

DO NOT TURN TO THE NEXT PAGE until your proctor tells you.

Please read the directions carefully.

- ▶ You have 100 minutes for 32 Problems.
- ▶ Mark your answers on your Answer Form with a pencil.
- ▶ Extra scratch paper is neither given nor allowed. You may use blank pages/spaces in the booklet as scratch paper.
- ▶ There are no penalties for incorrect answers. Answer as many problems as you can; go back and check your work and also go to questions you skip, before the time is over.

- ▶  Use of calculators is prohibited. Cell phones must be turned off completely and placed out of sight. MathCON problems are ALL done without a calculator.

- ▶ The problems are divided into three categories by the difficulty levels:
3 Points (Questions 1-8)
5 Points (Questions 9-24)
7 Points (Questions 25-32)

- ▶ Problems 29-32, the last four problems are constructed-response problems. Enter your numerical answer in the grid on your answer sheet as shown on the right.

1. Although not required, it is suggested that you write your answer from left to right in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.

2. Mark no more than one circle in any column.
3. You may start your answers in any column, space permitting. Leave unused columns blank, and there should be no blank columns between columns that are not blank. For example, if your answer is 201, then either arrangement of filled-in circles shown below is acceptable.

For example: Answer: 201 – either position is correct.

	2	0	1
Ⓐ	Ⓐ	●	Ⓐ
Ⓑ	Ⓑ	Ⓑ	●
Ⓒ	●	Ⓒ	Ⓒ
Ⓓ	Ⓓ	Ⓓ	Ⓓ

2	0	1	
Ⓐ	●	Ⓐ	Ⓐ
Ⓑ	Ⓑ	●	Ⓑ
●	Ⓒ	Ⓒ	Ⓒ
Ⓓ	Ⓓ	Ⓓ	Ⓓ

4. No problem has a negative answer.

▶ Notations in Geometry Problems:

- A : Point A
- $\overleftrightarrow{AB}$: Line through points A and B
- $\overline{AB}$: Line segment joining A and B
- AB : Length of the line segment AB
- $\angle ABC$: Angle with the vertex point at B
- $m\angle ABC$: Measure of angle ABC
- $\perp$: Perpendicular
- // : Parallel

3. [Number Theory, 5 Points]

Let a , b , and c , be positive integers such that

$$b^2 = a \cdot c$$

$$a \cdot b \cdot c = 216$$

What is the sum of all distinct values of $\text{LCM}(a, b, c)$?

(LCM: Least Common Multiple)

A) 78

B) 72

C) 66

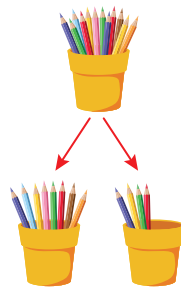
D) 60

E) 54

7. [Number Theory, 3 Points]

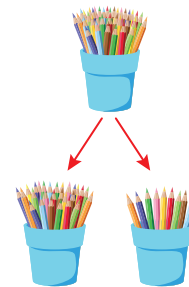
The two largest factors, excluding the number itself, of the number of pencils Eva has, and the two largest factors, excluding the number itself, of the number of pencils Maya has, are shown below.

Eve's Pencils



Largest factors:
(excluding itself) **8 and 4**

Maya's Pencils



Largest factors:
(excluding itself) **27 and 9**

Eva and Maya gave their friends several pencils equal to the sum of the factors mentioned above. How many pencils do Eva and Maya have left in total?

A) 22

B) 48

C) 49

D) 64

E) None of the preceding

9. [Algebra, 5 Points]

Raul calculates that he will arrive at the office 9 minutes before the meeting starts if he drives 75 miles per hour at a constant speed. Due to traffic, he drives at 40 miles per hour for half the distance at a constant speed and 60 miles per hour the remaining distance at a constant speed. He arrives at the office 9 minutes after the meeting has begun. How far is the road to his office?

A) 36 miles

B) 40 miles

C) 44 miles

D) 48 miles

E) 50 miles

11. [Number Theory, 5 Points]

The number of positive factors of an integer n is denoted by $F(n)$.

For example, $F(12) = 6$ since the positive factors of 12 are 1, 2, 3, 4, 6, 12.

If $F(F(n)) = 6$, which of the following is a possible value for n ?

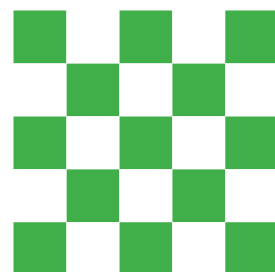
- A) 64 B) 66 C) 68 D) 70 E) 72

12. [Combinatorics, 5 Points]

A 5 by 5 chessboard is given, and 4 tokens are to be placed on the board.

Each row and column can contain at most one token.

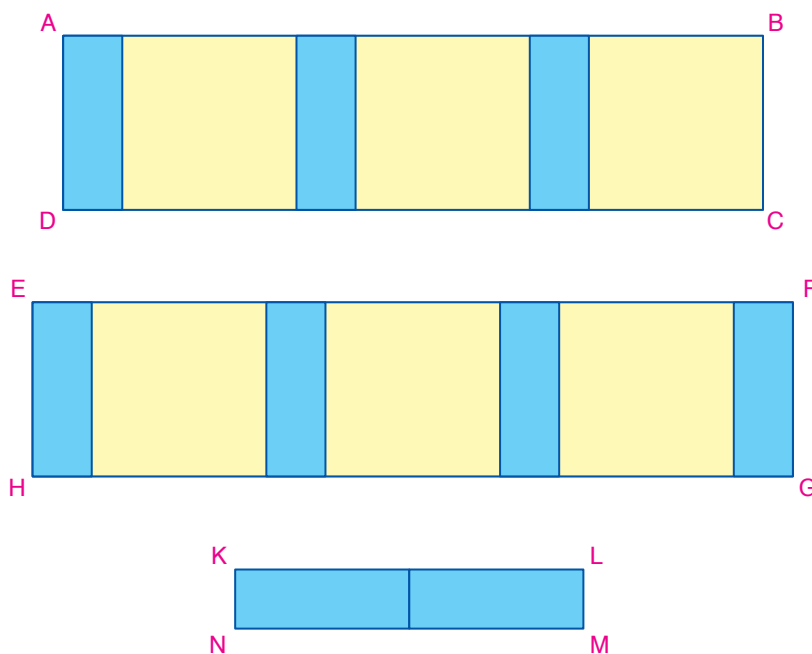
In how many different ways can this arrangement be done?



- A) 480 B) 500 C) 575 D) 600 E) 625

22. [Geometry, 5 Points]

Using identical blue rectangles and yellow squares, the rectangles ABCD, EFGH, and KLMN are composed.



If the perimeter of ABCD is $(13x - 5)$ cm, and the perimeter of EFGH is $(14x + 2)$ cm, what is the perimeter of KLMN?

- A) $(x + 7)$ cm B) $(11x - 9)$ cm C) $6(x + 1)$ cm D) $6(x - 1)$ cm E) $(10x - 3)$ cm