Surname ..... **Candidate number** .....

First name .....

Current school .....

The Manchester Grammar School

Entrance Examination 2012
Arithmetic Paper 2

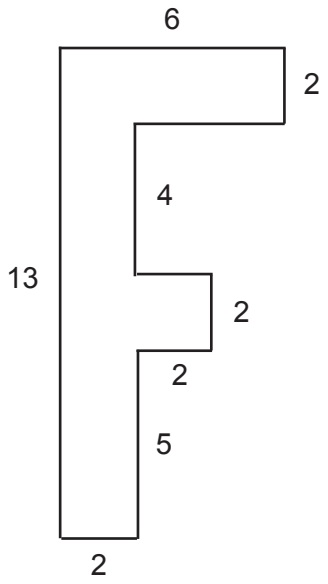
1 Hour

Do not open this booklet until told to do so
Calculators may not be used

Write your names, school and candidate number in the spaces provided at the top of the page.

Show all your working in full, as this will be marked, and then write your answer clearly.

1. All the measurements in the following diagram are given in centimetres



(a) Find the perimeter of this letter F

1a ____ cm

(b) Find the area of this letter F

1b ____ cm^2

[5 marks]

2. The FAB of a number is obtained by multiplying the number by all the whole numbers less than or equal to it down to one.

So FAB 3 = 6 because 3 x 2 x 1 = 6

(a) Work out FAB 5 | 2a |

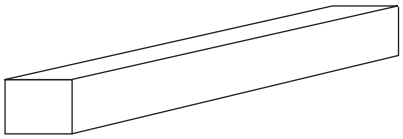
(b) If FAB x = 720, what is the value of x? | 2b |

(c) What is FAB 11 divided by FAB 9? | 2c |

(d) If FAB 10 = 3,628,800; what is FAB 9? | 2d |

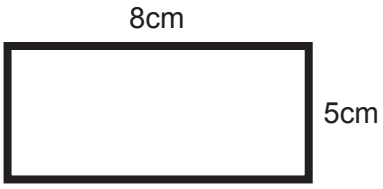
[5 marks]

3. Cheadle Construction uses metal beams, like the one below, in buildings to support walls and ceilings.



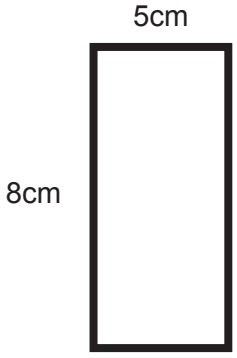
The beams can be placed in one of two ways so the end of the beam is in either Position 1 or Position 2

Position 1



or

Position 2



The height and width of a beam (in cms) determines the size of the greatest load (in kgs) the beam can support, according to the following formula

Load = 10 x height x height x width

So if the height is 4cm and the width is 6cm, the greatest load is given by

L = 10 x 4 x 4 x 6 = 960kg

(a) What is the greatest load a beam can support when it lies in position 1?

3a	kg

(b) What is the difference in the loads between the two positions?

3b	kg

The weight of a wall means that a beam in the wall is needed to support a load of 4860kg.

(c) If the width of the beam had to be 6cm, what height of beam would a builder have to use?

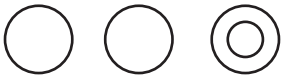
3c	cm

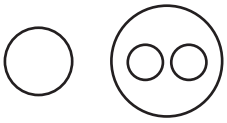
[5 marks]

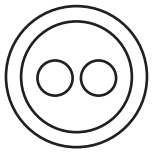
4. The Code Club at Bletchley Park School were taking a break from their normal activities to devise some codes of their own. One of the apprentice code makers came up with the following system for listing circles and circles inside circles, using only brackets and the number I.

Code	**for the picture of**
I	a circle
I (I)	a circle inside a circle
and I (I (I))	a circle inside a circle inside a circle

and so on.

So  is I I I(I)

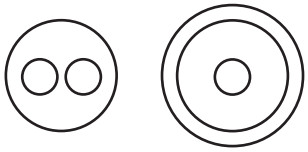
and  is I I(I I)

and  is I(I(I I))

(a) Give the codes for

i) 

4ai

ii) 

4aii

(b) Draw the picture for the following code I I I(I(I)) I(I)

[5 marks]

5. A festival in Platt Fields attracted a huge crowd and all the people attending brought food with them to share out. Some people brought bread with them, others brought fish while the remainder brought fruit in the form of apples.

Everyone agreed that they would share their food with each other according to the following rules

Two loaves of bread could be swapped for one fish

and one loaf could be swapped for three apples

(a) Oliver brought two fish and firstly swapped them for loaves of bread. Then he decided to change the loaves for apples.
How many apples did he get?

5a	apples

(b) How many loaves could Irfan have for three fish and twelve apples?

5b	loaves

(c) Aidan wanted four fish to go with each loaf, how many loaves and fish could he exchange for 54 apples?

5c	loaves
	fish

[5 marks]

6. In a skate-boarding competition competitors do a series of tricks which judges score as follows:-

Super scores 5 points **Good scores 3 points** **Poor scores 2 points**

After a few tricks the scores are put up on a board with the competitors in order of their total score. Unfortunately it started to rain and some of the figures were then washed out.

Name	No of tricks	Super	Good	Poor	Total Points
Derek	8		1	2	
Ali	9				
Charlie	9	2			30
Brian		4			23

Fill in all the missing numbers on the board so that the judges have a complete set of scores.

[5 marks]

7. You are given that 27 x 351 = 9477

Use this information to answer the following questions

(a) 9477 ÷ 351 = 7a

(b) 2.7 x 3.51 = 7b

(c) 947.7 ÷ 270 = 7c

(d) 54 x 351 = 7d

[5 marks]

8. If the differences between each pair of consecutive terms of a sequence are taken, and then the differences in this new sequence are taken, and so on, the numbers may turn out to be the same.

For example for the sequence 1 4 9 16 25

The first differences are 3 5 7 9

And the second differences are 2 2 2

As the second differences are the same, we say that the original sequence is a "sequence of order 2"

(a) Fill in the gaps for this sequence of order 2

3 __ __ __ __

1 __ __ __

5 5 5

(b) Fill in the gaps for this sequence of order 3

__ 12 __ __ __

__ __ __ 30

__ 7 __

3 __

[5 marks]

9. In the game of flog, a player has to try to get a ball in a hole in as few shots as possible. The target number of shots for each hole is 5 . The player is awarded a number of points according to how many shots he took:

Shots	Points
1	4
2	3
3	2
4	1
5	0
6	-1
7	-2

If David plays 3 holes and scores 3, 3 and 4, his total points score will be 5 because his points for each hole would be as follows 2 + 2 + 1 = 5

But if John's scores were 5, 7 and 6 on the same three holes, his total points score will be -3 because his points for each hole would be 0 + (-2) + (-1) = -3

The winner is the player with the highest total number of points at the end of the game.

(a) What would the total points score be if a player took the following number of shots on successive holes:

i) If Rodger took 6, 6, 6, 5 and 5 | 9ai |

ii) If Nigel took 2, 5, 7, 4 and 7 | 9aii |

(b) Howard played four holes and scored 4, 1, 5, x. His total points score was 3. What is the value of x, the number of strokes that Howard took on the fourth hole?

9b

(c) Rachel played six holes and scored 7, 2, 6, 6, 2, y. Her total points score was 3. What is the value of y, the number of strokes that Rachel took on the sixth hole?

9c

(d) What is the maximum score that a player can get from playing:

i) 5 holes?

9di

ii) 6 holes if he scores a 6 and two 7s on his first three holes?

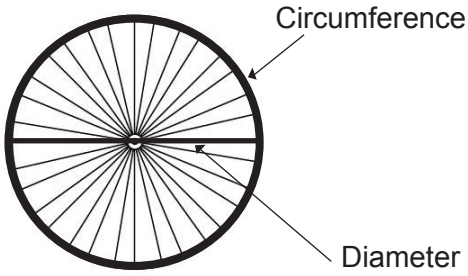
9dii

(e) The target number of shots for each hole is changed from 5 to T. Tim played 6 holes and his number of shots on each hole was 5, 5, 3, 3, 2, 4. He scored 2 points. What is the value of T, the target number?

9e

[10 marks]

10. The distance all the way round the outside of my bicycle wheel is known as the circumference. It is about three times the distance across the middle of the wheel, known as the diameter.



So if Andrew has a wheel with diameter 50 centimetres, its circumference would be about 150cm or 1.5 metres and it would take 100 turns of the wheel to travel a distance of 150m and 1000 turns to travel 1.5 kilometres.

Using this approximation that **Circumference = 3 x diameter**

(a) How many metres would Andrew travel in 60 turns of the wheel?

10a		m

(b) How many turns of the wheel would it take him to cover 600m?

10b	

Andrew enters a road race, the distance for which is 75km

(c) How many turns of his front wheel does this race take?

10c	

Andrew's great-great-grandfather took part in the same race over a hundred years ago, but the large wheel on his penny-farthing bicycle was 2 metres across

(d) How many turns of this large wheel were required to complete the race?

10d

(e) What fraction of Andrew's number of turns was his great-great-grandfathers number?

10e

(f) Give a reason why this is.

10f

[10 marks]

11. The Yummy Jam Company makes jam for a wide range of shops and supermarkets. The cost of a jar of jam is made up by adding the costs of the jam, the jar and the lid.

So

Total cost of a jar of jam = Cost of the jar + Cost of the lid + Cost of the jam

At present, the company calculates that the cost of the jam is 20p for every 100g

(a) For a small jar, containing 200g of jam, the lid costs 10p and the jar 50p. What is the total cost of the jar of jam?

11a ____ p

(b) A medium jar contains 350g of jam and the medium jar costs 60p. If the total cost is £1.55, what is the cost of the lid for the medium jar of jam.

11b ____ p

(c) A large jar of jam contains 500g of jam and the total cost is £3.00. If the jar costs four times as much as the lid, what does the jar cost?

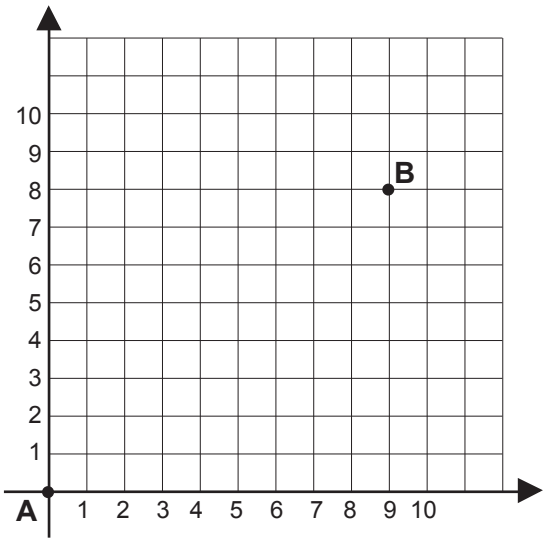
11c ____ p

(d) A catering jar with a lid costing 65p and a jar costing £2 has a total cost of £4.65. What weight of jam does the catering jar contain?

11d ____ g

[10 marks]

12.



A point is described by its coordinates, eg point B on the diagram has coordinates (9,8). This is **not the same** as (8,9). Point A has coordinates (0,0).

To move from one point to another on the graph you can travel by K-steps or by T-steps.

A K-step moves you 1 place to the right and 2 places up

A T-step moves you 3 places to the right and 1 place up.

(a) Starting from point A, what would your coordinates be after a K-step followed by a T-step?

12a (,)

(b) It is possible to move from point A to point B by combining some K-steps and some T-steps. Write down how many K-steps and T-steps are needed.

12b K-steps

T-steps

(c) To get from point C (which is not shown on the diagram) to point B you need to take one K-step and two T-steps. Write down the coordinates of the point C.

12c (,)

A U -step is the reverse of a T-step. So a U-step moves you 3 places left and 1 place down.

(d) Starting from point B, and then doing a U-step, a K-step and a T-step, you finish up at a point D (not shown). Write down the coordinates of point D.

12d (,)

[10 marks]