BEYOND MATHS

PRIMARY SCHOOL CHALLENGE 2019

LEVEL 2 CHALLENGE
GRADE 6 AND 7 ROUND TWO

INSTRUCTIONS

1. The time allocated for this paper is $1\frac{1}{2}$ hours.
All participants must remain for the full allocated time.
Under no circumstances may extra time be given.

2. This paper consists of two sections.
Section A consists of 10 multiple choice questions.
Section B consists of 5 questions where working out must be shown.

3. Question 1 – 10 are worth 2 marks each.
Question 11 – 15 are worth 4 marks each.

4. Negative marking will not be applied.

5. Calculators (and other calculating devices) and geometry instruments are not allowed.

6. Figures are not necessarily drawn to scale.

7. Answer all questions on the answer sheet provided.

8. Circle the letter you have chosen as your answer in pen for Section A (Questions 1 – 10). Should you wish to change an answer, put a cross over the letter and then circle your new chosen letter.

9. For Section B (Questions 11 – 15), full working must be shown in the space provided. Your final answer must be written in the allocated space.

10. Paper may be used for rough working.

SECTION A

1. What is the value of $2019 - \frac{2019}{10} + \frac{2019}{100}$?

$2019 + 20,19 = 2039,19 - 201,9 = 1837,29$

A. 1837,29 B. 1819,119 C. 1838,29 D. 2241,09 E. 1827,29

2. N is a fraction between 0 and 1. Which of the following statements must always be true?

(1) $2 \times N$ is a fraction (2) N is greater than $N \times N$

(3) $1 \div N$ is a fraction. (4) $5 \times N$ is less than $3 \times N$

(5) $1 \times N$ is a fraction.

(1) $2 \times \frac{1}{2} = 1$ (false) (2) eg $\frac{1}{2} > \frac{1}{4}$ (true) (3) $1 \div \frac{1}{2} = 2$ (false) (4) $5 \times \frac{1}{5} \not< 3 \times \frac{1}{5}$ (false)

(5) $1 \times N = N = a\ fraction$ (true)

A. (2) and (4) only B. (5) only C. (1) only D. (2) and (5) only E. (3) and (5) only

3. If $(\otimes + \otimes) \times \triangle = 40$ and $\triangle \times \triangle + \otimes = 29$, where $\otimes$ and $\triangle$ are whole numbers, what is the value of $(\otimes + \triangle) \times \otimes$?

Options for $\otimes$: $1, 2, 4, 5, 10, 20$ $\leftrightarrow$ $\otimes + \otimes$: $2, 4, 8, 10, 20, 40$ $\rightarrow$ $\triangle$: $20, 10, 5, 4, 2, 1$

From these options, only $5 \times 5 + 4 = 29 \rightarrow (4 + 5) \times 4 = 36$

A. 45 B. 36 C. 41 D. 19 E. 120

4. A class of school pupils lined up one behind the other. Brian was standing 7th from the front. Penny was standing 7 places behind Brian, and 20th from the back. How many pupils were in the line?

Penny is standing 14th from front $\rightarrow 14 + 19 = 33$ (there are 19 pupils behind her)

A. 34 B. 38 C. 31 D. 33 E. 32

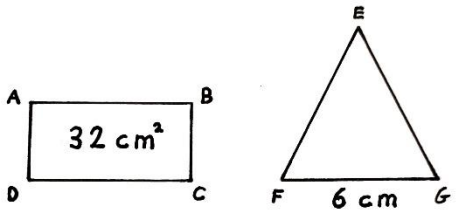
5. A number is divisible by another number if there is no remainder.
A number is divisible by 8 if its last three digits are divisible by 8.
A number is divisible by 9 if the sum of its digits is divisible by 9.
M and N are single digits in the number 47M25N.
If this number is divisible by 72, what is the value of M+N?

If a number is divisible by another number, then it must also be divisible by the factors of that number. Two factors of 72 are 8 and 9.

$\frac{25N}{8} \Rightarrow N = 6$ (since 2 x 8 = 16) Then the number is 47M256. Sum of digits is 24 + M and therefore M = 3 since 27 is divisible by 9. Therefore M + N = 3 + 6 = 9.

A. 12 B. 10 C. 8 D. 14 E. 9

6. A piece of wire 40 cm long is cut into two pieces. The first piece is bent to exactly form a rectangle ABCD of area 32 cm^2, where AB = 2 × BC. The rest of the wire is bent to exactly form an isosceles triangle EFG where the base FG = 6 cm. What is the area of the triangle EFG in cm^2 ?



$BC \times 2BC = 32 \rightarrow BC^2 = 16 \rightarrow BC = 4 \rightarrow AB = 8 \rightarrow$ Perimeter of ABCD = 24cm

Remaining length of wire is $40 - 24 = 16$cm. $16 - 6 = 10$, therefore EF = EG = 5cm

Perpendicular height of $\triangle$ EFG $= \sqrt{25 - 9} = 4 \rightarrow$ Area $= \frac{1}{2} \times 6 \times 4 = 12$cm^2

A. 24 B. 10 C. 30 D. 16 E. 12

7. If $3 \circledcirc 2 \circledcirc 4 = 7$
$4 \circledcirc 5 \circledcirc 3 = 11$
$6 \circledcirc 4 \circledcirc 5 = 21$
$6 \circledcirc 7 \circledcirc 5 = 29$
What is the value of $7 \circledcirc 6 \circledcirc 8$?

The square of the average of the three numbers minus the middle number. $7^2 - 6 = 43$

A. 39 B. 40 C. 43 D. 45 E. 44

8. Mlu has exactly enough money to buy the following :

Either 4 pens / 1 ruler / 2 erasers.
or 1 pen / 4 rulers / 5 erasers

He decides to use all his money to buy only rulers and erasers.
How many rulers and how many erasers could he buy?

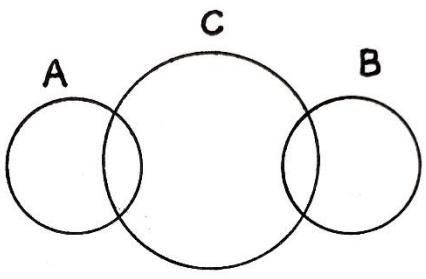
(Cost is the same): 4 pens + 1 ruler + 2 erasures = 1 pen + 4 rulers + 5 erasers

Therefore (cost) : 3 pens = 3 rulers + 3 erasures → 1 pen = 1 ruler + 1 eraser

Substituting : Can buy 1 ruler + 1 eraser + 4 rulers + 5 erasures = 5 rulers + 6 erasures

A. 5 rulers and 6 erasers B. 4 rulers and 7 erasers C. 6 rulers and 6 erasers
D. 6 rulers and 5 erasers E. 7 rulers and 4 erasers

9. Rabbits are playing in the circular areas A, B, and C as shown. They can move between areas A and C, and between areas B and C.



At a certain time :

- The total number of rabbits playing in circle A is 100.
- The total number of rabbits playing in circle B is 120.
- The total number of rabbits playing in circle C is 360.
- The total number of rabbits playing in both circles A and C is 30.
- The total number of rabbits playing in both circles B and C is 40.

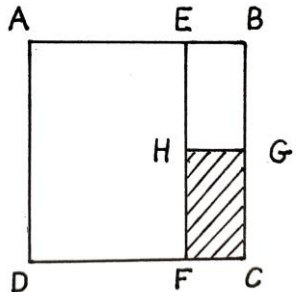
How many rabbits are playing altogether?

A on its own = 100 – 30 = 70. B on its own = 120 – 40 = 80. C on its own = 360 – 30 – 40 = 290.

Therefore in each area from left to right : $70 + 30 + 290 + 40 + 80 = 510$

A. 580 B. 560 C. 650 D. 590 E. 510

10. In the diagram, ABCD is a square with an area of 81 cm^2. AE is two thirds of AB, and BG is half of BC. What is the area of HGCF in cm^2 ?



$AB = BC = \sqrt{81} = 9 \rightarrow EB = \frac{1}{3} \times 9 = 3$ $GC = \frac{1}{2} \times 9 = 4\frac{1}{2}$

Shaded area HGCF $= 3 \times \frac{9}{2} = \frac{27}{2} = 13\frac{1}{2}\ cm^2$

OR : Area EBCF $= 3 \times 9 = 27 \rightarrow$ Area HGCF $= \frac{1}{2} \times 27 = 13\frac{1}{2}\ cm^2$

A. $\frac{25}{2}$ B. $13\frac{1}{2}$ C. $\frac{40}{3}$ D. $14\frac{1}{2}$ E. $12\frac{1}{3}$

SECTION B

NB : Show all working and write your final answer in the allocated space.

11. At a school fundraising day, juices sell at R9, chocolates sell at R3, and buns sell at R5. You have R100 to spend. What is the greatest (maximum) number of these items you can buy if you receive no change, and you buy at least one of each?

Need to maximize the cheaper item (R3) and have a remainder of at least 14 (R9 + R5) over. Such remainder must be able to be made up of a combination of 9 and 5.
Try 29 x 3 = 87 → Rem 13 (no). Try 28 x 3 = 84 → Rem 16 (no). Try 27 x 3 = 81 → Rem 19 (yes since 19 = 9 + 5 + 5). So maximum number of items = 27 + 1 + 2 = 30.

SCORING GUIDELINES: Correct answer only → 1 mark. At least 1 mark for showing understanding of maximizing the cheapest item. All working showing understanding of maximizing the cheapest item, but giving an answer of 27 → 2 marks. All working showing understanding of maximizing the cheapest item, but giving an answer of 27 + 1 + 1 = 29 → 2 marks. Full detailed correct solution → 4 marks.

12. T is equal to the sum of :

- Integers greater than -5 and less than 6, and
- The first five whole numbers, and
- The first five prime numbers, and
- The first five positive integer perfect squares.

What is the value of T ?

$\mathbf{T = (-4 - 3 - 2 - 1 + 0 + 1 + 2 + 3 + 4 + 5) + (0 + 1 + 2 + 3 + 4) + (2 + 3 + 5 + 7 + 11) + (1 + 4 + 9 + 16 + 25) = 5 + 10 + 28 + 55 = 98}$

SCORING GUIDELINES: Correct answer only → 1 mark. 1 mark each for the correct sum in each of the four bullets (showing all working), but with a maximum of 3 marks if the answer is not correct. Full detailed correct solution → 4 marks.

13. Ten cards are laid down side by side as shown. A positive whole number is written on each card such that the numbers on any three consecutive cards add to 20. The first card is numbered 2 and the ninth card is numbered 8. The other cards are turned over. What is the number on the fifth card?

2				?				8	

The sum of the 2nd and 3rd cards is 18, therefore the 4th card is 2.
The sum of the 7th and 8th cards is 12, therefore the 6th card is 8.
Therefore the 5th card is $20 - 2 - 8 = 10$.

SCORING GUIDELINES: Correct answer only → 1 mark. 1 mark each for correctly showing that the 4th card is 2 and that the 6th card is 8. Full detailed correct solution → 4 marks.

14. A water tank has two different sized taps, A and B, at the bottom to release the water when required. When the tank is full, it takes 5 hours to empty when only the larger tap A is opened. It similarly takes 20 hours to empty the full tank when only the smaller tap B is opened. How long will it take to empty the full tank if both tap A and tap B are opened together?

Tap A : 1 hour → $\frac{1}{5}$ of the tank is empty. Tap B : 1 hour → $\frac{1}{20}$ of the tank is empty.

Together : Tap A and Tap B: 1 hour → $\frac{1}{5} + \frac{1}{20} = \frac{4+1}{20} = \frac{1}{4}$ of the tank is empty.

Therefore together it will take 4 hours to empty the tank.

SCORING GUIDELINES: Correct answer only → 1 mark. Working showing the rate per hour for each tap → 1 mark each. Full detailed correct solution → 4 marks.

15. What is the value of the last digit of $(2^{2019} + 0^{2019} + 1^{2019} + 9^{2019}) \times 2019$?

2^n has a last digit cycle of four (2, 4, 8, 6) 9^n has a last digit cycle of two (9, 1)
$0^n = 0$ $1^n = 1$

$2019 \div 4 = 504\ Rem\ 3$ → last digit of $2^{2019} = 8$
$2019 \div 2 = 1009\ Rem\ 1$ → last digit of $9^{2019} = 9$
Therefore with last digits in the bracket, we have: $(8 + 0 + 1 + 9) = 18 \rightarrow 8$
Multiplying 8 by 2019 will therefore result in a last digit of 2. (8 x 9 = 72)

SCORING GUIDELINES: Correct answer only → 1 mark. Correctly showing calculation of the last digits related to 2^{2019} and 9^{2019} → 1 mark each. Correctly showing the value of both 0^{2019} AND 1^{2019} → 1 mark total. Maximum of 3 marks for that described if final answer is incorrect. Full detailed correct solution → 4 marks.