You are expected to use a calculator in this paper.

All working should be clearly shown.

You should attempt all the questions, in any order you like.

1   Mr Cadbury has just over one million chocolates. He puts them all into boxes, with 42 chocolates in each box; there are none left over. What is the least number of chocolates that he could have had?

2   Aidan's car travels 17 kilometres per litre of petrol. How much petrol would he use if he travelled for one hour and 35 minutes at a speed of 84 kilometres per hour?
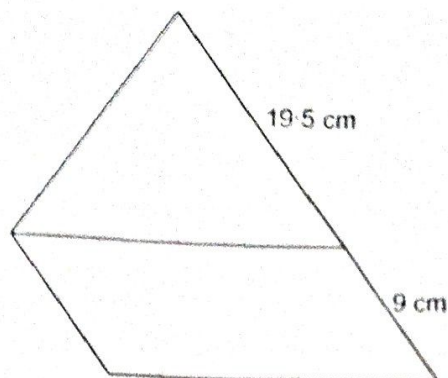
3   Solve the simultaneous equations.
$$6x - 5y = 18$$
$$14x + 2y = 1$$

4   Thirty-five percent of the volume of a toy is plastic.
The toy also contains 53·7 grams of metal and 0·328 cubic inches of rubber.
The density of the metal in the toy is 8·62 grams per cubic centimetre.
One inch is equal to 2·54 centimetres.

Find the total volume of the toy in cubic centimetres. Set out your method clearly.

5   Simplify

a $2ab \times \dfrac{a}{2b}$;

b $2x + y + \dfrac{x - 2y}{2}$.

6   An avant-garde artist wishes to make a sculpture (the Angel of the South) which will be a scale model of you constructed by gluing together marbles. If he wants his sculpture to be 25 metres high, estimate how many marbles he will need.

7   The sum of the cubes of the first n positive whole numbers is given by the formula
$$C(n) = \left(\tfrac{1}{2}n(n+1)\right)^2.$$
With the help of your calculator, find
a   the sum of the cubes of the first 115 positive whole numbers;
b   the smallest value of n for which $C(n)$ is greater than 144 000 000 000 000.

8   The distance from North pole to South pole around the surface of the Earth is 20000 km.
a   A tunnel is to be drilled in a straight line through the centre of the Earth from North to South Pole. How long will this tunnel be?
b   A tunnel is to be drilled through the Earth in a straight line from the North Pole to a point on the Equator. How long will this tunnel be?

9 a   The population of Ruritania is 23 432 000. If the population of Ruritania decreased by $14\frac{1}{2}\%$ what would the new population be?

   b   After an increase of 9% the population of Urbania is 37 865 000. What was the population of Urbania before the increase?

   Give your answers to the nearest thousand people.

10   In the diagram, the triangle has area 130 cm². What is the area of the parallelogram?

19·5 cm

9 cm

11   Call signs on a radio network must consist of
   • one of the letters W, K or B
   followed by either
   • two digits
   or
   • three digits
   For example, K07 and B550 are call signs

   How many different call signs are there on this network? Do *not* attempt to list them.
   [A digit is any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.]

12   Do you think that the word "probability" is being used differently in the following two paragraphs? Do you think it is being used correctly in each case?

   Explain your answer briefly. You are asked to comment on the third sentence, in italics, in each paragraph; you may assume that the first two sentences in each paragraph are true.

   Paragraph a: "Robin is in my year 9 class. Half the boys in my year 9 class have ginger hair.
   Therefore the probability that Robin has ginger hair is $\frac{1}{2}$."

   Paragraph b: "My birthday is in November. Half the days in November last year were wet.
   Therefore the probability that my birthday will be wet next year is $\frac{1}{2}$."

13   James is told to raise the price of an item by both adding £15 to it *and* increasing it by 20%.
   He finds that the two methods
   • adding £15 and then increasing by 20%
   • increasing by 20% and then adding £15
   give different answers.

   a   What is the difference between the answers given by the two methods, if the original price of the item is £90?
   b   Show that the difference between the answers given by the two methods is always the same, whatever the original price of the item.
   c   What would be the difference between the answers given by the two methods if he was told to raise the price of the item by both adding £A to it and increasing it by 20%.