CATERHAM SCHOOL

MATHS SAMPLE QUESTIONS

13+ ENTRANCE EXAMINATION
(For Entry into Year 9)

1 Hour (Non Calculator)

Caterham School 13+ Maths Examination information

The entrance examination is 1 hour long. Calculators are not allowed.

The purpose of the examination is to identify candidates who are competent at numerical and basic algebraic methods as well as identifying those whose mathematical potential can be built upon.
The earlier questions in the paper will mainly test routine mathematical skills; the later questions will be more of a problem solving nature. Some of the ideas may not have been met previously but the questions will explain any processes needed.

Syllabus

Using and Applying Mathematics:

- Applying mathematical techniques in order to solve 'wordy' problems.

Number:

- Addition, subtraction, multiplication and division of whole numbers; order of operations; negative numbers (the four operations); primes, factors, multiples, product of prime factors (simple indices and roots), LCM and HCF.
- Decimal numbers: place value; multiplying and dividing by powers of 10; long multiplication and long division; approximation to a given number of decimal places (or significant figures).
- Fractions: equivalent fractions and comparison of size; finding a fraction of a given quantity; ratio calculations; addition, subtraction, multiplication and division of fractions, including decimal fractions.
- Percentages: equivalence to hundredths; finding a percentage of a quantity; expressing one quantity as a percentage of another; percentage increase and decrease; finding the original value.

Algebra:

- E.g.: knowing that $a + a + a + a + a = 5a$; $a \times a \times a = a^3$ etc.; collecting like terms including expanding brackets; substitution of numbers into algebraic expressions; derive formulae from words.
- Solve linear equations including the variable on both sides, brackets and rational (simple fractional) types.
- Spotting the rule (in words) for generating a sequence; finding the n^{th} term of a linear sequence; recognising well known sequences such as the square, triangle or Fibonacci numbers.

Shape, Space and Measures:

- Conversion between metric (linear, mass, capacity etc.) measures (e.g., km→m, kg→g, cm^3→litres etc.).
- Calculations involving time (timetables and 24 hour clock).
- Angles: acute, obtuse, reflex; adjacent, alternate, corresponding, interior; parallel and perpendicular lines; angle sum of a triangle; isosceles and equilateral triangles; exterior angle; definitions of parallelogram, rhombus, trapezium and kite; sum of interior angles of a polygon and the size of the exterior angle of a regular polygon.
- Three figure bearings.
- Coordinates, including the equations of straight lines parallel to the axes and $y = \pm x$; plotting a straight line given an equation by generating points (table of values).
- Perimeter, area and volume: standard shapes (rectangle, triangle, parallelogram, trapezium, kite, circle) and solids (cuboid).
- Transformations: reflection in a given line, rotation about a point given an angle and direction, translations.
- Distance, speed and time calculations.
- Drawing and interpreting simple frequency (bar, pictogram) diagrams; constructing pie charts; understand the terms mean, median, mode and range; calculating the mean, median, mode and range including from frequency tables (ungrouped).
- Probability: counting equally likely outcomes; calculating probabilities as a fraction, decimal or percentage; calculating an expected number; using frequency tables.

The style of the examination paper is a combined question and answer paper with sufficient room for relevant workings (method marks are given).

Skills questions (all non-calculator)

Number:

A1. Calculate 12% of £650.

A2. Work out the value of $(8-2)^2 - 3\times 2$

A3. Express 300 as a product of prime factors using index notation.

A4. Without using a calculator, find the value of 3.23×1.4 showing all your working.

A5. Without using a calculator, find the value of $4905 \div 15$ showing all your working.

A6. Without using a calculator, find the fraction equivalent to $9\frac{2}{5} - 4\frac{2}{3}$.

A7. Make 370 kg 17% bigger.

A8. Write $\frac{5}{8}$ as a) a decimal b) a percentage.

A9. Find the lowest common multiple (LCM) of the numbers 5, 7 and 10.

A10. Find the highest common factor (HCF) of the numbers 12 and 54.

A11. Divide 162 in the ratio 2 : 3 : 4.

A12. Three quarters of a very solid fruit cake weighs 3.6 kg. What would the whole cake have weighed?

Algebra:

A1. Simplify $3a + 5a - 7a$.

A2. Expand the brackets and collect like terms to simplify $5(3a\ (3pb)\ 3pana\ 3pb)$.

A3. If $a = 3$, $b = -2$ and $c = 5$ find the value of i) abc ii) $3b^2$ ii) $\frac{4ab}{c}$.

A4. A rectangle is a cm long and b cm wide. Write down a formula for P if P cm is the perimeter of the rectangle.

A5. Solve the equation $3(2x+2)=10$.

A6. Solve the equation $5x+3=10-2x$.

A7. Solve the equation $\frac{2x}{3}=8$.

A8. Find the next three terms in the sequence 3, 5, 8, 12, 17, …

A9. Give the general (n^{th}) term of the sequence 5, 8, 11, 14, 17, …

A10. Solve the equation $\frac{(x+3)}{5}=\frac{(x+9)}{7}$

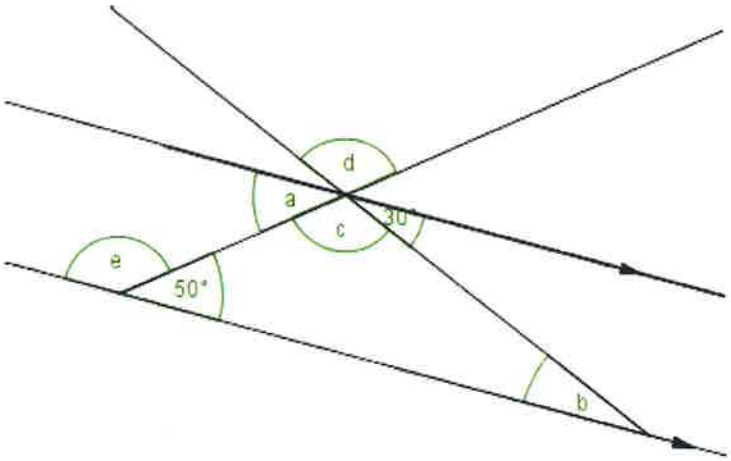
Shape, Space and Measures:

A1. A vase is made in the shape of a cuboid measuring 6 cm by 6 cm by 25 cm. Find the capacity of the vase in a) cm^3 b) litres.

A2. A train sets off on its journey at 1057 and arrives at its destination at 1309. How long does the journey take in hours and minutes?

A3. Calculate the average speed of a car in km/h that travels for 330 km in 3 hours and 45 minutes.

A4. Work out the sizes of the lettered angles in the diagram:



A5. A polygon has five sides. What is the name given to this polygon? Write down the sum of the interior angles of this polygon.

A6. On the set of axes (*which will be provided*) plot the triangle ABC where A is at the point (1,2), B is at the point (2,2) and C is at the point (2,5).

a) Rotate the triangle ABC 90° anticlockwise about the point (0,2) and label it R.

b) Translate the triangle ABC 2 to the right and 2 down, and label it T.

A7. Using the approximate value of $\pi \approx \frac{22}{7}$, find the area of a circle whose radius is 14 cm. Give your answer correct to three significant figures.

Handling Data:

A1. The table below shows the results of a traffic count.
Construct a pie chart of this data showing your calculations clearly.

Ford	32	
BMW	19	
Toyota	22	
Other	17	

A2. For this list of numbers, find the mean, the median, the mode and the range:
12, 4, 15, 3, 8, 4, 3, 11, 20, 3, 5

A3. The frequency table shows the results of rolling a die 50 times:

Score	1	2	3	4	5	6
Frequency	7	13	10	10	2	8

Calculate the mean score.
Is the die fair? Give a reason for your answer.

A4. A bag contains some coloured balls.
There are 3 red balls, 7 white balls and 5 yellow balls.
If a ball is picked out at random, what is the probability that it is a yellow ball?

A5. Two fair dice are rolled and the scores obtained on each are added together.
By drawing up a probability space to show all the equally likely outcomes, or otherwise, find the probability of scoring a total of 7.

A6. Over a period of time it has been noticed that the probability of a novice swimmer getting cramp in a long distance race is $\frac{1}{6}$. If 48 novices swim in a race, how many would you expect to get cramp?

Problem Solving Questions (non-calculator):

Number:

B1. The organisers of a concert hope to sell 22,000 tickets to the nearest 500. What is the minimum number of tickets they hope to sell?

B2. By writing both 1400 and 2250 as a product of prime factors or otherwise, find the highest common factor of both 1400 and 2250.

B3. The value of an antique painting in 2015 was £26040. This represents a rise of 5% from its value in 2014.
Find the value of the painting in 2014.
Show your method clearly and give your answer to the nearest £10.

Algebra/Shape and Space:

B1. The n^{th} term of a sequence is $3n^2 + 5$.

Write down the first three terms of the sequence.

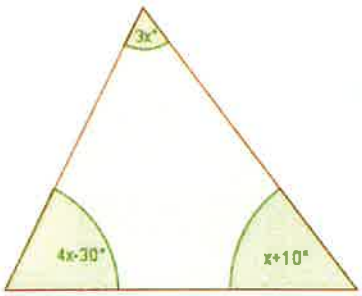
Which term in the sequence has a value of 152?

B2. The operation # is defined by $x \# y = x + y + 1$.

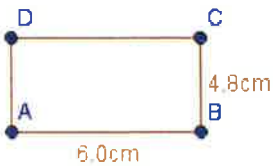
This means $3 \# 4 = 3 + 4 + 1 = 8$.

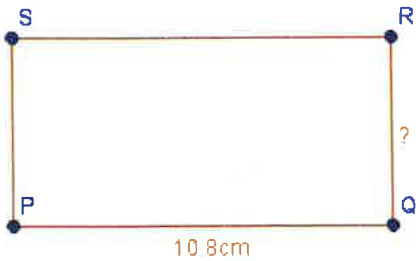
a) find $7 \# 8$ b) find x if $x \# 8 = 7$ c) find x if $x \# (x \# x) = x$.

B3. Use the diagram to form an equation in x and hence find the sizes of the three interior angles of the triangle.



B4. The rectangle ABCD has been enlarged to give the rectangle PQRS.





Find the length of QR.

Handling Data:

B1. A paperboy's sales during a certain week were: Monday 84, Tuesday 112, Wednesday 108, Thursday 95 and Friday 131.

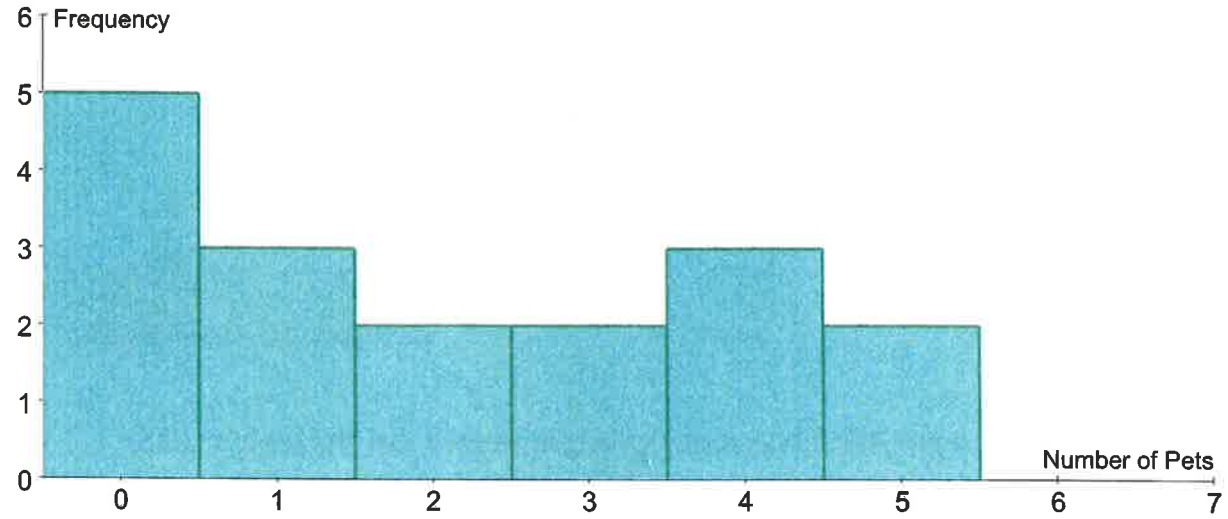
Find the average daily sales.

When the sales for Saturday were included the daily average increased to 128. How many papers were sold on Saturday?

B2. The average weight of the 18 boys in a class is 63.2 kg.
The average weight of the 12 girls in the same class is 71.2 kg.

Calculate the average weight of a pupil in this class.

B3.



The bar chart above shows the results of a survey to find the number of pets kept in the homes of Nancy's friends.
Use the information given in the graph to find

a) the modal number of pets;

b) the median number of pets;

c) the mean number of pets.

Additional problems:

B1. Write down the n^{th} term of this sequence: $\frac{1}{1}, \frac{4}{3}, \frac{9}{5}, \frac{16}{7}, \frac{25}{9}, \frac{36}{11}, \ldots$

B2. A square matrix is an array of numbers like this: $\begin{bmatrix} 3 & 7 \\ 2 & 1 \end{bmatrix}$.

We can multiply these arrays together like this:

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \times \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} = \begin{bmatrix} 1\times5+2\times7 & 1\times6+2\times8 \\ 3\times5+4\times7 & 3\times6+4\times8 \end{bmatrix} = \begin{bmatrix} 19 & 22 \\ 43 & 50 \end{bmatrix}$$

a) Work out $\begin{bmatrix} 1 & -1 \\ 2 & 0 \end{bmatrix} \times \begin{bmatrix} 3 & 0 \\ -1 & 2 \end{bmatrix}$.

b) Find the values of x and y if $\begin{bmatrix} x & 2 \\ 7 & y \end{bmatrix} \times \begin{bmatrix} 3 & -2 \\ -7 & 5 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Answers to sample questions

Skills:

Number

A1 £78

A2 30

A3 $3\times2^2\times5^2$

A4 4.522

A5 327

A6 4 11/15

A7 432.9

A8 0.625, 62.5%

A9 70

A10 6

A11 36:54:72

A12 4.8kg

Algebra

A1 a

A2 $13a-6b$

A3 -30, 12, -4.8

A4 $P = 2a+2b$

A5 2/3

A6 1

A7 12

A8 23, 30, 38

A9 $t_n = 3n + 2$

A10 x=12

Shape, Space, and Measures

A1 900 cm³/0.9 L

A2 2 h 12 m

A3 88 km/h

A4 a=50°, b=30°, c=100°, d=100° e=130°

A5 pentagon, 540°

A7 616 cm²

Handling data

A1 F128°, B76°, T88°, O68°

A2 mean 8, median 5, mode 3 range 17

A3 3.22, would expect mean 3.5, so this appears close, so not biased OR would expect around 8 fives and we only get 2, so appears biased.

A4 1/3

A5 1/6

A6 8

Problem solving

Number

B1 21 750

B2 22 , 2 5 50

B3 £24800

Algebra/Shape&Space

B1 8, 17, 32; 7th

B2 16, -2, -1

B3 70°, 75°, 35°

B4 86.4cm

Handling data

B1 106, 238

B2 66.4 kg

B3 mode 0, median 2, mean 2 1/17

Additional questions

B1 $n^2/(2n-1)$

B2 [4 -2] , [6 0]

x=5, y=3