S.A.M
Seriously Addictive Mathematics
Singapore Math

Junior Maths Mastery Challenge Sample

Paper C

Section A

Questions 1 to 5 carry 3 marks each.

1. Find the missing term in the pattern below.

1, 2, 3, 6, 11, 20, 37, _____, 125, …

[Addition and Subtraction Within 10 000 / Look for Patterns]

1 + 2 + 3 = 6
2 + 3 + 6 = 11
3 + 6 + 11 = 20
6 + 11 + 20 = 37
From 6 onwards, each term is the sum of its 3 preceding terms.

11 + 20 + 37 = 68
20 + 37 + 68 = 125
The missing term is 68.

    (A) 63   (B) 57   (C) 74

    (D) 81   (E) None of the above

2. Each box in the magic circle below must be filled with a whole number from 3 to 10 such that the sum of the numbers along each circle is equal. What is the greatest possible sum of the numbers along each circle? (Each number can only be used once.)

[Addition and Subtraction Within 10 000 / Logical Reasoning]

The remaining numbers we can fill are 3, 6, 7, 9 and 10.
4 + 8 + 3 = 15
We cannot form the sum 15 using three of the remaining numbers.
4 + 8 + 6 = 18
We cannot form the sum 18 using three of the remaining numbers.
4 + 8 + 7 = 19
3 + 6 + 10 = 19
The sum of the numbers along each circle is 19 + 5 = 24.
4 + 8 + 9 = 21
We cannot form the sum 21 using three of the remaining numbers.
4 + 8 + 10 = 22
6 + 7 + 9 = 22
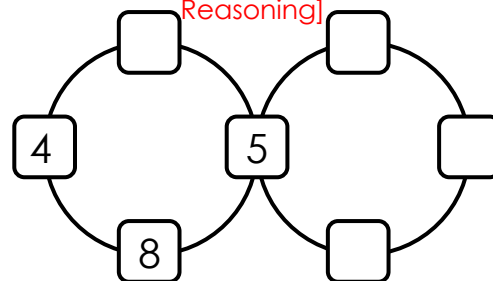The sum of the numbers along each circle is 22 + 5 = 27.

    (A) 24   (B) 25   (C) 26

    (D) 27   (E) None of the above

3. A company rented some boats for 52 employees. The boats could seat either 6 or 8 of them. A 6-seater boat cost $12 to rent. An 8-seater boat cost $15 to rent. What was the minimum amount the company had to pay to rent the boats? [Multiplication and Division and More Word Problems / Make a List]

It costs less if the company can rent as many 8-seater boats as possible.

Number of people (6-seater)	Number of people (8-seater)	Divisible by 8
6	46	✗
12	40	✓

$12 \div 6 = 2$
$40 \div 8 = 5$
$2 \times \$12 = \$24$
$5 \times \$15 = \$75$
$\$24 + \$75 = \$99$
The company had to pay a minimum of $99 to rent the boats.

(A) $102 (B) $105 (C) $108

(D) $123 (E) None of the above

4. Paul has 36 two-dollar notes and five-dollar notes. The total value of the notes is $111. How many five-dollar notes does he have? [Multiplication and Division and More Word Problems / Guess and Check]

Number of $2 notes	Value of $2 notes	Number of $5 notes	Value of $5 notes	Total value	Guess
19	$19 \times \$2 = \$38$	17	$17 \times \$5 = \$85$	$123	✗
20	$20 \times \$2 = \$40$	16	$16 \times \$5 = \$80$	$120	✗
23	$23 \times \$2 = \$46$	13	$13 \times \$5 = \$65$	$111	✓

(A) 17 (B) 15 (C) 13

(D) 11 (E) 9

5. Joe wants to pack 20 muffins and 30 egg tarts. He has some boxes and tries to pack an equal number of each pastry into the boxes. What is the greatest possible number of boxes he has if he is short of 4 muffins and has 2 egg tarts left in the end?

[Multiplication and Division and More Word Problems / Make a List]

20 + 4 = 24
30 – 2 = 28
He packs 28 egg tarts into the boxes. He would have packed 24 muffins into the boxes as well if he had 4 more muffins.

The greatest number that can divide 24 and 28 is 4.
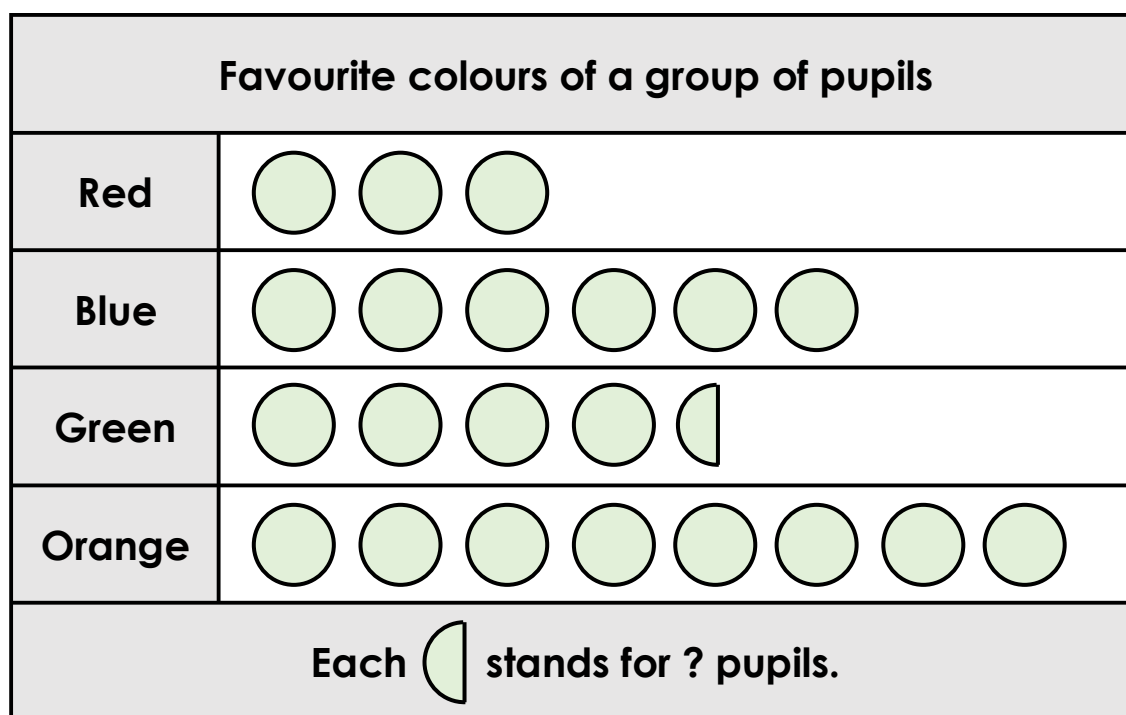
(A) 3   (B) 4   (C) 6

(D) 7   (E) 8

Questions 6 to 10 carry 4 marks each.

6. The picture graph shows the favourite colours of a group of pupils.

Favourite colours of a group of pupils	
Red	○ ○ ○
Blue	○ ○ ○ ○ ○ ○
Green	○ ○ ○ ○ ◗
Orange	○ ○ ○ ○ ○ ○ ○ ○
Each ◗ stands for ? pupils.	

12 more pupils choose blue than green. How many pupils are there altogether? [Picture Graphs / Arithmetic]

1 circle is made up of 2 half circles.
3 half circles represent 12 pupils.
1 half circle represents 4 pupils.
1 circle represents 8 pupils.

21 × 8 = 168
168 + 4 = 172
There are 172 pupils altogether.

(A) 132   (B) 142   (C) 152

(D) 162   (E) 172

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7. The diagram below shows a menu from a café.

SET LUNCH MENU

MAIN
Fried chicken	$6.90
Fish and chips	$9.90

SOUP
Mushroom soup	$3.20
Pumpkin soup	$2.60

DRINK
Fruit punch	$2.50
Mango milkshake	$4.20

Lily has $15. She wants to order a set lunch which includes 1 main dish, 1 soup and 1 drink. How many different ways can she order the set lunch? [Money / Make a List]

1) $6.90 + $3.20 + $2.50 = $12.60 (Fried chicken, mushroom soup, fruit punch)
2) $6.90 + $3.20 + $4.20 = $14.30 (Fried chicken, mushroom soup, mango milkshake)
Since pumpkin soup is cheaper than mushroom soup, she is able to make set 3) and 4).
3) Fried chicken, pumpkin soup, fruit punch
4) Fried chicken, pumpkin soup, mango milkshake

Observe that fish and chips costs $3 more than fried chicken. So, she cannot make a set with fish and chips and mushroom soup.
5) $9.90 + $2.60 + $2.50 = $15 (Fish and chips, pumpkin soup, fruit punch)

She can order the set lunch in 5 different ways.

(A) 4   (B) 5   (C) 6

(D) 7   (E) 8

8. In the puzzle below, each letter represents a different digit.

$$
\begin{array}{cccc}
 & A & B & C \\
+ & A & B & C \\
\hline
D & E & B & A
\end{array}
$$

Find the greatest possible number ABC represents.

[Addition and Subtraction Within 10 000 / Logical Reasoning]

C + C = A or C + C = 1A
So, A must be an even number.

$$
\begin{array}{cccc}
 & A & B & C \\
+ & A & B & C \\
\hline
1 & E & B & A
\end{array}
$$

Since ABC + ABC gives a 4-digit number, D = 1.
The possible digit A can be is 6 or 8.

Let A = 8 since we are looking for the greatest possible number ABC represents.
The possible digit B can be is 0 or 9.
B can be 9 only if C + C = 18 but this means that C = 9. This is not possible since B and C are different digits.
So, B = 0.

$$
\begin{array}{cccc}
 & 8 & 0 & C \\
+ & 8 & 0 & C \\
\hline
1 & E & 0 & 8
\end{array}
$$

C + C = 8. So, C = 4.
So, E = 6.

$$
\begin{array}{cccc}
 & 8 & 0 & 4 \\
+ & 8 & 0 & 4 \\
\hline
1 & 6 & 0 & 8
\end{array}
$$

The greatest possible number ABC represents is 804.

(A) 603   (B) 698   (C) 803

(D) 804   (E) None of the above

9. What is the first number from the left in the 10th row of the following pattern?

Row 1   1
Row 2   2   3   4
Row 3   5   6   7   8   9
Row 4   10 11 12 13 14 15 16
                    ⋮

[Addition and Subtraction Within 10 000 / Look for Patterns]

Let's list down the first number from the left of each row. We will get the following:
1, 2, 5, 10, 17, 26, 37, 50, 65, 82

The first number from the left in the 10th row is 82.

(A) 84   (B) 86   (C) 88

(D) 90   (E) None of the above

10. Joe adds up consecutive numbers from 1 onwards, 1 + 2 + 3 + 4 + 5 + …. He writes the sum on a piece of paper as he adds the numbers mentally. When he reaches the sum 260, he realises that he has forgotten to add one number. What is the number?

[Addition and Subtraction Within 10 000 / Arithmetic]

Let's add up numbers 1 to 10.
1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55

11 + 12 + 13 + 14 + 15 + 16 + 17 + 18 + 19 + 20 = 155
(This is the same as adding 10 to each number in the row above.)

Adding up numbers from 1 to 20, the sum is 55 + 155 = 210
210 + 21 = 231
231 + 22 = 253
253 + 23 = 276
The only possible way is forgetting to add one number when he has added up numbers 1 to 23.

276 – 260 = 16
He has forgotten to add the number 16.

(A) 16   (B) 18   (C) 20

(D) 22   (E) 24

Section B

Questions 11 and 12 carry 6 marks each.

11. A leap year has 366 days, in which there are 29 days in February. In a certain leap year, there are 5 Fridays in the month of February. On which day of the week is the last day of that year?

[Multiplication and Division and More Word Problems / Arithmetic]

To have 5 Fridays in the month of February, the only possible way is for the first Friday to fall on 1 Feb, 8 Feb, 15 Feb, 22 Feb and 29 Feb.

If we count backwards, 31 Jan is a Thursday as well as 24 Jan, 17 Jan, 10 Jan and 3 Jan. So, 1 Jan is a Tuesday.

There are 366 days in that year. 31 Dec is the 366th day in that year, which is 365 days after 1 Jan.
$365 \div 7 = 52$ R 1
31 Dec, the last day of that year, is 52 weeks and 1 day after 1 Jan.

52 weeks after 1 Jan is a Tuesday and 1 day after will be Wednesday.

The last day of that year is a Wednesday.

12. A teacher gave each of her 36 pupils a role, Truth-teller or Liar.

The pupils had 15 minutes to walk around and shake hands with any other pupil only once. A pupil could choose not to shake hands with anyone. When two pupils shook hands, they would reveal their role only to each other.

After 15 minutes, the teacher asked the pupils, 'How many Truth-tellers did you shake hands with?'

A Truth-teller had to give the correct answer and a Liar had to give an incorrect answer. Each pupil gave a different answer, 0, 1, 2, 3, …, 33, 34 and 35.

How many pupils were Liar(s)?   [Logical Reasoning]

The pupil who said he shook hands with 35 Truth-tellers must be a Liar.
Because if he shook hands with 35 Truth-tellers, he must have shaken hands with the pupil who said he had shaken hands with 0 Truth-tellers. This is a contradiction.
So, the pupil who said he shook hands with 35 Truth-tellers was a Liar.

The pupil who said he shook hands with 34 Truth-tellers could not have shaken hands with the pupil who was a Liar (shown above). This means he had shaken hands with the pupil who said he had shaken hands with 0 Truth-tellers. This is a contradiction.
So, this pupil was also a Liar.

Similarly, pupils who said they shook hands with 1, 2, 3, 4, …, 35 Truth-tellers were Liars.
How about the pupil who said he shook hands with 0 Truth-tellers?
If he was a Truth-teller, then he was right that he shook hands with 0 Truth-tellers or he just did not shake hands with any pupil.

If he was a Liar, then he did shake hands with some Truth-tellers but this is not possible as we have shown that the other pupils were Liars.

Therefore, this pupil is the only 1 Truth-teller. 35 pupils were Liars.