WESTMINSTER SCHOOL

THE CHALLENGE 2017

MATHEMATICS II

Tuesday 25 April 2017

Time allowed: 1 hour 30 minutes

You will need a calculator for this paper.

All your working should be clearly shown.

You should attempt all the questions.

Please write in black or blue ink.

1 Tom bought a box of 30 hoodies and sold them at £16·50 each. He made 32% profit. How much did he pay for the box of hoodies?

2 Alex ran 8·1 km from his home to a viewpoint, where he sat down for a time before running the same distance home. While he was running, his average speed was 13·5 km per hour and he arrived home one hour and twenty-five minutes after leaving it. For how long did he sit down at the viewpoint?

3 **a** **i** What is the result of dividing $\frac{x}{3}$ by 3?

ii What would you need to add to $2-x$ to make $x+2$?

b Simplify

$\frac{1}{2}(x-3)-\frac{1}{3}(x-2)$.

c Solve the equation

$$\frac{x+1}{4}=2+\frac{x-3}{10}.$$

4 A circle has an area of 140·47 cm^2, correct to five significant figures.
What is its circumference? Give your answer correct to four significant figures.

5 **a** At a compound interest rate of 12% per year, what will an investment of £21,510 be worth in three years' time?

b An investment grows in three years from £37, 580 to £49, 340. At what compound interest rate per year is it growing?

6 The pupils in one year at a school play hockey, in teams of 11.
Three eighths of the boys, and one tenth of the girls are chosen for the A team. Then one third of the remaining boys and one third of the remaining girls are chosen for the B team.
How many boys and girls were there in the year?

7 Chocolates come in large or small boxes. A small box contains 10 chocolates.
Two large boxes and eight small boxes contain more chocolates than five large boxes and three small boxes. What possible numbers of chocolates could be in a large box?

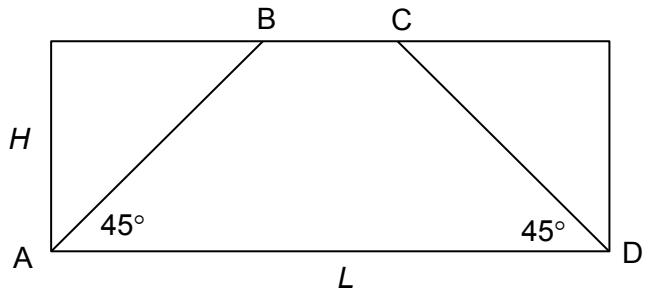
8 I have a tuk-tuk, which consumes fuel at 22 kilometres per litre. In the back I carry a moped, which consumes fuel at 28 kilometres per litre.
I have to travel 42 km, which I will do by travelling part of the way by tuk-tuk, and then abandoning this for the moped which I will use for the remaining part of the journey.

Method A: travel half of the distance by tuk-tuk and half of the distance by moped.

Method B: travel for half of the time by tuk-tuk and half the of the time by moped.

If I drive at 36 kilometres per hour in the tuk-tuk and 24 kilometres per hour on the moped, show clearly that Method B takes less time but uses more petrol than Method A.

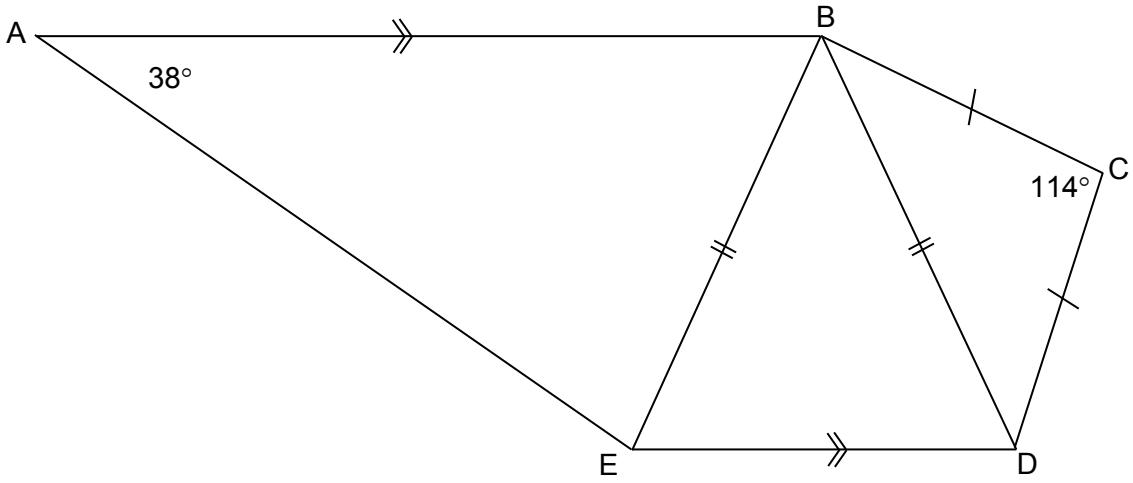
9 The diagram shows a rectangle of length L and height H. A trapezium ABCD is drawn inside the rectangle. The angles BAD and CDA are both equal to 45°.



a Find a formula for the area A of the trapezium in terms of L and H.

b Make L the subject of this formula.

10 In the diagram, AB is parallel to ED, and triangles BED and CBD are isosceles, with BE = BD and CB = CD. Angle BAE = 38° and angle BCD = 114°.



a Let angle ABE = x°. Find the following angles in terms of x, giving reasons for each step in your argument.

i Angle AEB.

ii Angle EBC.

b Prove that, if triangle ABE is isosceles, with AB = AE, then BC is parallel to AE.

11 **a** In 2015, Mr and Mrs Weasley each gave the same amount to the charity "Save the Griffin". In 2016, Mr Weasley gave this charity 25% less than in 2015, and Mrs Weasley gave 40% more. This meant that Mrs Weasley gave the charity £299 more than Mr Weasley in 2016. How much did they each give the charity in 2015?

b In 2015, Mr and Mrs Weasley each gave the same amount to the "Three-headed Dogs' Home". In 2016, Mr Weasley gave the Home 25% more than in 2015, and Mrs Weasley gave 40% less. Between them, Mr and Mrs Weasley gave the Home £999 in 2016. How much did they each give the Home in 2015?

c Was the amount Mr and Mrs Weasley gave to these two causes in 2016 more or less than in 2015, and by how much?

12 The diagram shows the points

A with co-ordinates (1, 2)

B with co-ordinates (4, 8)

C with co-ordinates (13, 5)

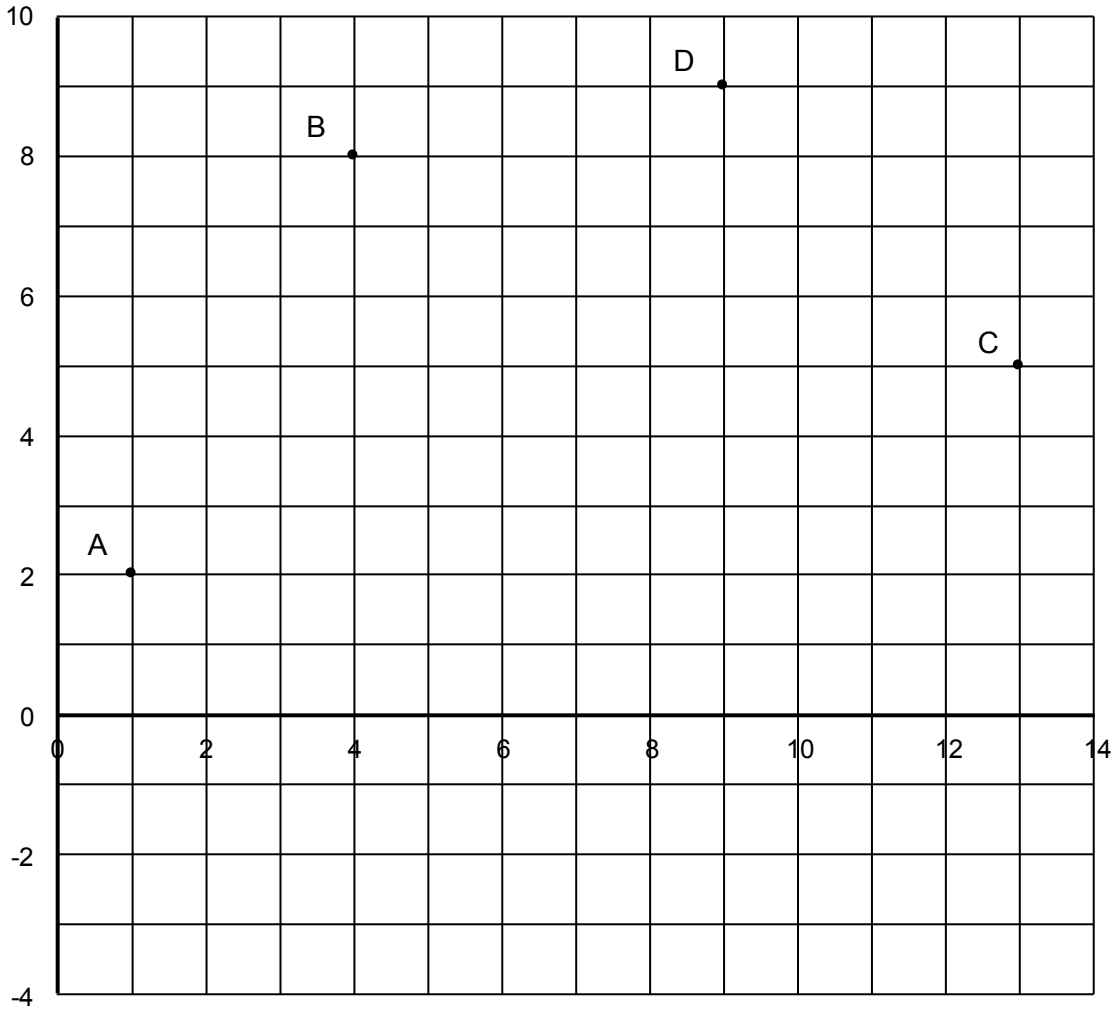
and D with co-ordinates (9, 9).

a Work out the co-ordinates of the point where line AB meets line CD.

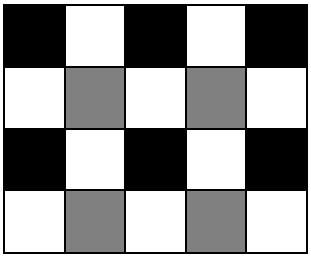
The *y* co-ordinate of point P is negative. ABCP is a parallelogram.

b **i** Work out the co-ordinates of point P.

ii Find the area of parallelogram ABCP.



13 The diagram shows how a rectangle is covered with black, white and grey tiles.
There is always a black tile in the top left hand corner of the rectangle. Rows and columns consist successively of alternating black and white tiles and alternating grey and white tiles.



a How many black, white and grey tiles would be needed to cover a rectangle

i 20 tiles by 16 tiles;

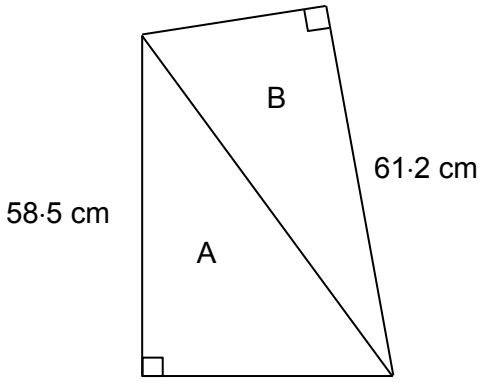
ii 18 tiles by 17 tiles

ii 17 tiles by 13 tiles.

b A rectangle requires 77 black tiles and 60 grey tiles. How many white tiles does it require?

c What are the possible sizes of rectangles which require 77 grey tiles?

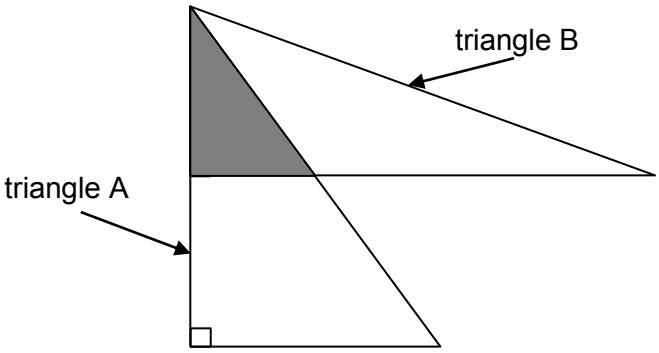
14 The diagram shows two right-angled triangles, A and B. Some of their side lengths are shown.



Triangle A has area 912·6 cm^2.

a Find the area of triangle B.

In the diagram below, the **same** two triangles are shown.



b Find the area of the shaded triangle, where A and B overlap.