

Qualifying Test for Middle School Girls - 12 to 15 years of age

I Instructions

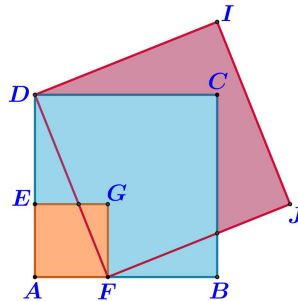
1. The time duration for the below qualifying test is 120 minutes from 10:00 am to 12:00 pm (IST)
2. Answers have to be submitted on the Google form:
3. You cannot submit the Google form more than once.
4. No other form of submission will be accepted.
5. Beyond 12:00 pm, the form will be deactivated.
There is no option to save your answers in a Google form
6. Hence it is suggested that you write your answers on a sheet of paper.
Submit it together in Google form before 12:00 pm.
7. Wherever there is a field/box to write the answer, write ONLY the INTEGER part of the answer.
E.g. If the answer is 134 hours or 134 sq cm, write (fill) the answer as: 134 only.
Do not use any full stop or any other explanation along with the answer.
Any such content will fetch you a wrong answer because the checking is automated and not manual.
8. For multiple choice questions, use the appropriate option.
9. The participant is not allowed to use any device for calculations or any sort of help from anyone else.
Any such act will disqualify the application.
10. Preserve your rough calculations. You may be asked to submit it.
If you are unable to submit it, you may be disqualified.
11. There is no negative marking for incorrect answers.
12. Be honest.
13. Ensure that you have filled respective fields about your personal details correctly in the Google form.

Hope you have read the instructions thoroughly !

See Problems from next page! ↓

II PROBLEMS

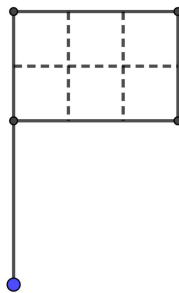
- Ria has many toy soldiers which she can arrange into a rectangular array consisting of several rows and columns. She notices that if she removes 100 toy soldiers, then she can arrange the remaining ones into a rectangular array with 5 fewer rows and 5 more columns.
How many toy soldiers should she remove from the original configuration to be able to arrange the remaining ones into a rectangular array with 11 fewer rows and 11 more columns? _____.
- $ABCD$, $AEFG$ and $DIJF$ are overlapping squares in the same plane. as shown.



Note: The figure is not drawn to scale

If CD is 35 units and FJ is 37 units, what is the length of AE ? _____ unit.

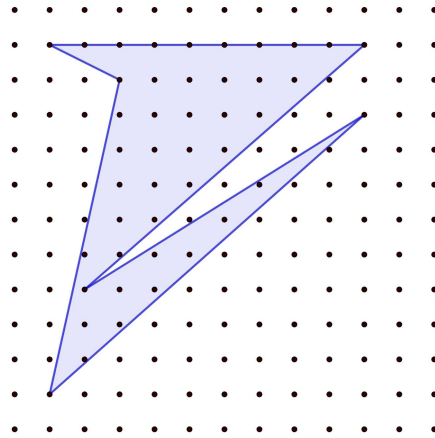
- A 3×2 flag is divided into six squares as shown.



Each square is to be colored green or blue, so that every square shares at least one edge with another square of the same color. In how many ways this can be done? _____.

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4. In the grid shown below, the distance between any two consecutive dots on any row/column is 1 unit.



The area (in sq. units) of the above hexagon is _____.

5. A Harshad number is a number which is divisible by the sum of its digits.

E.g. 21 is a Harshad number because 21 is divisible by $2 + 1$.

The two digit number AB is such that it is not a Harshad number but $AB \times BA$, $(AB + 1)$ and $(BA - 1)$ are all Harshad numbers.

If $AB + BA = 110$, then the product $AB \times BA =$ _____.

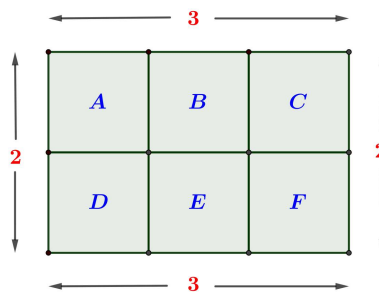
6. m is the smallest positive integer with the following property:

Among the first 10 positive integers,

- There is only one positive integer n that doesn't divide m .
- and all 9 integers other than n divide m .

The value of $(m - n)$ is _____.

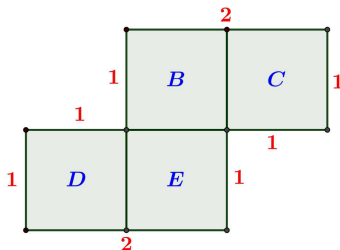
7. Six unit squares together form a rectangle, as shown.



Area of the rectangle is 6 sq.unit and its perimeter is 10 unit.

You are allowed to remove any two unit squares to form a single polygon with perimeter 10 units.

E.g. You can remove A and F to achieve this



In how many ways this can be done (including the given example)? _____.

8. Professor Sujatha's car number is a 4-digit number with the following properties:

- It is an even number.
- It is not a multiple of 4.
- It is not a multiple of 10.
- It is not a multiple of 27.
- It is of the form $p \times q^2 \times r^3$ where p, q, r are distinct primes.

Professor Sujatha's car number is _____.

9. It is known that 3^{1000} has 478 digits in its decimal representation.

- Let a be the sum of the digits of the decimal representation of 3^{1000} .
- Let b be the sum of the digits of a .
- Let c be the sum of the digits of b .

Then, the value of c is _____.

10. There are many ways to write 24 as a sum of three distinct positive integers: $2 + 3 + 19$ is

one of them whereas $2 + 2 + 20$ is not, since the three numbers in this sum are not distinct.

If you write 24 in all possible ways as a sum of three distinct natural numbers and in each sum, multiply the three numbers, what is the maximum product you will obtain? _____.

11. How many triples of positive integers (a, b, c) are there such that $1 < a < b < c < 25$ and $\frac{1}{a} = \frac{1}{b} + \frac{1}{c}$? _____.

12. Two five digit numbers put together contain all the 10 decimal digits.

How many such pairs are there that gives the maximum sum? _____.

13. How many natural numbers N are there such that the sum of all positive integer divisors of N is 24?
_____.

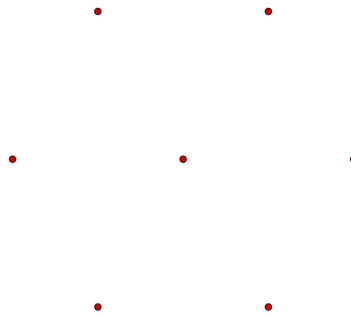
14. a, b, c, d, e, f, g, h are distinct numbers chosen from $-7, -5, -3, -2, 2, 4, 6, 13$
(not necessarily in the given order).

The minimum possible value of $(a + b + c + d)^2 + (e + f + g + h)^2$ is _____.

15. Three marbles need to be chosen from 2 red, 1 green, 1 blue and 3 yellow and should be arranged in a row.
No two successive marbles in the row should be of the same color.

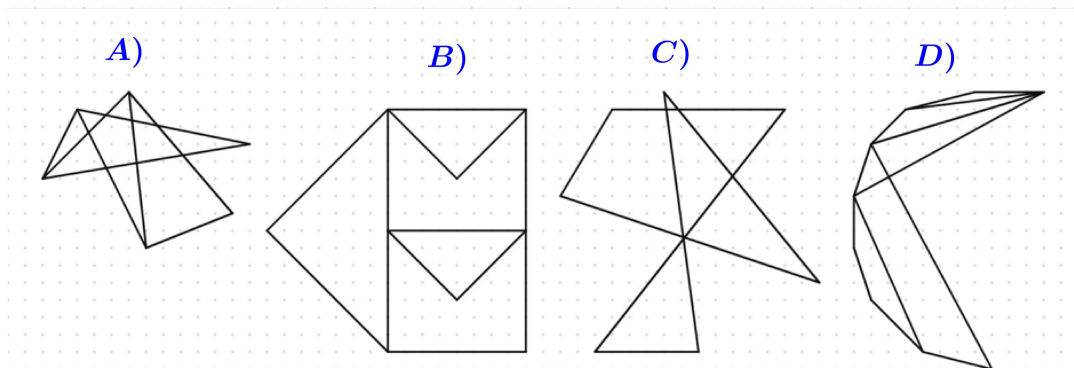
How many such arrangements are possible? _____.

16. Here you observe the six corners of a regular hexagon and its centre, as dots!



How many hexagons all of whose sides have equal length can be formed using 6 of the seven dots
as vertices? _____.

17. Which of the following cannot be drawn without lifting your hand and without retracing any part of the figure; (however you can visit the same vertex more than once)?

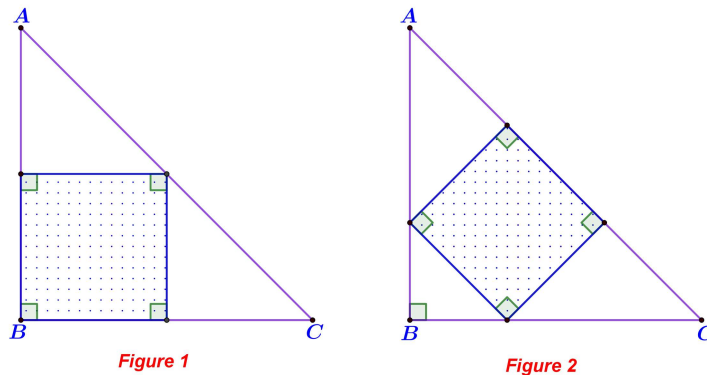


18. A 12-sided polygon $ABCDEFGHIJKL$ is equilateral of side length 2 cm. The vertex angles of A, C, E, G, I, K are 240° each in measure. The vertex angles of B, D, F, H, J and L are 60° each in measure. The area of the 12-sided polygon will be

- A. $6\sqrt{3}$ sq.unit. B. $12\sqrt{3}$ sq.unit. C. $24\sqrt{3}$ sq.unit. D. $48\sqrt{3}$ sq.unit.

19. Suppose $x = \frac{13}{\sqrt{19 + 8\sqrt{3}}}$. Then, $x^2 - 8x + 15 = \underline{\hspace{2cm}}$.

20. There are two ways to inscribe a square in an isosceles triangle $\triangle ABC$, as shown.



The $\triangle ABC$ is right angled at B .

If the area of the square inscribed in $\triangle ABC$ of figure 1 is 441 sq.units., then the area of the square inscribed in $\triangle ABC$ of figure 2 is $\underline{\hspace{2cm}}$ sq.units.