WESTMINSTER SCHOOL
THE CHALLENGE 2016

MATHEMATICS II

Tuesday 26 April 2016

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.

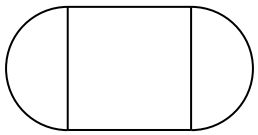
1 Sam and Tom are desperate for Mint Cake. Sam's eco-friendly car takes him from London to Kendal, a distance of 273 miles, while consuming petrol at an average rate of 72·8 miles to the gallon. Tom's gas-guzzler uses $6\frac{3}{4}$ gallons more petrol to cover the same distance. At what average rate does Tom's car consume petrol?

2 Archie buys 30 book bags at £4 each. He sells some at £6·50 and has to discount the rest, selling them at £3·50. When he has sold them all, He finds he has made an overall profit of 40% of his initial outlay. How many bags did he sell at the higher price?

3 **a** **i** What would you need to multiply $2a$ by to make 6?
ii What would you need to subtract from 10 to make x?

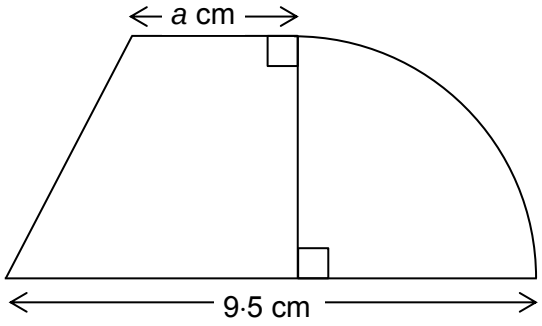
b Simplify
$3(a-2)-a+4-(a-3)$.

4 The shape in the diagram is made from a square and two semicircles. Each of the semicircles has radius r.



a Write a formula, in terms of r, for the perimeter, P of the shape.
b Make r the subject of the formula.

5 The diagram shows a quarter circle and a trapezium. Each has an area of 15·2 cm^2. Find a.



6 Solve the simultaneous equations
$\frac{1}{2}(3x-5)-\frac{2}{3}(y-1)=1$
$\frac{1}{4}(x-1)+\frac{1}{5}y=1$.

7 **a** In 2015, David spent 35% of his pocket money on chocolate. He spent £81·90 on chocolate. How much pocket money did David get in 2015?

b Euan's pocket money went up by 12.5% each year from 2011 to 2015. In 2011 he received £286·72 in pocket money. How much did he receive in 2015?

c In 2015, Fabio received £279·36 in pocket money. His pocket money went up by 28% between 2013 and 2015. How much did he receive in 2013?

d In 2011, Greg received £265·90 in pocket money. Between 2011 and 2015, his pocket money increased by the same percentage P each year. In 2015 he received £368·50 in pocket money. What is the value of P?

8 Josh and Kai share 12 sausage rolls and 12 muffins for their supper.
Josh eats some of the sausage rolls, each of which contains 270 calories, and seven muffins.
He consumes a total of 3190 calories.
Kai eats the remaining sausage rolls, and the five remaining muffins. He consumes a total of 4130 calories.
How many sausage rolls does each boy eat, and how many calories does each muffin contain?

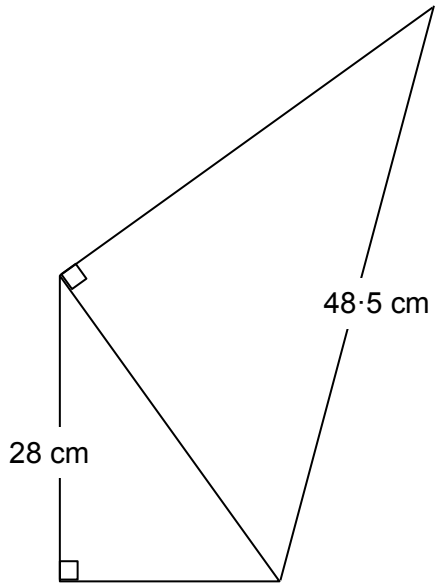
9 For which values of y will

$$3(x-y+2)-(y+1)$$

be greater than

$$3x-y+2-y+1?$$

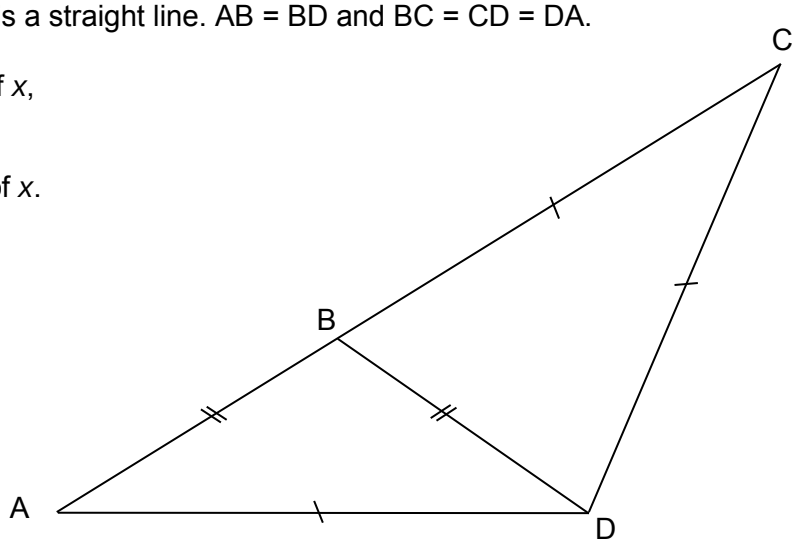
10 The diagram shows two right angled triangles.
The area of the smaller triangle is 231 cm^2.
What is the area of the larger triangle?



11 In this diagram, ABC is a straight line. AB = BD and BC = CD = DA.
Let angle BAD = $x°$.

a Find, in terms of x,
- **i** angle CBD
- **ii** angle BCD

b Find the value of x.



12 In 2014, Vastco sold 68% more widgets than Megacorp, but in 2015, Vastco only sold 44% more widgets than Megacorp. Between 2014 and 2015, Vastco's widget sales rose by 32%.
By what percentage did Megacorp's widget sales rise between 2014 and 2015?

13 **a** The set {7, 5, 1} is a set of three different positive (non-zero) whole numbers that add up to 13. Write down the other seven sets of three different positive whole numbers that add up to 13.

b Three boys take part in three challenges.
In each challenge, one of the boys comes first and is awarded *a* points, one comes second and is awarded *b* points, and one comes third and is awarded *c* points. There are no ties and *a*, *b* and *c* are all different positive numbers.
After the three challenges, the boys have scored totals of 17, 16 and 6.

i Show clearly that there are exactly two possible sets of values of *a*, *b* and *c*.

ii Alex came first in one challenge, and third in another. What are the values of *a*, *b* and *c*?

14 The diagram shows the points

A with co-ordinates (1, 3)

B with co-ordinates (9, 7)

C with co-ordinates (12, 6)

and Q with co-ordinates (8, –1).

a Use Pythagoras's Theorem to show that point Q is the same distance from point A as it is from point B.

Point P is also the same distance from point A as it is from point B.
Points P and Q both lie on the same circle with centre C.

b Work out the co-ordinates of point P. Explain how you found your answer.