

NMOS 2018 Round 1

Time Duration: 1 hour 30 minutes Name: _____

Marks: _____

1. Evaluate $\left(\frac{2017}{2018} + \frac{20172017}{20182018}\right) \div \frac{201720172017}{201820182018}$.

2.

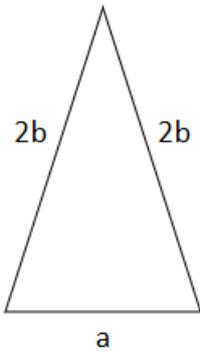


Figure A

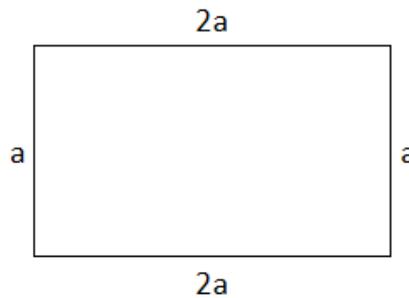


Figure B

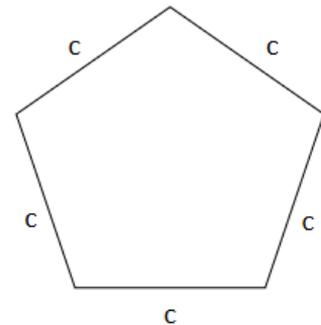


Figure C

Figure A is an isosceles triangle. Figure B is a rectangle. And Figure C is a regular pentagon. The lengths of their sides are as shown in the diagrams above. Given that the perimeters of the three figures are equal, and $a + b + c = 138$, find the value of a .

3. When 2018 is divided by a positive integer N , the remainder is 11. Find the sum of all possible values of N .

4. Alice, Betty and Christine talked about their ages as follows.

Alice: I am 12 years older than the average age of the three of us.

Betty: Christine is as old as me.

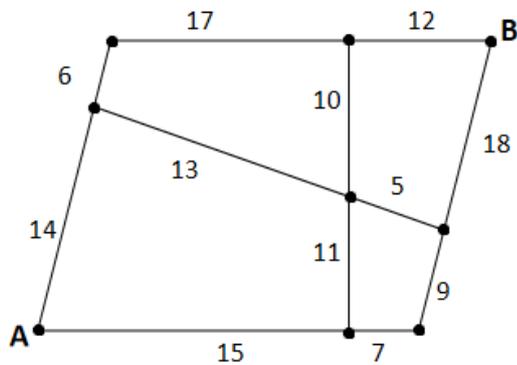
By how many years is Alice older than Betty?

5. In a sale, there is a 50% discount for all items off the regular price. If at least 5 items were bought, there would be an additional 20% discount on the discounted price. Mr Tan bought 8 items at the shop and the regular total price for the 8 items is \$120. How much did Mr Tan pay in dollar?

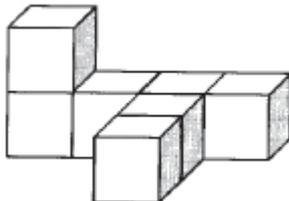
6. Amongst the children in a family each boy has as many sisters as brothers, but each girl has only half as many sisters as brothers. How many children are there in the family?

7. A train and a car start travelling from Town X towards Town Y at the same time. The train travels 76% faster than the car. However, the train stops at a train station in between the towns for 38 minutes. If the distance between Town X and Town Y is 85km, and they both reach Town Y at the same time, find the speed of the train in km/h.

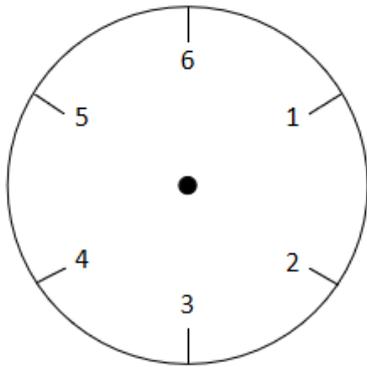
8. The map below shows the time taken (in minutes) for Sean to walk along the road. If Sean starts walking at point A , what is the shortest time (in minutes) to take to reach point B ?



9. The solid figure below is made up of 7 identical cubes of length 2 cm. Find the total surface area, in cm^2 , of the solid.

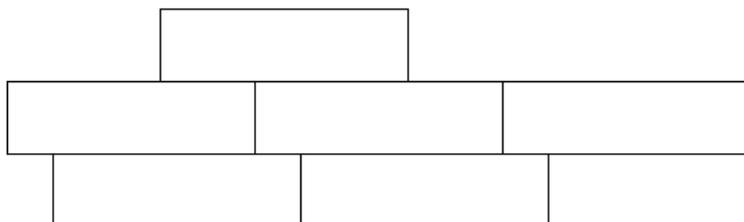


10. Suppose for now we are on a planet other than Earth, where there are 12 hours in a day and 36 minutes in an hour. The diagram below shows the clock we are using on this planet. When it is 3:09 am, what is the obtuse angle (in degrees) formed by the hour hand and minute hand?



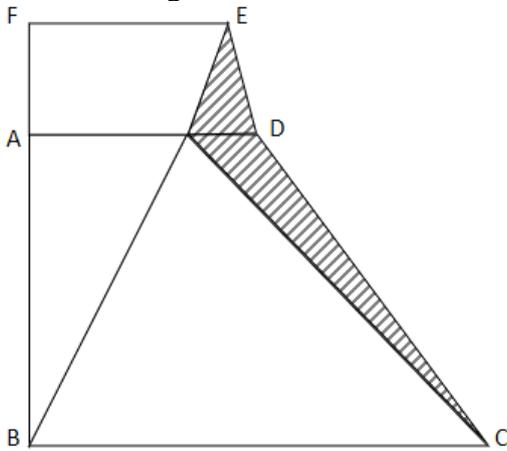
11. Every year, Teacher Chloe gives out candies as Children's Day gift among her pupils. This year, she plans to give each pupil 5 candies, and 4 candies will be left as extra. However, 3 pupils are absent on Children's Day. Teacher Chloe then gives each pupil 6 candies, and still 4 candies are left as extra. How many candies does Teacher Chloe have in total as this year's Children's Day gift?

12. The figure below shows part of a wall, which consists of 6 identical rectangular bricks. If the perimeter of one brick is 123 cm, what is the perimeter (in cm) of the following figure?



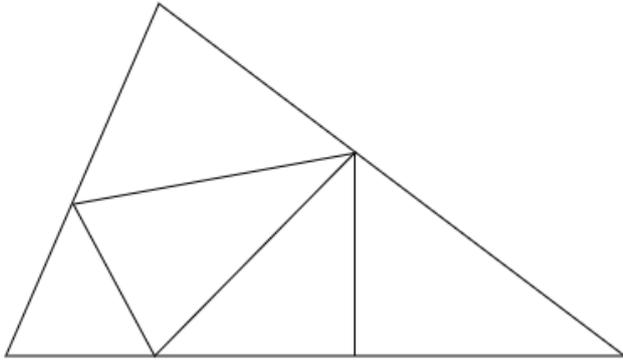
13. Tina started her trip from city A . She went east for 15 km, then went north for 3 km. After that she went west for 9 km. Finally, she went north for 5 km to end her trip at city B . What is the shortest distance, in km, from city A to city B ?

14. In the figure below, $ABCD$ is a right-angled trapezium with $\angle DAB = \angle ABC = 90^\circ$. $ADEF$ is a rectangle with an area of 78 cm^2 . Connect BE to intersect AD at point P . Find the area (in cm^2) of the shaded region.



15. Seven years ago, David's age was 25% of his sister's age. Three years later, David's age will be 50% of his sister's age. How many years later will it be when David's age is 75% of his sister's age?

16. Find the total number of triangles in the figure shown below.

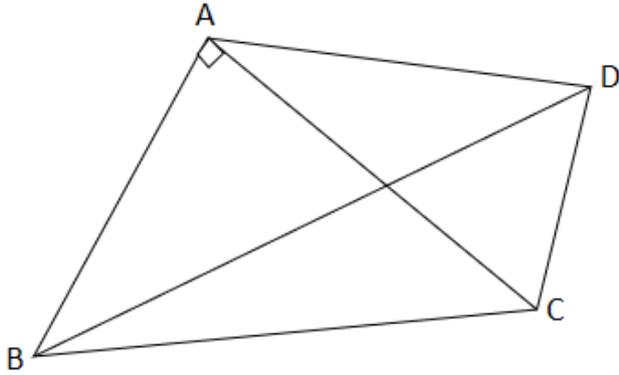


17. If 1 master and 3 apprentices are working together, they will complete a task in 4 days. If 2 masters and 1 apprentice are working together, they will take 3 days to complete the task. How long will it take to complete the task if 1 apprentice is to work alone on the task?

18. Four consecutive whole numbers A , B , C and D are all composite numbers. What is the smallest possible value of $A + B + C + D$?

[A **Composite Number** is a whole number that can be divided exactly by whole numbers other than 1 or itself.]

19. In the figure below, $\triangle ABC$ is a right-angled isosceles triangle with $\angle BAC = 90^\circ$, and $\triangle ACD$ is an isosceles triangle with $AC = AD$. Find, in degrees, $\angle BDC$.



20. A museum is open every day and at least 12 security guards are needed around the museum. If every security guard can work for not more than 5 days per week, find the least number of security guards the museum must hire.

21. The **Koch snowflake** can be constructed by starting with an equilateral triangle, then recursively altering each line segment as follows:

Step 1: Divide the line segment into three segments of equal length.

Step 2: Draw an equilateral triangle that has the middle segment from Step 1 as its base and point outward.

Step 3: Remove the line segment that is the base of the triangle from Step 2.

The first three iterations are shown in the figures below.

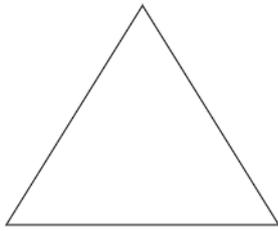


Figure 1

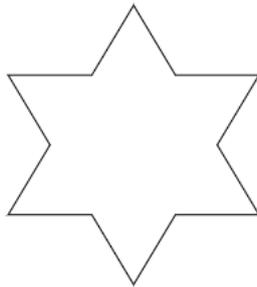


Figure 2

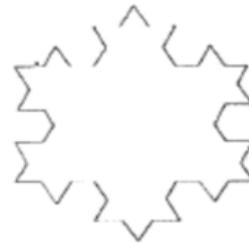
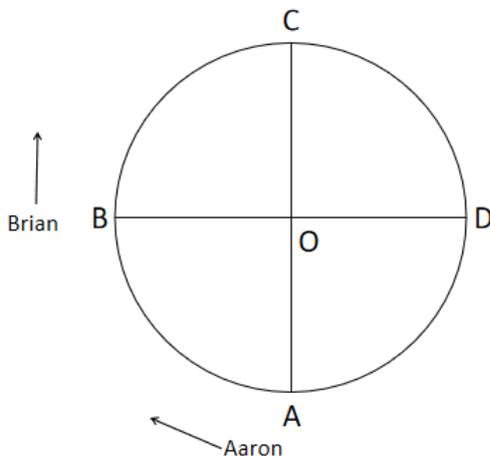


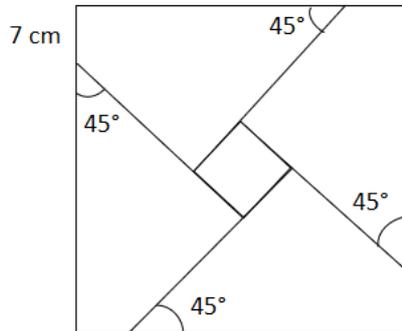
Figure 3

If the ratio of the area of Figure 3 to the area of Figure 1 is $m:n$ in the lowest term, find the value of $m+n$.

22. Aaron and Brian are walking along a circular track with center O . AOC and BOD are diameters of the track. It takes Aaron 8 minutes and Brian 12 minutes respectively to complete walking 1 round of the track. If Aaron starts walking at point A and Brian starts walking at point B at the same time, and they both walk in a clockwise direction, how long, in minutes, will it take Aaron to catch up with Brian?



23. Elsa has a square paper of side 28 cm (as shown in the diagram below). Starting from the point 7 cm from each vertex, she cuts along 45° from each side and get a small square paper in the middle. What is the area of the small square paper in cm^2 ?



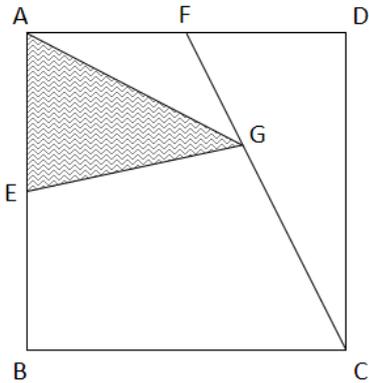
24. From 74 to 199 inclusive, how many whole numbers with distinct digits are there? (For example, 129 is a whole number with distinct digits, but 166 is not.)

25. Each of the letters N , U , S , H , X and Y represents a different one of the digits from 1 to 9 such that

$$\begin{array}{r}
 N \ U \ S \ H \\
 U \ S \ H \ N \\
 S \ H \ N \ U \\
 + \ H \ N \ U \ S \\
 \hline
 X \ 9 \ 9 \ 9 \ Y
 \end{array}$$

Find the largest possible 4-digit number \overline{NUSH} .

26. In the figure below, each side of the square $ABCD$ is 12 cm. E and F are midpoints of AB and AD respectively, and $FG = \frac{1}{3}FC$. Find the area (in cm^2) of the shaded region.



27. There are 150 students in the level and they are divided into teams of three. It is found that:
- i. There are 15 teams with only 1 boy.
 - ii. There are 27 teams with two or more boys.
 - iii. The number of all-boy teams is twice the number of all girl teams.

How many girls are there in the level?

28. Ashley and Betty are new friends.

Ashley: Hi Betty, when is your birthday?

Betty: Let my birthday month number times 31 and day number times 12. Then the addition of the two products will be 376.

Can you help Ashley to find out Betty's date of birth?

[Shade your answer in the form of "ddmm". For example: if your answer is 27th June, shade the answer "2706".]

29. A 4-digit number has the following properties:

- a. This number is a perfect square.
- b. The first two digits of the number are equal.
- c. The last two digits of the number are equal.

What is the 4-digit number?

30. Put the number 2012, 2013, ..., 2018 into the seven regions in the following diagram, so that each region has only 1 number and the sums of the numbers inside each circle are equal. What is the smallest possible value of this sum?

