

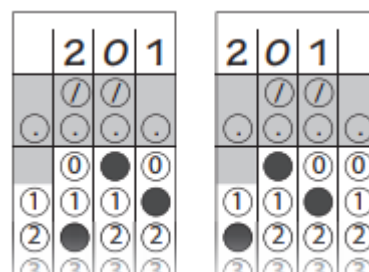
**DO NOT TURN TO THE NEXT PAGE
until your proctor tells you.**

Please read the directions carefully.

- ◆ You have **100 minutes** for **40 Problems**.
- ◆ Mark your answers on your Answer Form with a pencil.
- ◆ Extra scratch paper is neither given nor allowed. You may use blank pages in the booklet as scratch paper.
- ◆ There are no penalties for incorrect answers. Answer as many problems as you can; return to the others in the time you have left for the test.
- ◆ Calculators are not permitted. Cell phones must be turned off completely and placed out of sight.
- ◆ The problems are divided into three categories, Part **A**, Part **B** and Part **C**, according to difficulty level. A correct answer for a Part A problem is worth 3 points, Part B is worth 5 points, and Part C is worth 7 points. Each problem is a multiple-choice problem except the last four problems in Part C.
- ◆ Problems 37-40, the last four problems of Part C, 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 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.



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 \overline{AB} .
- $\angle ABC$: Angle with the vertex point at B
- $m\angle ABC$: Measure of $\angle ABC$
- \perp : Perpendicular
- $//$: Parallel

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Problem 1

Algebra

3 points

Suppose $x + \frac{1}{y} = 3.125$. Find the decimal equal to $\frac{y}{xy + 1}$.

- A) 0.25
- B) 0.32
- C) 0.80
- D) 1.25
- E) 3.35

Problem 2

Geometry

3 Points

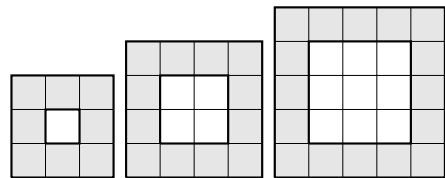
The lengths, in inches, of the sides of the equilateral triangle are $a + 2b$, $3a - b$, and $5b - a$. Which of the following **could not** be the values of a and b ?

- A) (12, 8)
- B) $\left(\frac{9}{2}, 3\right)$
- C) (10, 6)
- D) (3, 2)
- E) $\left(\frac{3}{2}, 1\right)$

Problem 3

Algebra
5 Points

The pictures on the right show a 3 by 3 grid, a 4 by 4 grid, and a 5 by 5 grid, each with shaded borders. How many square units are in the shaded border of a 101 by 101 grid?

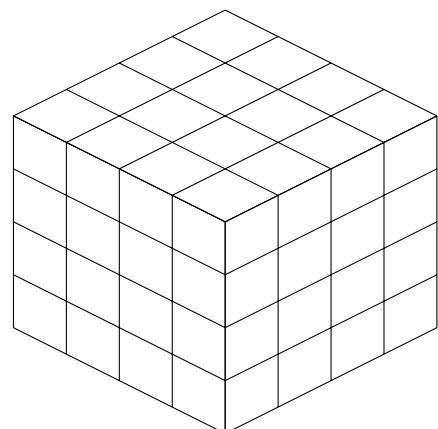


- A) 396
- B) 400
- C) 698
- D) 704
- E) None of the preceding

Problem 4

Combinatorics
5 Points

The big cube is made up 64 white small cubes. All the faces of the big cube are then painted in red. How many of the small cubes have exactly two painted red faces?



- A) 28
- B) 20
- C) 12
- D) 10
- E) None of the preceding

Problem 5

Algebra

5 Points

When an empty jar is filled with water, it weights 6 pounds. When $\frac{3}{7}$ of the water is poured out, the jar weights 4 pounds. How much does the empty jar weight in pounds?

- A) $\frac{4}{3}$
- B) $\frac{3}{2}$
- C) $\frac{5}{3}$
- D) 2
- E) $\frac{5}{2}$

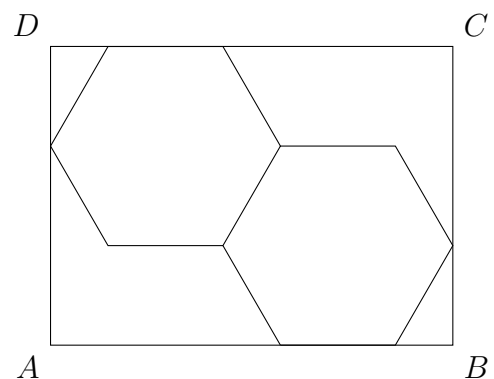
Problem 6

Geometry

5 Points

Suppose $ABCD$ is a rectangle with two identical regular hexagons. If the area of one hexagon is 6 unit squares, then find the area of the rectangle in unit squares.

- A) 18
- B) 21
- C) 24
- D) 27
- E) None of the preceding



Problem 7

Algebra

7 Points

Suppose a and b represent positive numbers. Of the two numbers, a is the smaller and b the larger. What number represents the point two third of the way between a and b on a number line?

A) $\frac{a+b}{3}$

B) $\frac{a+2b}{3}$

C) $\frac{3a+b}{3}$

D) $\frac{2a+2b}{3}$

E) None of the preceding

Problem 8

Number Theory

7 Points

How many two-digit positive integers have at least one digit that is a 8?

A) 17

B) 18

C) 19

D) 20

E) 21

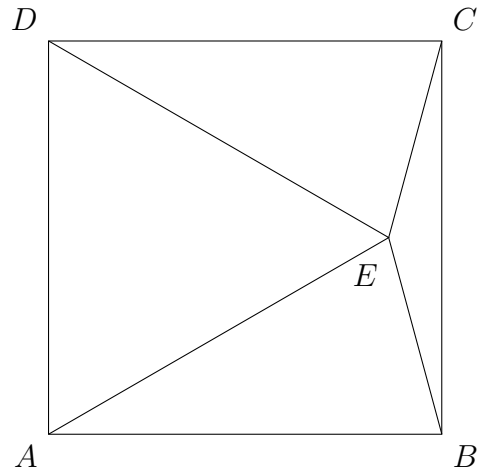
Problem 9

Geometry

7 Points

Equilateral triangle EAD shares a side with square $ABCD$. What is the sum of $m\angle CEB$ and $m\angle AEB$?

- A) 195°
- B) 200°
- C) 215°
- D) 225°
- E) 245°

**Problem 10**

Number Theory

7 Points

How many whole numbers from 1 to 1000 (including 1 and 1000) do not contain the digit 1?