

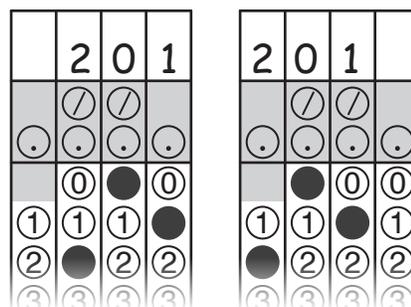
# DO NOT TURN TO THE NEXT PAGE until your proctor tells you.

## 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.
- ▶ Calculators are not permitted. 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 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. Columns you don't use should be left blanks, 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.



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

1. [Algebra, 3 Points]

The sum of the **three** (not four) side lengths of a rectangle is 56 cm. Each side length is a whole number. The length is 8 cm longer than the width. What is the perimeter of the rectangle?

- A) 66 cm      B) 72 cm      C) 76 cm      D) 80 cm      E) None of the preceding

2. [Geometry, 3 Points]

What is the value of  $a$  such that the line passing through the points  
 $(2a + 3, -6)$  and  $(4a - 5, 4)$   
is parallel to the  $y$ -axis?

- A)  $-4$       B)  $-1$       C)  $0$       D)  $3$       E)  $4$

4. [Combinatorics, 3 Points]

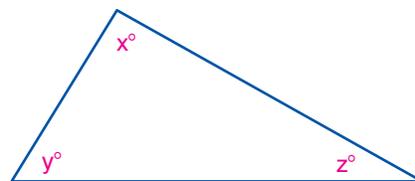
How many distinct six-digit numbers that are multiples of 5 can be formed using digits 1, 2, 3, 4, 5, 6 if no digits are repeated?

- A) 60      B) 90      C) 120      D) 360      E) 720



## 6. [Geometry, 3 Points]

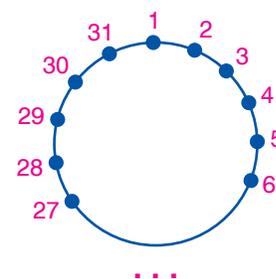
In the triangle,  $x^\circ$ ,  $y^\circ$ , and  $z^\circ$  are the measures of the interior angles, and the arithmetic mean of  $y$  and  $z$  is equal to  $x$ . What is the value of  $x$ ?



- A) 50                      B) 60                      C) 70                      D) 75                      E) 80

## 12. [Combinatorics, 5 Points]

Whole numbers from 1 to 31 are written on a circle in order. The sum of any  $n$  consecutive numbers from this circle is called an  $n$ -sum. For example, 12 is a 3-sum since  $3 + 4 + 5 = 12$ , and 46 is a 6-sum since  $31 + 1 + 2 + 3 + 4 + 5 = 46$ . Which of the following is **not** a 4-sum?



- A) 26                      B) 30                      C) 34                      D) 38                      E) 40

## 27. [Number Theory, 7 Points]

Suppose that  $m$  and  $n$  are positive integers such that  $12 \cdot n = m^3$ . What is the minimum possible value of  $m + n$ ?

- A) 18                      B) 20                      C) 24                      D) 26                      E) 32