Work out the new coordinates when the rectangle is:

(i)   reflected in the y-axis;
(ii) rotated 90 degrees clockwise about the point (0,0).

[8 MARKS]

> **Key vocabulary**: Cartesian coordinates, reflection, rotation

13 Identify the number of faces, vertices and edges on the following solids:

Solid	Faces	Edges	Vertices
Cube	_____	_____	_____
Tetrahedron	_____	_____	_____
Triangular prism	_____	_____	_____

[9 MARKS]

> **Key vocabulary**: face, edge, vertex, net, Platonic solid, cube, tetrahedron, prism

14   A cuboid has edges of lengths 3 cm, 4 cm and 6 cm.

      (i)   What is the area of each face?   [3 MARKS]

      (ii)   What is the total surface area of the cuboid?   [1 MARK]

      (iii) What is the volume of the cuboid?   [1 MARK]

15   Find the surface area and volume of the following cylinder, with radius 5 cm and length 10 cm.
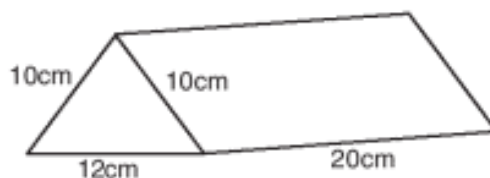
Surface area =

Volume =

[2 MARKS]

16   Find the surface area and volume of the following triangular prism:

10cm   10cm   Surface area =

12cm   20cm   Volume =

[2 MARKS]

> **Key vocabulary**: surface area, volume, cuboid, cylinder, prism

Statistics

1   Find the mode, median and mean of the data set:

3   3   3   3   3   3   4   5   5   6   6

[3 MARKS]

2   The average adult male shoe size is size 8.

The average salary in the United Kingdom is £21500

The sign in a lift says 'Maximum number of occupants 6. Average weight of occupants 80 kg.'

For each of the above determine which average is being referred to: the mode, median or mean.
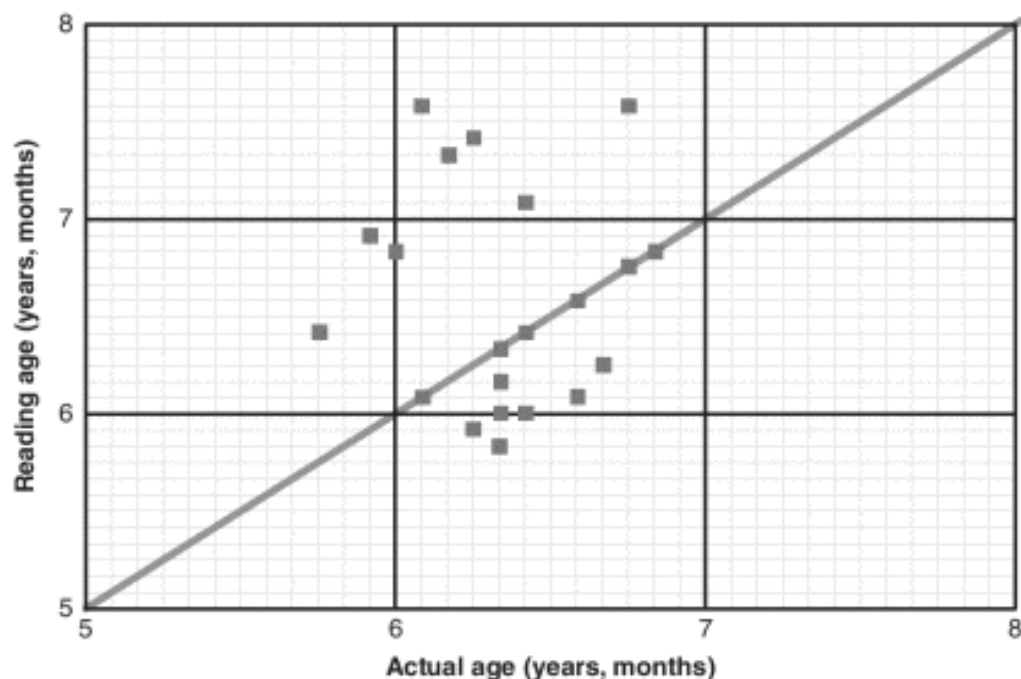
[3 MARKS]

3   Find the lower quartile, median, upper quartile, range and inter-quartile range of the data set:

2   3   3   4   6   6   7   8   9   10   11
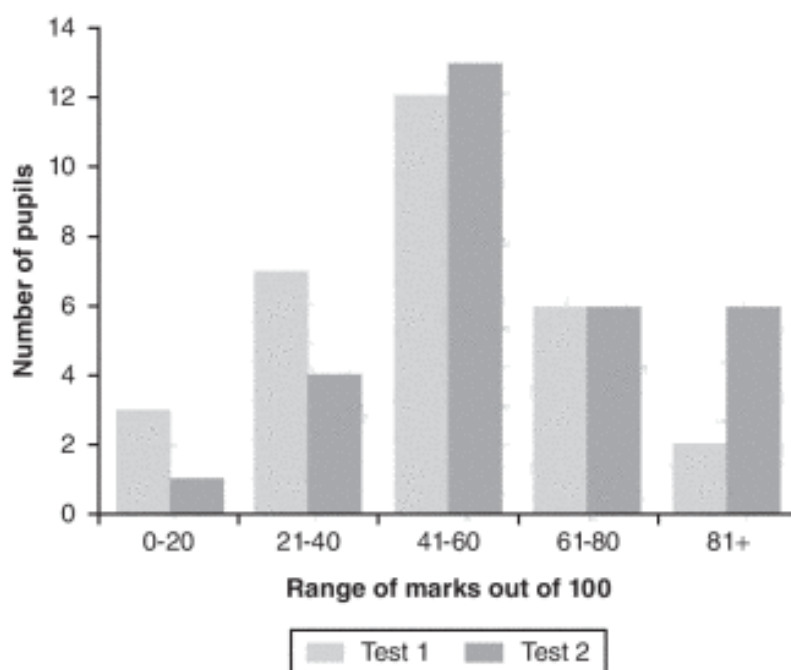
[5 MARKS]

4 The scatter diagram shows the actual ages and reading ages of the pupils in a class.

(i)   How many pupils are there in the class?

(ii) How many pupils have the same reading age as their chronological age?

(iii) Identify the pupil who has the greatest difference between their reading age and their actual age.

[3 MARKS]

**5** A teacher gave two tests to his class of pupils. The results are shown in the dual bar chart.

(i)   How many pupils are there in the class?

(ii) How many pupils scored more than 40 marks in test 1?

(iii) How many pupils scored fewer than 81 marks in test 2?

(iv) Is the mean mark higher in test 1 or test 2?

[4 MARKS]

6 The pie chart shows how pupils travelled to school.

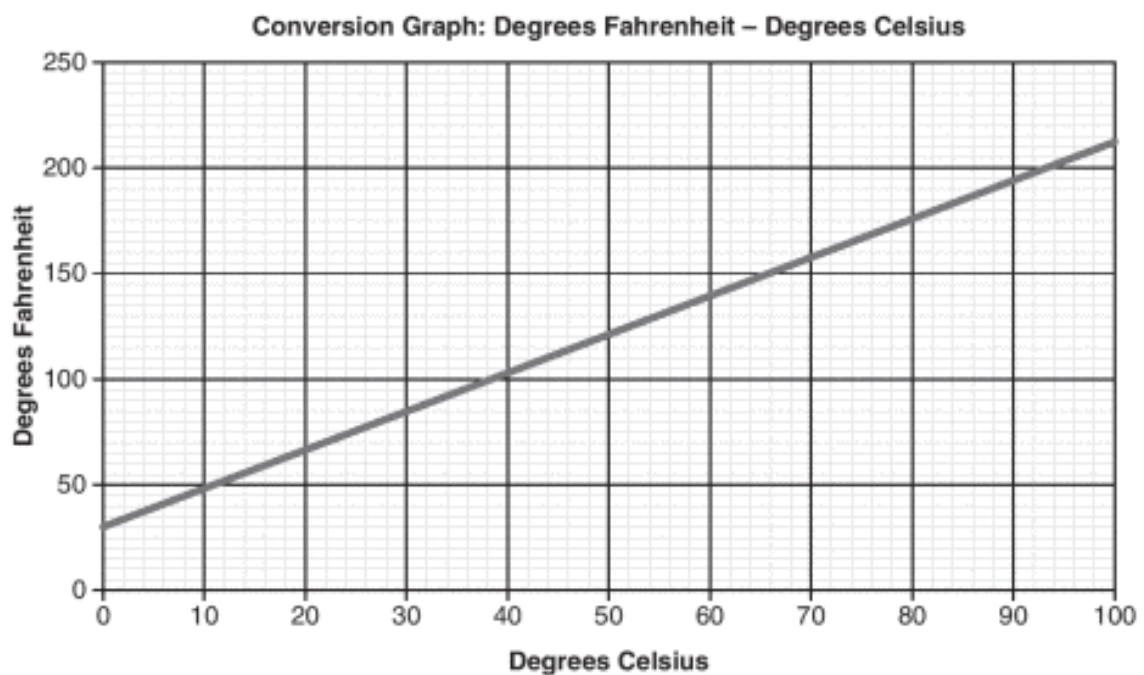82 came by car, 14 cycled, 38 walked and 48 came by bus.
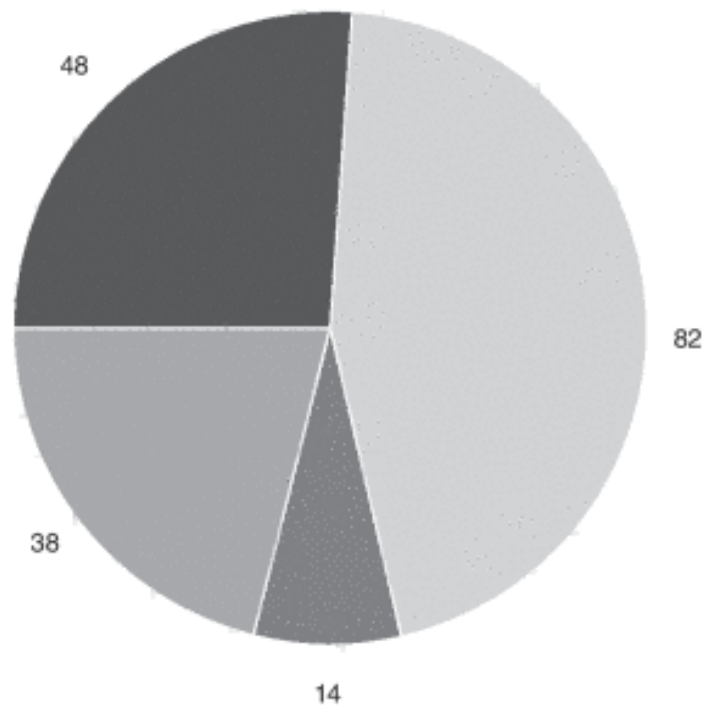
Which of the following statements are true? Explain your reasoning.

    (i)   3/7 came by car

    (ii) 1/13 cycled

    (iii) 2/7 walked

[6 MARKS]

7 Use the conversion graph to answer the questions.

(i)   Change 10 degrees Celsius into degrees Fahrenheit.

(ii) Which is hotter 40 degrees Celsius or 100 degrees Fahrenheit?

(iii) Water boils at 212 degrees Fahrenheit. At how many degrees Celsius does water boil?

[3 MARKS]

8 Categorise the following variables as either discrete, continuous or categoric:

(i)   Eye colour

(ii)   Shoe size

(iii) Type of breakfast cereal

(iv)   Height

(v)   Weight

[5 MARKS]

Probability

1 Dice are numbered 1–6. Two fair dice are thrown and the numbers added. Find the probability that the total is:

(i) 2   (ii) 7   (iii) 6   (iv) 14

[4 MARKS]

2 (i)   A fair die is rolled. What is the probability that a 5 will be rolled?

(ii) A coin is flipped. What is the probability tails is uppermost?

(iii) A fair die is rolled and a coin is flipped. What is the probability of a 5 showing on the die and tails on the coin?

[3 MARKS]

3 A card is drawn from a pack of 52. What is the probability:

(i)   it is a heart?

(ii)   it is a black card?

(iii) it is a card less than a 10? (Ace is high.)

(iv)   that the card is higher than a Jack? (Ace is high.)

[4 MARKS]

4 Asif has the following cards:

(i) Gareth takes a card without looking. He says, 'I'm more likely to have an even number than an odd number'. Is he correct? Explain.

[1 MARK]

(ii)   Choose one of the following words to complete the sentences below.

likely   impossible   certain   unlikely

a) It is _____ that Gareth's card will contain ☹
b) It is _____ that Gareth's number will be greater than 10.

[2 MARKS]

Measures

1 Metric: metre, hectare, square centimetre, tonne, litre, kilogram, cubic centimetre, gram, kilometre, centimetres per minute, centimetres per year, kilometres per hour

Imperial: ton, pint, pound, cubic inch, ounce, yard, acre, mile, square inch, miles per hour, inches per minute, inches per year

For each of the following choose the appropriate measure from the list above. Choose an Imperial measure and a metric measure in each case.

(i)   The length of a football pitch
(ii)   The mass of a baby
(iii)   The distance from London to Brighton
(iv)   The area of a piece of A4 paper
(v)   The area of a farmer's field
(vi)   The mass of a bag of sweets
(vii)   The capacity of a large bottle
(viii) The mass of a bus
(ix)   The speed of a car
(x)   The speed of a snail
(xi)   The speed at which hair grows
(xii)   The volume of a match box

[24 MARKS]

2 Identify which is bigger.

(i)   Acre or hectare
(ii)   Litre or 2 pints
(iii)   Kilogram or 2 pounds
(iv)   Yard or metre
(v)   Mile or 2 kilometres
(vi)   Gallon or 3 litres
(vii)   Inch or 2 centimetres
(viii) 4 furlongs or 1 kilometre

[8 MARKS]

3 Identify the scale of a map if 2 centimetres on the map represents 2 kilometres.

What distance on this map represents:

  (i)   10 kilometres?
  (ii)   100 metres?

[2 MARKS]

4 Identify the scale of a map if

  (i)   1 centimetre represents 100 metres.
  (ii)   1 metre represents 10 kilometres.
  (iii)   1 millimetre represents 100 metres.

[3 MARKS]

> **Key vocabulary**: scale, ratio

5 Change the following into kilometres per hour:

  (i)   10 metres per second
  (ii)   100 metres per minute
  (iii)   50 centimetres per second

[3 MARKS]

> **Key vocabulary**: compound measure, newton

6 How many days are there from:

  (i)   23 April until 18 September?
  (ii)   1 February 2014 until 1 August 2014?   [2 MARKS]

7 How many leap years are there between 1890 and 2018?   [1 MARK]

8 How long is it from:

  (i)   9.32 a.m. until 3.18 p.m.
  (ii)   07.35 until 18.48

[2 MARKS]