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

**First name** .....

**Current school** .....

mgs Founded 1515 | The Manchester Grammar School

# Entrance Examination 2020
# Arithmetic Section B

## 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 this page.**

For each question, show all your working in full, as this will be marked, and then write your answer clearly in the space provided. If you run out of space for an answer use the space provided at the end of this booklet, numbering your answers carefully.

You have 1 hour for this paper which is worth 80 marks.

| **Marker** | Short Problems Q1 - 6 | Longer Problems Q7 - 11 | **TOTAL** |
|---|---|---|---|
| **Score** | | | |
| **out of** | **30** | **50** | **80** |

1. **Using the fact that 43 x 275 = 11825, <u>write down</u>** the answers to the following questions

(a) 11825 ÷ 43 = 1a

(b) 430 x 27.5 = 1b

(c) 118.25 ÷ 2.75 = 1c

(d) 4.3 x 2.75 = 1d

(e) 86 x 275 = 1e

**[5 marks]**

2. A group of boys play their own game of darts on a special dart board with numbers 1 to 20, each number having a **"single"** section and a **"double"** section.

They each throw two darts. One of the darts has to land in any number's "single" section and the other has to land in any number's "double" section when you then multiply that "double" dart's score by two.

**As an example, player A throws a "single" 3 and a "double" 4, so scores**

**3 + 2 x 4 = 11 as shown in the table below.**

(a) Complete the rows in the table below for players B, C and D

(b) Player E throws his "double" dart in a number which is twice the "single" number dart that he throws and scores a total of 45. Complete the row for player E.

(c) Player F scores a total of 55. Show **one** of the three ways he could have done this.

| Player | Single Section Number | Double Section Number | Total Score |
|---|---|---|---|
| **A** | 3 | 4 | 11 |
| **B** | 7 | 11 | |
| **C** | | 14 | 30 |
| **D** | 19 | | 53 |
| **E** | | | 45 |
| **F** | | | 55 |

**[5 marks]**

3. Fifty years ago, the units of money in this country were not pounds and pence, they were pounds, shillings and pence and an amount of money such as four pounds five shillings and six pence was written as £4 5s 6d.

**There were 12 pence in a shilling and 20 shillings in a pound.**

(a) How many pence were there in 8s 4d (eight shillings and four pence)?

3a ____ d

(b) How many pounds and shillings would 136 shillings be?

3b £ ____ s

(c) How many pence would there be in £3 5s 7d?

3c ____ d

**[5 marks]**

4. The **"drent"** of two numbers is the remainder when the product of the two numbers is divided by ten.

**For example, the drent of 7 and 6 is 2 because 7 x 6 = 42 and the remainder when 42 is divided by 10 is 2. This answer has been filled in on the table below for you.**

(a) Complete the rest of the table

| drent | 3 | 6 | 7 | 9 |
|---|---|---|---|---|
| **3** | | | | |
| **6** | | | | |
| **7** | | 2 | | |
| **9** | | | | |

(b) Using the table, write down a number such that the drent of the number with 6 is 4

4b

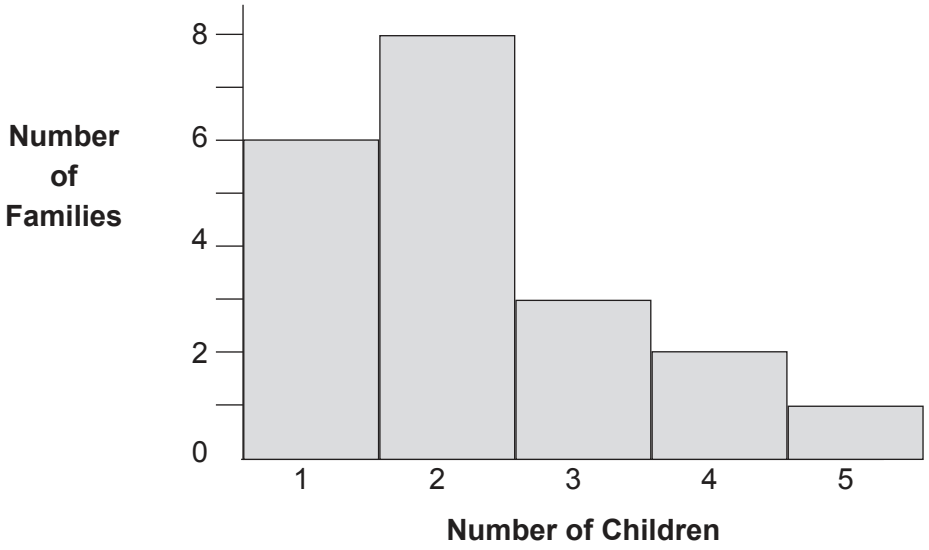
(c) Using the table again, write down the number such that the drent of the number with itself is itself

4c

**[5 marks]**

5. Irfan carried out a survey amongst the members of his form at school to find out how many children were in each family. The results are shown in the bar chart below and no family was counted more than once in the survey.

**Bar Chart showing number of children in each family for form 6A**




(a) How many of the families had two children?

5a

(b) How many members of Irfan's form were included in the survey?

5b

(c) What was the total number of children in all the families surveyed?

5c

(d) What was the average or mean number of children per family in his form?

5d

**[5 marks]**

6. David invents a game to change the order of the digits in 5-digit numbers.

He uses three different instructions to change the order of the digits

**Instruction A :** **Reverse the digits** **so 12345 becomes 54321**

**Instruction B :** **Move the 2nd digit to the end** **so 12345 becomes 13452**

**Instruction C :** **Switch the 2nd and 4th digits** **so 12345 becomes 14325**

**Fill in the blanks in the following table - the first row has been completed as an example**

| Starting number | First instruction used | Number becomes | Second instruction used | Number then becomes |
|---|---|---|---|---|
| 12345 | B | 13452 | A | 25431 |
| 23415 | C | | B | |
| | A | 34251 | C | |
| | C | | A | 12345 |

**[5 marks]**



**FOR MARKER USE ONLY**

| Short problems | /30 |
|---|---|

7. Two managers in a company organise work in different ways.

Tim has all the available workers working together, but Andy splits the **same** available workers into **two** groups and has the groups working for different lengths of time.

Between them, Andy and Tim have a way of working out how long a job will take using their different ways of working.

**For example, if Andy employs 5 workers for 2 days and 3 workers for 10 days then Tim will employ all 8 workers together and he then works out the time required as follows:-**

**5 workers x 2 days + 3 workers x 10 days = 8 workers x how many days**

**ie: 5 x 2 + 3 x 10 which makes 40 = 8 x ?**

**This means it will take 5 days, as 8 x 5 = 40**

(a) If Andy employs 4 workers for 3 days and 1 worker for 8 days how long will all 5 workers take working for Tim?

7a ____ days

(b) Tim employs 5 workers for 7 days. Andy splits them into 2 groups, of course. If 2 workers work for 10 days how long will the other 3 workers work?

7b ____ days

(c) Andy employs 1 worker for 4 days and some workers for 8 days. When Tim puts the workers together it takes 7 days. How many workers does **Tim** employ?

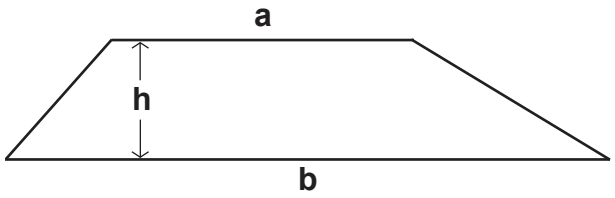
7c ____

(d) Andy employs 3 workers working a few days and 2 workers working **twice (2 times)** as many days. For Tim the 5 workers take 14 days. How many days did the **3 worker group** work for Andy?

7d ____ days

**[10 marks]**

8. A trapezium is a four sided shape with one pair of parallel sides like the one shown in the diagram below.




**We can work out the area of a trapezium using the formula below**

$$A = \frac{1}{2}h(a + b) \qquad \text{ie} \qquad A = \frac{1}{2} \times h \times (a + b)$$

where a and b are the lengths of the two parallel sides and h is the distance between those sides which we call the height of the trapezium.

**So, if we have a trapezium with height 8cm and parallel sides of 6cm and 4cm it would have an area given by $\frac{1}{2} \times 8 \times (6 + 4) = 40\text{cm}^2$**

(a) find the area of a trapezium with height 14cm, and parallel sides 3cm and 4cm

8a ____ $\text{cm}^2$

(b) find the height of a trapezium with parallel sides 7cm and 3cm and area $65\text{cm}^2$

8b ____ cm

(c) a trapezium with area $60\text{cm}^2$ has a height 8cm. One of the parallel sides is **twice as long** as the other. Find the length of the **longer** side.

8c ____ cm

(d) a special trapezium in which the height and parallel sides are **all the same length** has an area of $64\text{cm}^2$. Find the height of the trapezium.

8d ____ cm

**[10 marks]**

9. On a range of large trucks of different sizes, 10% of the mass of each truck is its bodywork. One third of the **remaining** mass is the engine. The rest of the mass is its storage capacity. (1 tonne = 1000kg)

(a) For a 4 tonne truck, what is the storage capacity in kgs?

| 9a | kgs |
|---|---|

(b) If a different truck has a 0.6 tonne engine what is its storage capacity in kgs?

| 9b | kgs |
|---|---|

(c) If the bodywork on a third truck is 450kg, what is the mass of its engine in kgs?

| 9c | kgs |
|---|---|

(d) If the storage capacity of a fourth truck is 1.8 tonnes, what is the total mass of the truck in kgs?

| 9d | kgs |
|---|---|

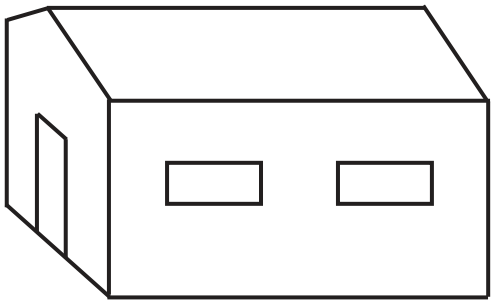
**[10 marks]**

10. Place the numbers **40 to 49 inclusive** in the boxes in the table below to make each of the statements true. **Each number may only be used once.** Read all of the statements first before starting to fill in the numbers

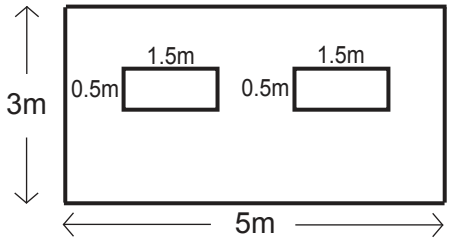
| Statement | Number |
|---|---|
| An **even** number | |
| The first digit is greater than the second digit and **is NOT a multiple** of the second digit | |
| The **difference** between the digits of the number is 4 | |
| A **factor** of 144 | |
| A **multiple** of 5 | |
| One of the two **prime** numbers **which differ by two** | |
| A **multiple** of the **square root** of the square number in the list | |
| A **square** number | |
| The **average or mean** of the three numbers immediately above | |
| The **remaining** number from the list of 10 numbers | |

**[10 marks]**

11. A large wooden shed is built by connecting together various different wooden sections. These sections have spaces for windows and a single door which are then fitted later

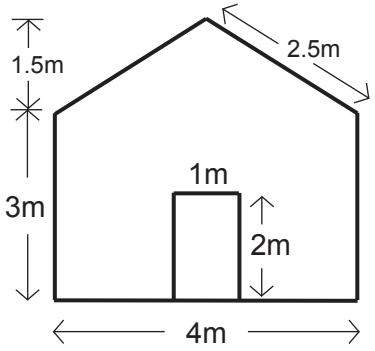


Each of the two side sections of the shed is 5 metres long and 3 metres high, with two windows, as shown.




**Side Section View**

The end section with the door looks like this. The other end is the same size and shape **but without a space for a door.**




**End Section View**

(a) By subtracting the area of the window spaces from the area of the large rectangle, find the area of wood in **one** of the side sections.

| 11a | | $m^2$ |
|---|---|---|

(b) The floor of the shed is completely fitted with wooden boards. Find the area of the floor.

| 11b | $m^2$ |
|---|---|

(c) (i) What **shape** will each of the two roof sections be?

| 11c(i) | |
|---|---|

(ii) Find the area of **one** of these roof sections.

| 11c(ii) | $m^2$ |
|---|---|

(d) Find the total area of wood in both of the end sections, **if a door has yet to be fitted**

| 11d | $m^2$ |
|---|---|

**[10 marks]**

## This is the end of the Examination

**Use any remaining time to check your work or try any questions you have not answered.**

**FOR MARKER USE ONLY**

| Longer problems | /50 |
|---|---|