Junior Maths Mastery Challenge Sample

Paper D

Section A

Questions 1 to 5 carry 3 marks each.

1. A number is written below. Its digits follow a pattern.

257192571925719257192…

Find the sum of its first 52 digits.

The repeating block of digits is 2 5 7 1 9.
There are 5 digits in the block.
2 + 5 + 7 + 1 + 9 = 24
The sum of the digits in the block is 24.
52 ÷ 5 = 10 R 2
There are 10 such blocks and the next 2 digits are 2 and 5.
10 × 24 = 240
240 + 2 + 5 = 247
The sum of its first 52 digits is 247.

[Four Operations of Whole Numbers/ Look for Patterns]

(A) 242 (B) 247 (C) 254
(D) 255 (E) 264

2. How many numbers at most can we select from

1, 2, 3, 4, 5, …, 46, 47, 48, 49 and 50

such that the sum of any two numbers is divisible by 5?

[Factors and Multiples / Arithmetic]

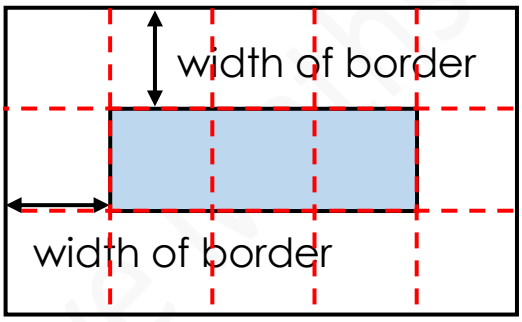
We can select all multiples of 5 that are from 1 to 50. The sum of any two multiples of 5 can be divided by 5.

50 ÷ 5 = 10
At most, 10 numbers can be selected.

(A) 5 (B) 10 (C) 15
(D) 20 (E) 25

3. The figure shows a shaded rectangle pasted on a large rectangle, leaving a border of equal width around it. The width of the border is $\frac{1}{3}$ of the breadth and $\frac{1}{5}$ of the length of the large rectangle. If the area of the shaded rectangle is 24 cm^2, find the area of the border.

[Area and Perimeter/ Simplify the Problem]



Draw dotted lines as shown to divide the large rectangle into 5 × 3 = 15 equal parts.
The area of the shaded rectangle is made up of 3 such parts.
The area of the border is made up of 15 – 3 = 12 parts.

3 parts = 24
12 parts = 4 × 24
= 96
The area of the border is 96 cm^2.

(A) 32 cm^2 (B) 64 cm^2 (C) 96 cm^2
(D) 128 cm^2 (E) None of the above

4. Boxes A, B, C, D and E contain 370 beads altogether.
Boxes A and B contain 160 beads altogether.
Boxes B and C contain 148 beads altogether.
Boxes C and D contain 140 beads altogether.
Boxes D and E contain 128 beads altogether.
How many beads do boxes B and D contain altogether?

[Four Operations of Whole Numbers / Logical Reasoning]

Boxes A and B contain 160 beads altogether.
370 – 160 = 210
Boxes C, D and E contain 210 beads altogether.

210 – 128 = 82
Box C contains 82 beads.

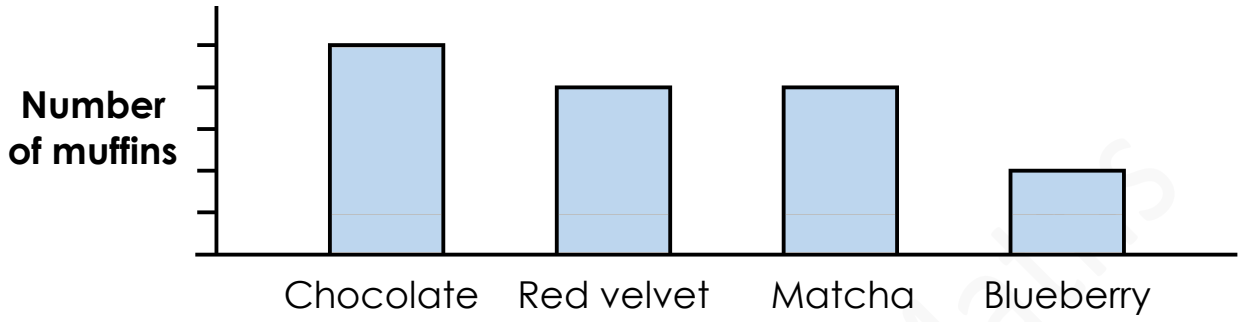
140 – 82 = 58
Box D contains 58 beads.

148 – 82 = 66
Box B contains 66 beads.

66 + 58 = 124
Boxes B and D contain 124 beads altogether.

(A) 124 (B) 136 (C) 152
(D) 176 (E) None of the above

5. The bar graph shows the number of muffins Lisa sold on Friday.



She sold 72 red velvet and matcha muffins altogether. How many more chocolate than blueberry muffins did she sell?

[Bar Graph / Arithmetic]

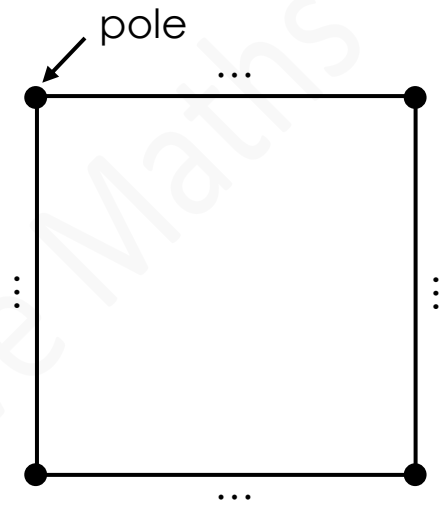
Let each interval be 1 unit.
She sold 5 units of chocolate muffins, 4 units of red velvet muffins, 4 units of matcha muffins and 2 units of blueberry muffins.

8 units = 72
1 unit = 72 ÷ 8
= 9
3 units = 3 × 9
= 27
She sold 27 more chocolate than blueberry muffins.

(A) 24 (B) 27 (C) 30
(D) 33 (E) 36

Questions 6 to 10 carry 4 marks each.

6. Tom has a square garden. He places poles at equal intervals of 8 metres along the perimeter of the garden. There is a pole at each corner. He uses 60 poles in total. Find the perimeter of the garden.



[Area and Perimeter / Simplify the Problem]

60 – 4 = 56
56 ÷ 4 = 14
Excluding the poles at the corners, there are 14 poles along each side of the garden.

14 + 2 = 16
There are 16 poles along each side of the garden.

16 – 1 = 15
There are 15 intervals along each side of the garden.

4 × 15 = 60
The perimeter of the garden is made up of 60 intervals.

60 × 8 = 480
The perimeter of the garden is 480 m.

(A) 448 m (B) 456 m (C) 472 m
(D) 480 m (E) None of the above

7. What is the ones digit in the following product?

$$\underbrace{2 \times 2 \times 2 \times \ldots \times 2 \times 2 \times 2}_{\text{30 digits 2}}$$

[Four Operations of Whole Numbers / Arithmetic]

2, 4, 8, 16, 32, 64, 128, 256, 512, …
Observe that the digit in the ones place follows the pattern, 2, 4, 8, 6, 2, 4, 8, 6, 2, ….
The repeating block is '2 4 8 6'. There are 4 digits in the block.

30 ÷ 4 = 7 R 2
There are 7 such blocks and the next 2 digits are 2 and 4.

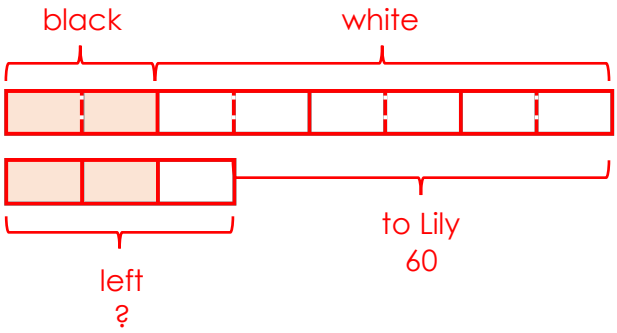
The ones digit in the product is 4.

(A) 2 (B) 4 (C) 6
(D) 8 (E) None of the above

8. Ella had some beads. $\frac{1}{4}$ of them were black and the rest were white. She gave 60 beads to Lily. $\frac{2}{3}$ of her remaining beads were black. How many beads did she have left?

[Fraction of a Set / Draw a Bar Model]

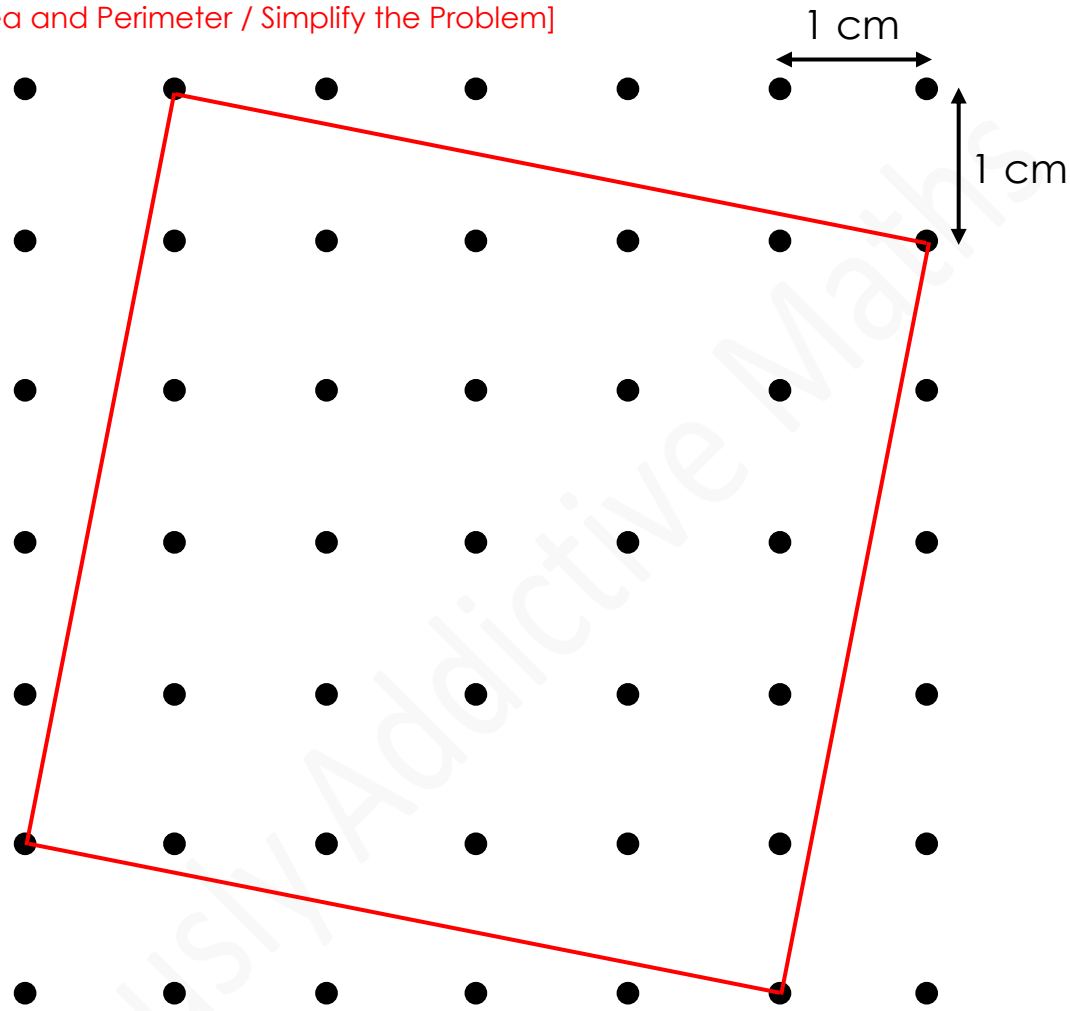
5 units = 60
1 unit = 60 ÷ 5
= 12
3 units = 3 × 12
= 36
She had 36 beads left.



(A) 36 (B) 60 (C) 84
(D) 144 (E) None of the above

9. Find the area of the largest possible square that can be drawn on the dot grid such that no more than 2 dots lie on a side of the square.

[Area and Perimeter / Simplify the Problem]



On the square grid, that is the largest possible square that can be drawn with no more than 2 dots lying on a side of the square.
$6 \times 6 = 36$
$36 - 5 - 5 = 26$
The area of the square is 26 cm^2.

(A) 16 cm^2 (B) 25 cm^2 (C) 26 cm^2
(D) 36 cm^2 (E) None of the above

10. Alice, Betty, Cheryl, Daisy and Ella competed in a race. Each of them made two statements as shown below.

Alice:	Daisy finished 2nd. Ella finished 3rd.
Betty:	Alice finished 5th. Cheryl finished 1st.
Cheryl:	Daisy finished 4th. Ella finished 2nd.
Daisy:	Betty finished 1st. Cheryl finished 3rd.
Ella:	Alice finished 2nd. Betty finished 1st.

Each girl was right about only 1 statement she has made. Who finished 2nd in the race? [Logical Reasoning]

Alice and Cheryl both made two statements about Daisy and Ella.
If Alice was right about Daisy finishing 2nd, then Cheryl was right about Ella finishing 2nd.
This is not possible.
This means that Ella finished 3rd and Daisy finished 4th.

Since Ella finished 3rd, Daisy was not right about Cheryl finishing 3rd.
This means that Betty finished 1st.

If Betty finished 1st, Betty was not right about Cheryl finishing 1st.
This means that Alice finished 5th.

So, Cheryl finished 2nd.

They finished the race in this order from 1st to 5th.
Betty, Cheryl, Ella, Daisy, Alice

(A) Alice (B) Betty (C) Cheryl
(D) Daisy (E) Ella

Section B

Questions 11 and 12 carry 6 marks each.

11. In the following puzzle, each letter represents a different digit.

$$\begin{array}{cccc} & M & A & T & H \\ \times & & & & 4 \\ \hline & H & T & A & M \end{array}$$

What 4-digit number does MATH represent?

[Four Operations of Whole Numbers / Logical Reasoning]

Observe that the product of the 4-digit number and 4 gives a 4-digit number.
So, the letter M can only be digit 1 or 2.
If M = 1, then H × 4 gives a product with the digit 1 in the ones place. This is not possible.
So, M = 2.

Since M = 2, H = 3 or 8. H cannot be 3 since MATH > 2000. So, H = 8.
Since 2 × 4 = 8, it means that there is no renaming when A × 4.
So, the possible digits for letter A are 0 or 1.

If A = 0, it means that T × 4 gives a product that has the digit 7 in the ones place. This is not possible. So, A = 1.

Since A = 1, then T × 4 is a product with the digit 8 in the ones place.
So, T = 7.

The 4-digit number MATH represents 2178.

$$\begin{array}{cccc} & 2 & A & {}^{3}T & 8 \\ \times & & & & 4 \\ \hline & 8 & T & A & 2 \end{array}$$

$$\begin{array}{cccc} & {}^{3}2 & {}^{3}1 & 7 & 8 \\ \times & & & & 4 \\ \hline & 8 & 7 & 1 & 2 \end{array}$$

12. Ali has between 70 and 100 cookies. He divides all the cookies equally into 3 jars and he has 1 cookie remaining.

    He then divides all the cookies in one of the jars into 3 equal packets. 1 cookie remains in the jar.

    He then divides all the cookies in one of the packets onto 3 equal plates. 1 cookie remains in the packet.

    How many cookies does he have?

    [Four Operations of Whole Numbers / Simultaneous Concept]

All cookies → 3 jars + 1 cookie

1 packet → 3 plates + 1 cookie
3 packets → 9 plates + 3 cookies

1 jar → 3 packets + 1 cookie
1 jar → 9 plates + 3 cookies + 1 cookie
1 jar → 9 plates + 4 cookies
3 jars → 27 plates + 12 cookies

All cookies → 27 plates + 12 cookies + 1 cookie
All cookies → 27 plates + 13 cookies

The number of cookies Ali has is 13 + a multiple of 27.
$3 \times 27 = 81$
$13 + 81 = 94$
He has 94 cookies.