Name: ______________________________ Candidate Number: ________

The Manchester Grammar School

Founded 1515

ENTRANCE EXAMINATION 2008
PART 2 ARITHMETIC EXAMINATION

Time available: 75 minutes

Remove the centre page of the booklet.

Write your name and candidate number in the spaces provided at the top of the pages on each answer booklet.

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 11.

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.

DO NOT WRITE IN THIS MARGIN

1. In a game of 'Toozy, Threezy' I have to find all the ways of making a number by adding together only 2s and 3s.

For example, to make 8, there are two ways:

$8 = 2 + 2 + 2 + 2$, so I add four 2s

$8 = 2 + 3 + 3$, so I add one 2 and two 3s.

So for 8,

Toozy	Threezy
4	0
1	2

Fill in these tables:

(a) For 12,

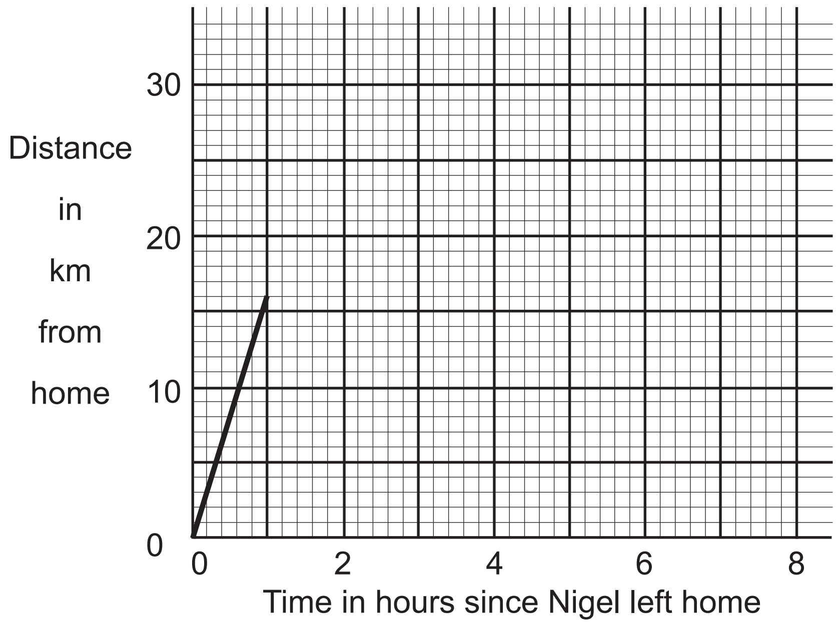
Toozy	Threezy

(b) For 20,

Toozy	Threezy

5 Marks

2. Nigel cycles from his home to his grandmother's house, 30 kilometres away.



The graph shows that after one hour he was 16 km from home.

(a) He slowed down after this, and cycled steadily for the remainder of the journey, arriving at his grandmothers house two hours later.
Draw a line on the graph to show this.

(b) Nigel stayed at her house for 1 hour.
Draw a line on the graph to show this.

(c) He cycled home at 10 kilometres per hour.
Draw a line on the graph to show this.

5 Marks

DO NOT WRITE IN THIS MARGIN

3. In a Tribonacci sequence, each number after the third one is the sum of the previous three numbers.

For example, if the first three numbers are 1, 2 and 3,

then the sequence is 1, 2, 3, 6, 11, 20, and so on.

Fill in the missing numbers in these Tribonacci sequences:

(a) 1, 5, 7, __, __, __

(b) 2, 3, __, 8, __

(c) 5, __, 12, __, 49

5 Marks

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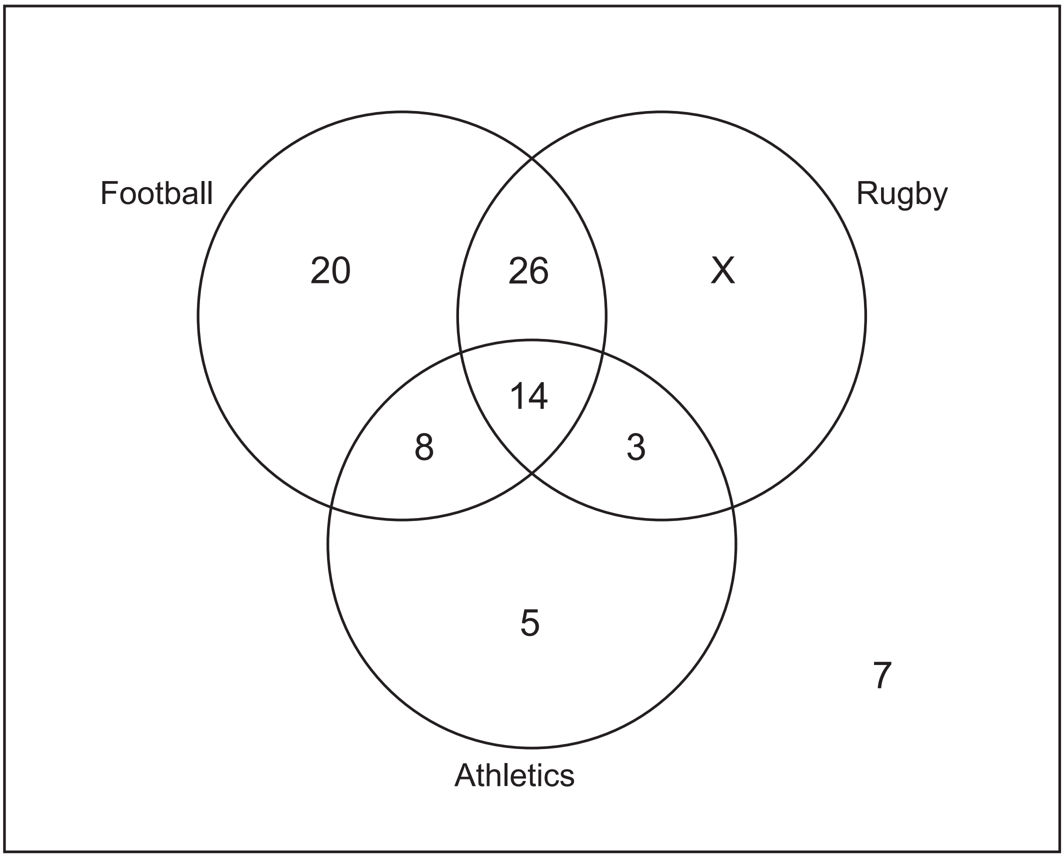
4. 100 first formers were asked whether they liked football, rugby or athletics. The results are shown in the diagram.



(a) What number does x stand for?

____

(b) How many liked all three sports?

____

(c) How many liked exactly two of the three sports?

____

(d) How many liked at least one sport?

____

(e) What fraction of these first formers liked athletics?

____

5 Marks

5. A newspaper is made up from double sheets of paper, placed on top of each other, and then folded down the middle.

For example, an 8-page newspaper is made from two double sheets. The outer one consists of the pages numbered 1, 2, 7 and 8. The inner one, which is tucked inside the outer, consists of the pages numbered 3, 4, 5 and 6.

(a) In a 16-page newspaper, what other three numbers are on the double sheet with page 3 on it?

____

____

(b) In a 24-page newspaper, what other three numbers are on the double sheet with page 18 on it?

____

____

(c) In another newspaper, pages 7 and 42 are on the same double sheet. How many pages does this newspaper have?

____

____

5 Marks

DO NOT WRITE IN THIS MARGIN

6. A number is a multiple of 3 if its digits add up to a multiple of 3.

For example, 4725 is a multiple of 3 because $4 + 7 + 2 + 5 = 18$.

A number is a multiple of 11 if the difference between the sum of the digits in the odd positions, and the sum of the digits in the even positions, is a multiple of 11.

For example, 76824 is a multiple of 11 because

$7 + 8 + 4 = 19$, $6 + 2 = 8$ and $19 - 8 = 11$

(a) Using this method explain why 1428 is a multiple of 3.

(b) Using this method explain why 819291 is a multiple of 11.

(c) Using this method explain why 62418 is a multiple of 6.

5 Marks

7. In a bungee jump, a person is tied to an elastic rope and jumps from a platform.

There is a formula to work out the distance D, in centimetres, that the person will fall from the platform.

The formula is $D = M \times L \times S^2$.

M is the mass in kg of the person.
L is the length of the rope in metres.
S is the stretchiness of the rope.

For example, if M = 50, L = 2 and S = 4, then D = 50 x 2 x 4 x 4 = 1600.

Fill in the missing values in this table.

D	M	L	S
	80	10	2
900	50		3
	60	40	0·2
6300		5	6
7500	60	5	

10 Marks

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ENTRANCE EXAMINATION 2007

PART 2 ARITHMETIC EXAMINATION

Remove this section from the exam paper now.
You can do this section at any time during the examination.

DATA QUESTION

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

In this section you cannot gain full marks without showing your working. All working must be done in the answer space provided. Working done elsewhere will not be marked.

However, if you need more space than there is alongside a question you can do more working on the blank back page but you should do this work neatly and show what question you are doing by putting the number of the question at the side of the working.

The marks for each part are shown in the bottom right hand corner of the section.
For example in Question 1, getting all your answers right gains 2 marks. If you show sensible working but get all the answers wrong you still gain 2 marks. Proper working and correct answers gain 4 marks.

Work neatly and organise your work well.

Mr Nomad is planning a family holiday in Manchuria.

He will be going with his wife and his three children, Matthew, aged 10, Mark, aged 8 a
Luke, aged 2.

There are three main costs for him to consider – the flights, the villa they will stay in, and car hire. He collects the following information.

Currency

In Manchuria the unit of currency is a wot and £1 is worth 15 wots.

Flight costs

£350 per person including all airport taxes and fuel surcharges.

Children travel at full fare except that children under 5 travel at 2/5 of the full fare.

Villa

£30 per person per night.

Children under 3 are free and there is a 40% reduction for children under 12.

Car hire

180 wots per day and you supply your own fuel.

Fuel costs 18 wots per litre and the car travels 6 miles per litre.

Mr Nomad is planning a holiday for 8 nights in the villa. He will hire a car for 5 days and will travel an average of 48 miles per day.

He sits down to work out the holiday cost and his plan is shown on the opposite page.

Fill in the gaps in his planning showing all your working in the space next to the calculation.

Flight … of us travel at full fare £350 and … travels cheaper at £….... Total flight cost is £ ….... 2	Flight calculations 2
Villa Total cost for one adult in the villa for the whole holiday is £ ….... Total cost for one child under 12 is £ ….... Total villa cost for family is £ ……. 3	Villa calculations 2
Car hire Total cost before fuel charges is ……. wots Total mileage …..…. miles Fuel used ..….. litres Cost of fuel is ….…. wots Total car hire cost is ….…. wots Total car hire is £ ….... 6	Car hire calculations 5

8 . In the famous Manchester square dance, 8 dancers stand in a square as shown in the diagram, all facing the middle of the square.

A	B	C
H	•	D
G	F	E

There are only three dance moves.

A Soozy - each dancer moves one place clockwise, for example A moves to B's position, and so on.

A double-reverse - Soozy each dancer moves two places anticlockwise.

A Timi - each dancer swaps places with the person opposite, so for example B swaps with F, C swaps with G and so on.

The dancers all start in the positions shown above.

(a) Who would be in A's starting position after:

(i) a double reverse Soozy; ________________

(ii) a Timi; ________________

(iii) a Soozy followed by a Timi; ________________

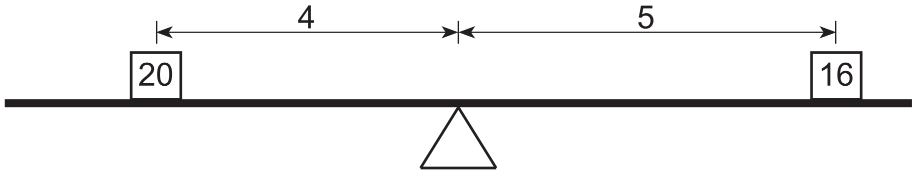
(iv) a Timi, then a Soozy, then a Timi. ________________

(b) After two moves, A is in F's position. What were the two moves?

(c) List the possible positions where B could end up after doing any two dance moves (including the same one twice).

10 Marks

9. On a see-saw, the **twist** of a mass is found by multiplying the mass by the distance of the mass from the balance point.



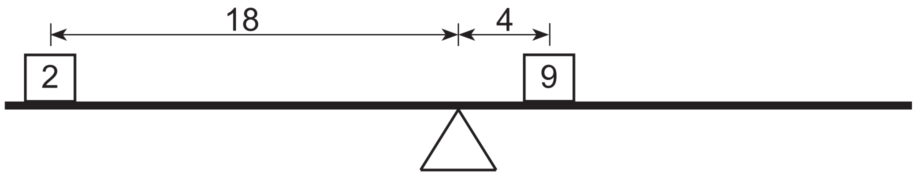
The masses are 20 and 16, the distances are 4 and 5.

The **twist** on one side = 20 x 4 = 80.

The **twist** on the other side = 16 x 5 = 80.

So the see-saw is balanced.

(a) Explain why this see-saw is balanced.



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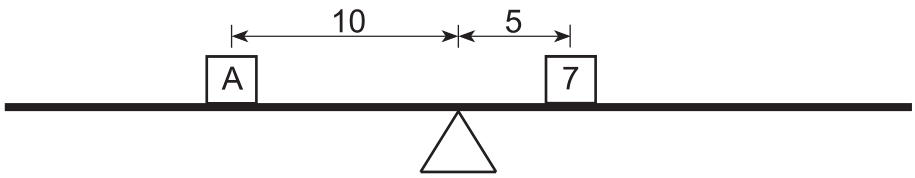
(b) Work out the value of A.



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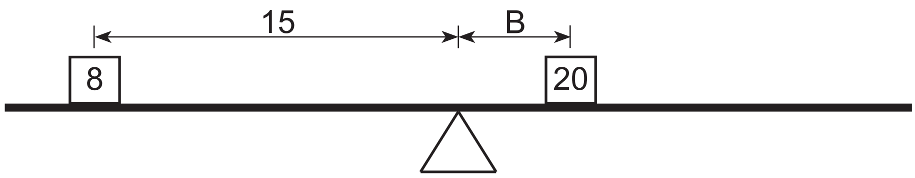
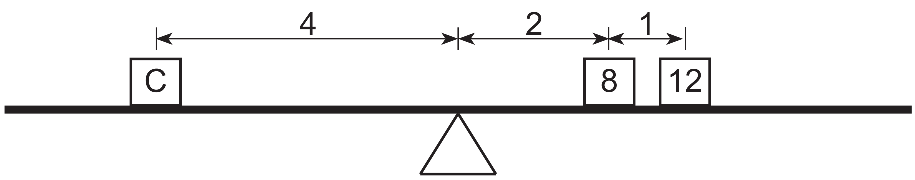
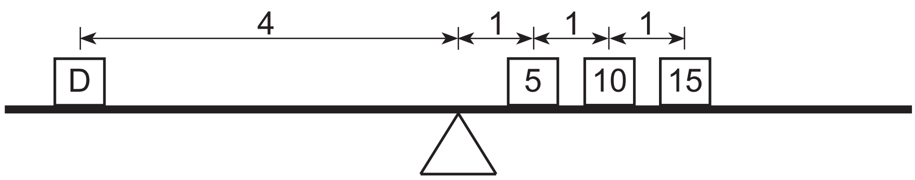
(c) Work out the value of B.



(d) Work out the value of C.



(e) Work out the value of D.



10 Marks

10. Put the numbers 10 to 19 (each is used once only) in the appropriate place to complete the following:

________ is a multiple of 5;

________ both digits are square numbers;

________ has six factors;

________ is a factor of 42;

________ has the first digit greater than the second;

________ is the sum of the two largest digits;

________ is a square number;

________ is a prime number;

________ has four consecutive factors;

________ divides into 2343.

10 Marks

11. A dart board has singles, doubles and trebles. In a game with some friends, we each threw three darts at the board. The aim of the game was to hit one single score, one double, and one treble.

Tim scored single 16, double 5 and treble 20. His score was 16 + 10 + 60 = 86.

(a) Rodger scored single 18, double 17 and treble 16. What was his score?

(b) Aidan threw single 6 and treble 11. His score was 67. What double did he hit?

(c) When Paul threw, he hit the same number for the single, double and treble. His score was 78. What was the number?

(d) Andrew scored 72. He hit the same number for his single and his double. The score he obtained for his treble was twice the score he obtained from the sum of the other two scores. Which double did he hit?

(e) When Neil threw, his double number was twice his single number, and his treble number was three times his single number. He scored 56. What was his single number?

10 Marks

END OF PAPER

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