# NMOS 2018 Special Round

Time Duration: 1.5 hour Name: __________ Marks: __________

1. In the Figure 1 below, the area of each small triangle is 5 cm$^2$. Join the three vertices $A$, $B$ and $C$ to form a triangle shown in Figure 2. Find the area (in cm$^2$) of $\Delta ABC$ .

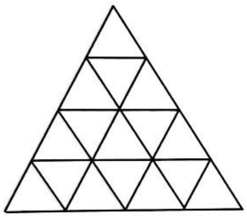


Figure 1

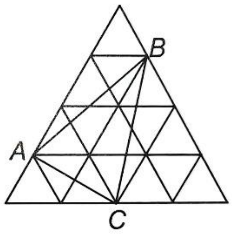
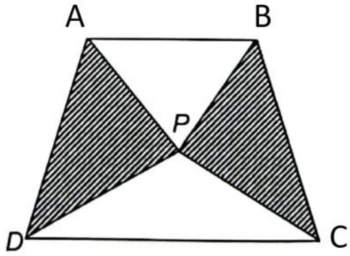



Figure 2

2. The current ages of two brothers add up to 42. A few years ago, when the elder brother was at the current age of the younger brother, the younger brother was exactly half the elder brother's current age. How old is the elder brother now?

3. The 6-digit number $\overline{1082ab}$ is a multiple of 12. How many possible different values of the last 2-digit number $\overline{ab}$ are there?

4. In the trapezium $ABCD$ below, the area of $\Delta APB$ and $\Delta CPD$ are 10 cm$^2$ and 12 cm$^2$ respectively. If $\frac{AB}{CD}=\frac{2}{3}$ find the area (in cm$^2$) of the shaded region.



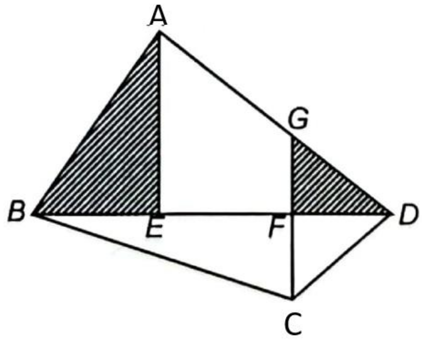
5. Two distinct numbers from 1 to 100 inclusive will form a pair if the sum of these two is a multiple of 5. How many different pairs are there?

6. $[x]$ is defined as the largest integer less than or equal to $x$ and $\{x\} = x - [x]$.
For example, $[4.3] = 4$, $\{4.3\} = 4.3 - [4.3] = 0.3$. $[5] = 5$, $\{5\} = 5 - [5] = 0$.
Find the value of $\left\{\frac{2018+1}{5}\right\} + \left\{\frac{2018+2}{5}\right\} + \left\{\frac{2018+3}{5}\right\} + \ldots + \left\{\frac{2018+2017}{5}\right\} + \left\{\frac{2018+2018}{5}\right\}$.

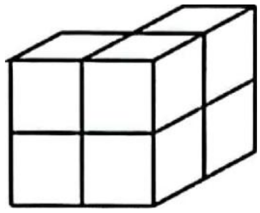
7. One class of pupils took Math, Science and English tests. 30 pupils passed the Math test, 28 pupils passed the Science test, and 25 students passed the English test. If 43 pupils passed at least one test, at most how many pupils passed all three tests?

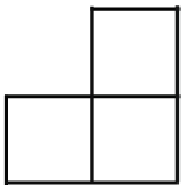
8. Four distinct positive whole numbers are arranged in descending order. Given that the sum of the smallest number and the average of the other three numbers is 39, and the sum of the largest number and the average of the other three numbers is 51. What is the largest possible value of the largest number?

9. In the quadrilateral *ABCD* below, $BE = EF = FD$ and $CF = GF$. *GFC* is a straight line. If the area of the shaded region is 13 $cm^2$, find the area of quadrilateral *ABCD*.

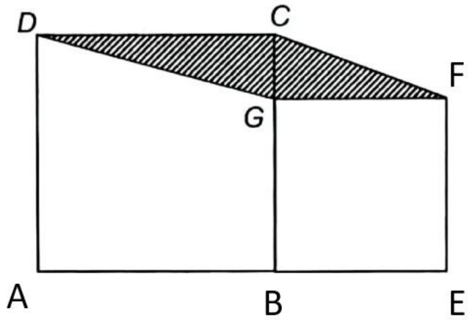



10. 6 identical unit cubes are piled up to build a structure. Refer to the diagram below on the left for an example. How many structures are there whose top views are like the diagram below on the right?





11. In the figure below, the difference of the areas of square *ABCD* and square *BEFG* is 74 $cm^2$. Find the area (in $cm^2$) of quadrilateral *CDGF*.




12. The full score of each common test is 100 marks. Paul has taken 4 common tests and his average score of these 4 tests is 89 marks. If he wants his average score to reach 95 marks or above, at least how many more tests should he take?

13. $A$ and $B$ are two distinct 3-digit numbers which have two equal digits (not necessarily in the same number place). It is known that the highest common factor of $A$ and $B$ is 75. Find the largest possible sum of $A$ and $B$.

14. Six bags of marbles contain 19, 21, 27, 32, 37 and 40 marbles respectively. One of the bags contains red marbles only. The other five bags do not contain any red marbles and are labelled 'X'. Jaslin takes three of the 'X' bags and George takes the remaining 'X' bags. If Jaslin gets twice as many marbles as George, how many red marbles are there?

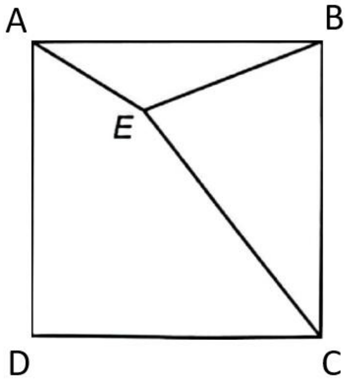
15. Peter and Queenie cycled towards each other from place A and B respectively at the same time. Peter was cycling faster than Queenie by 50%. After they met each other, Peter immediately increased his speed by 20%, and Queenie also accelerated by $\frac{1}{3}$ of her original speed. It is known that when Peter reached place B, Queenie was 41 kilometres away from place A. Find the total distance (in km) between place A and B.

16. 100 squares are placed in a row, each filled up with a digit among 0,1,2,...,9 . Now if a digit appears 5 times or more, all the squares filled up with that digit will be painted red. Find the smallest possible number of red squares.

17. A number of supercomputers take $N$ hours to solve a super maze. If two more supercomputers join the mission, it will take $\frac{7}{8}N$ hour to solve the maze. If two supercomputers are not working, it will take $\frac{2}{3}$ hour more to solve the maze. How long will it take, in hours, for one supercomputer to solve this super maze?

18. For any positive integers $a$, $b$, we define $a * b = \left(\frac{a \times b + 16}{a + b}\right)^2$. Find the largest integer not exceeding $(((1*2)*3)*4)*5$.

19. In the figure below, $ABCD$ is a square and the lengths of $EA$, $EB$ and $EC$ are in the ratio 1: 2 : 3. Find the angle $AEB$ in degrees.




(Hint: You may find Pythagoras' Theorem useful.)

20. 4 identical dice are glued together and form an inverted T-shape, as shown below. Each dice has 1 dots, 2 dots, 3 dots, 4 dots, 5 dots and 6 dots printed (not necessarily in the order that we are familiar with) on its 6 faces respectively. Find the largest possible total number of dots on the surface of this structure (including the base).