Name: _____ Candidate Number: _____

mgs Founded 1515 | The Manchester Grammar School

ENTRANCE EXAMINATION 2007
PART 2 ARITHMETIC EXAMINATION

Time available: 75 minutes

Write your name and candidate number in the spaces provided at the top of the page.

Try to answer all the questions in the order that they appear.

Write your working and your answer in the space provided after each question. If you cannot answer a question, go on to the next.

If you run out of space for an answer, use the space provided after Question 10.

All your working must be shown because it may be worth some marks. Scrap paper must therefore not be used.

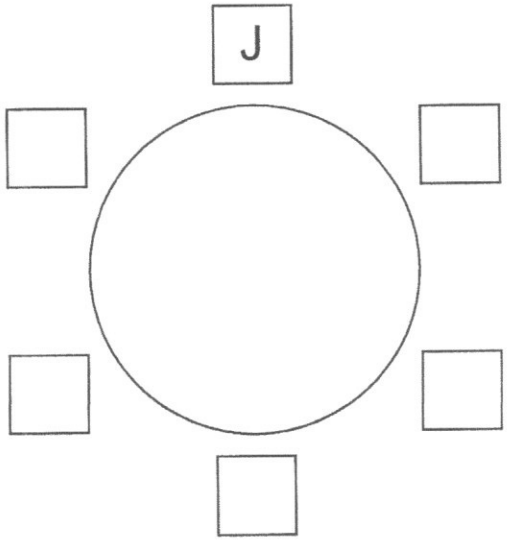
Take care to leave yourself enough time to answer all the questions. Use any time you have left to make the best attempt you can at any questions you have not done.

Calculators may not be used.

MGS Part 2 : 75MIN

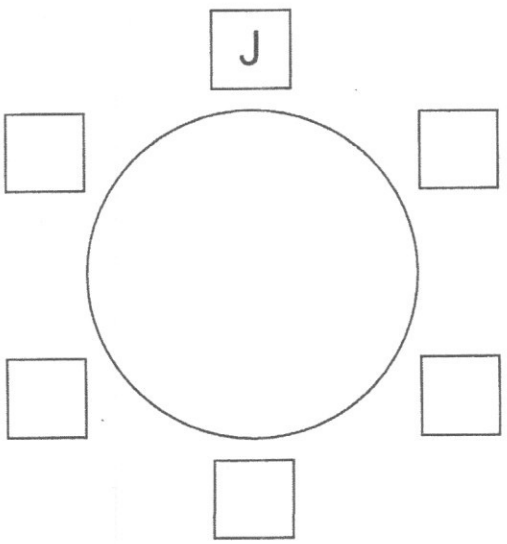
DO NOT WRITE IN THIS MARGIN

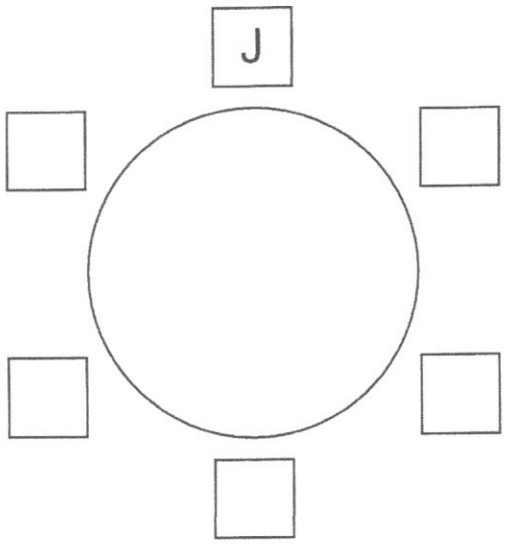
1. A round table has 6 seats placed around it.
Six children, Aidan (A), David (D), Jim (J), Nigel (N), Paul (P) and Rodger (R) sit at the table.
Jim sits down as shown in the diagram.
David does not sit next to Jim.
Nigel has David sitting next to him on his left.
Aidan sits opposite David.
Paul sits next to Jim.
On the diagram, show where the children sit down.



5 Marks

The diagrams below are to help you with your working, but your final answer must be entered on the diagram above.





DO NOT WRITE IN THIS MARGIN

2. A pyramid has a rectangular base.
The formula for working out the volume of a pyramid is:

$$V = \frac{1}{3} \times L \times W \times H$$

L metres and W metres are the length and width of the rectangular base.
H metres is the height of the pyramid.
V cubic metres is the volume of the pyramid.

For example, if the base is 6 metres long and 3 metres wide, and the height is 2 metres, then the volume is 12 cubic metres, because;

$$V = \frac{1}{3} \times 6 \times 3 \times 2 = 12$$

(a) A certain pyramid has a base with a length of 8 metres and a width of 6 metres. The height of the pyramid is 5 metres. What is its volume?

_____

_____ Volume = _____ m^3

(b) The volume of a different pyramid is 96 cubic metres, the length is 12 metres and the width 4 metres. What is the height?

_____

_____ Height = _____ m

(c) Another pyramid has a square base. Its volume is 108 cubic metres and the height is 9 metres. Work out the length of the side of the square.

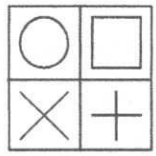
_____

_____ Length = _____ m

5 Marks

DO NOT WRITE IN THIS MARGIN

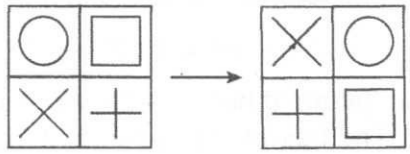
3. I have a square card which looks like this:



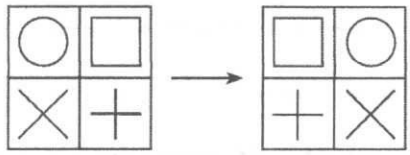
The other side of the card is exactly the same, with another circle at the back of the circle, and so on.

In a game there are two moves I can make using the card:

A 'rote' turns the card through a quarter of a turn clockwise, so it now looks like this:

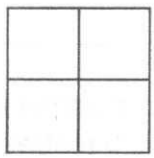


A 'flip' holds the right hand side of the card still and flips the card over, so it now looks like this:

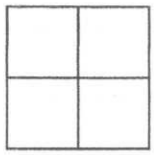


Starting every time with the card in its original position, show what the card will look like if I do: (there are some blank grids below for you to do your working)

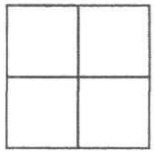
(a) a 'rote' followed by a 'flip';



(b) a 'flip' followed by a 'rote';

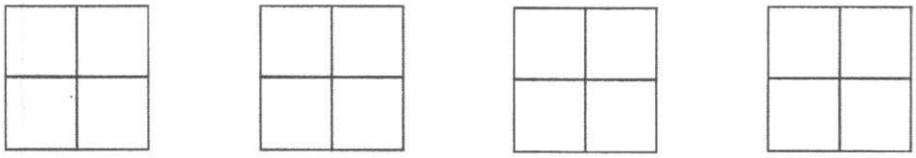


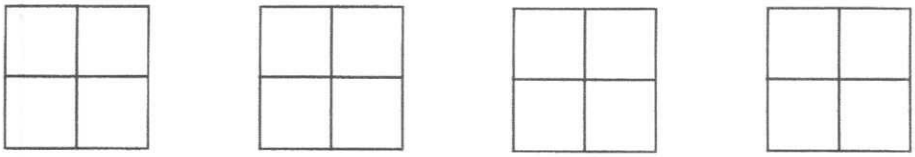
(c) a 'rote', then another 'rote', then a 'flip', then a 'rote'.



5 Marks

The grids below are to help you with your working.





DO NOT WRITE IN THIS MARGIN

5. **Note : The quotient of two numbers is the answer you obtain when you divide one of the numbers by the other.**

(a) Find two numbers which have a sum of 21 and a product of 108.

(b) Find two numbers which have a difference of 6 and a quotient of 2.

(c) Find two numbers which have a sum of 2000 and a difference of 200.

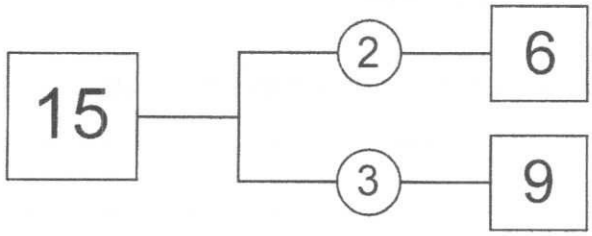
(d) Find two numbers which have a product of 54 and a quotient of $\frac{2}{3}$.

(e) Find three numbers which have a sum of 13 and a product of 60.

10 Marks

DO NOT WRITE IN THIS MARGIN

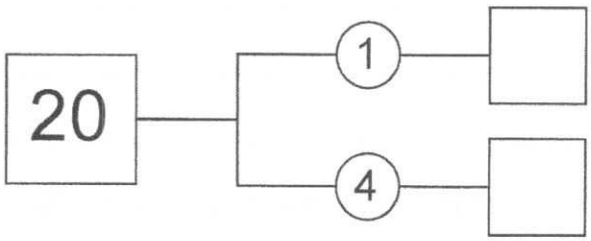
6. A **number-split** diagram shows how a number is split into parts. The diagram



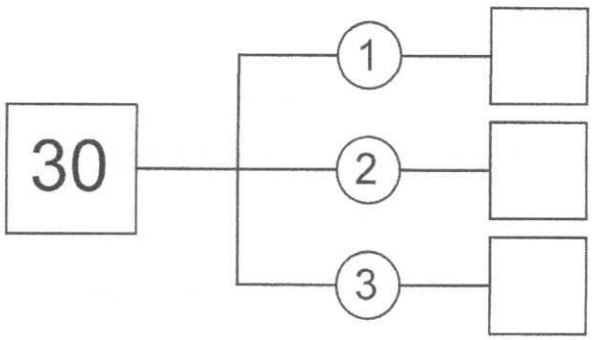
shows that, in a ratio ② : ③ split, the number 15 is split into 6 and 9.

Complete the following number-split diagrams.

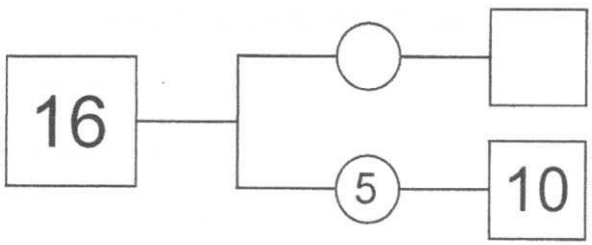
(a)



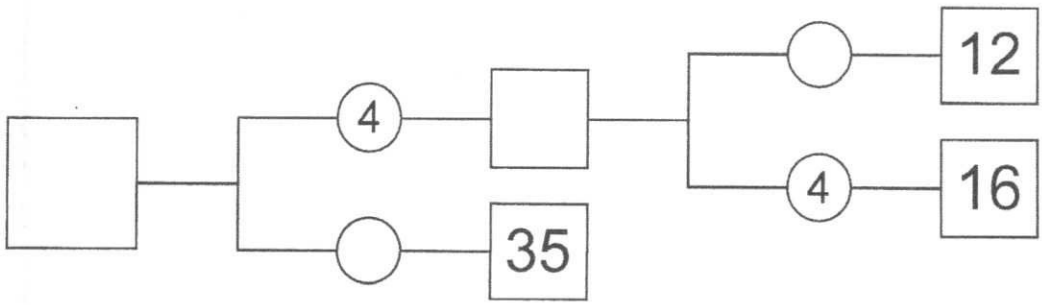
(b)



(c)



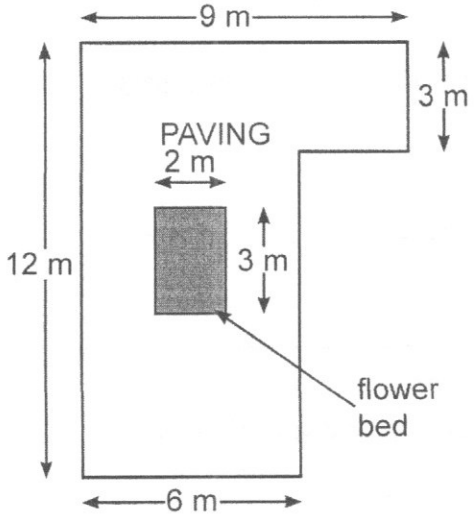
(d)

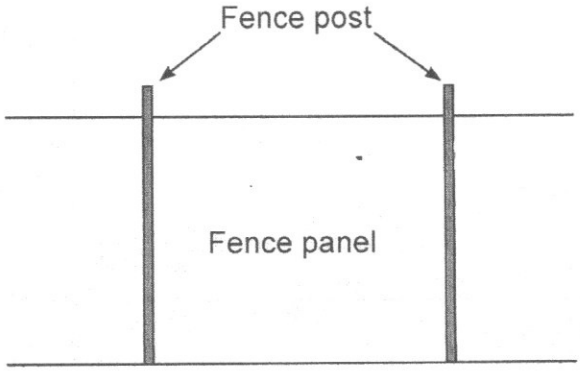


10 Marks

The Jardin family have just moved house. Mr Jardin is planning to do some work on the new garden. He is going to make a flowerbed 2m by 3m with soil 90cm deep, and then put flagstone paving over the remaining area.

Being a very systematic man he draws out a sketch of the garden. He then collects information from the local garden centre and notes down some details.





Fencing. Fence panels are 150 cm long and cost £1·80 each. Fence posts cost £1·20 each and I can ignore their width.

Flagstones. Flags are 1m by 50cm and cost £3·50 each.

Soil costs £6 for a bag containing 200 000cm³.

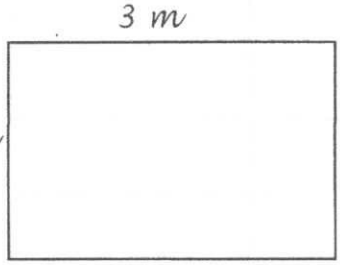
Flowering plants cost £1·80 each and must be planted at least 50cm from each other and at least 75cm from the nearest edge of the flower bed.

Mr Jardin then starts to work out what materials he will need and how much it will cost him, doing all his working carefully and then writing his conclusions.

You should show what he produced in his table on the opposite page showing all the necessary working.

Use this information to complete Mr Jardin's estimate for the total cost of the garden.

Item	*Number*	*Cost each*	*Total cost*
Fence panels			
Fence posts			
Flagstones			
Bags of soil			
Flower plants			
		Overall total cost	

All my working	Materials to buy
Fencing	Fencing The perimeter of the garden is _____ m I will need _____ panels I will need _____ posts
Flagstones	Flagstones The area of the garden is _____ m^2 The area which needs to be paved with flagstones is _____ m^2 I will need _____ flagstones
Soil	Soil The volume of soil I need is _____ cm^3 I will need _____ bags of soil
Flowers My sketch of the flowerbed showing how to fit as many plants as possible 3 m 2 m 	Flowers I will need _____ plants

DO NOT WRITE IN THIS MARGIN

8. To **digitise** a number I add the digits of the number repeatedly until I obtain a single digit.

For example, 23 digitises to 5 because $23 \longrightarrow 2 + 3 = 5$ and

4,863 digitises to 3 because

$4{,}863 \longrightarrow 4 + 8 + 6 + 3 = 21 \longrightarrow 2 + 1 = 3$

(a) Digitise 12,345.

(b) List all the 2-digit numbers which digitise to 1.

(c) For the numbers between 300 and 400

(i) What is the smallest number which digitises to 2?

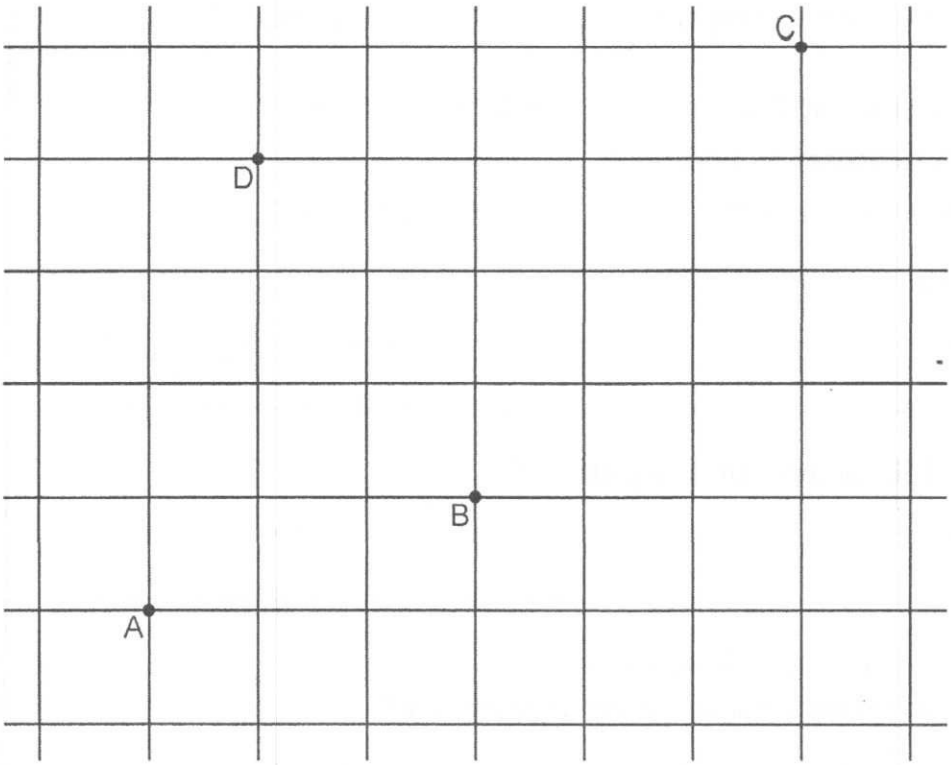
(ii) What is the largest number which digitises to 2?

(d) What are the first three numbers greater than 1000 which digitise to 3?

(e) What is the largest 3-digit number which digitises to 9?

DO NOT WRITE IN THIS MARGIN

9.



A **slider** takes you from one point on the grid to another point. The first number in a slider refers to left or right, the second number to up or down.

For example, the slider [3, 1] takes you from A to B, because from A you move 3 to the right and 1 up to get to B.

Likewise, from C to B, the slider is [–3, –4] because from C you would go 3 to the left and 4 down.

(a) What slider takes you from B to D? _____

(b) Slider [5, –1] takes you from D to E. Mark point E on the diagram above.

For the final three parts of the question you may mark points, and do any working, on the grid on the opposite page.

(c) The points P, Q and R are not marked on the grid. Slider [7, 3] takes you from P to Q, and slider [–2, 4] takes you from Q to R. What slider would take you from P to R?

_____

(d) The points S, T and U are not marked on the grid. Slider [3, 10] takes you from S to T. Slider [–7, –2] takes you from S to U. What slider would take you from U to T?

_____

(e) The points X, Y and Z are not marked on the grid. Slider [4, –3] takes you from X to Y. Slider [–2, –1] takes you from Z to X. What slider would take you from Y to Z?

_____

10 Marks

DO NOT WRITE IN THIS MARGIN

This page is for any rough working for question 8.

DO NOT WRITE IN THIS MARGIN

10. In the fantasy game 'Dragon Lair', creatures have different powers.

5 elves match 2 wizards.

6 devils match 5 wizards.

4 elves match 3 sprites.

(a) How many elves match 12 devils?

(b) How many sprites match 8 wizards?

(c) How many devils match 20 elves plus 7 wizards?

(d) How many sprites match 24 devils plus 12 wizards?

(e) 15 elves plus 12 devils are matched by 8 wizards plus x sprites. What is the value of x?

10 Marks

END OF PAPER