Please print your name, first and last, in the space below.

First Name                                   Last Name

## The quarter-end problem solving session.

| Pr # | 1 | 2 | 3 | 4 | 5 | 6 |
|------|-----|-----|------|------|------|------|
| Score | $\overline{\phantom{x}5}$ | $\overline{\phantom{x}5}$ | $\overline{\phantom{x}10}$ | $\overline{\phantom{x}10}$ | $\overline{\phantom{x}10}$ | $\overline{\phantom{x}10}$ |

| 7 | 8 | 9 | 10 | Total |
|------|------|------|------|-------|
| $\overline{\phantom{x}10}$ | $\overline{\phantom{x}20}$ | $\overline{\phantom{x}10}$ | $\overline{\phantom{x}10}$ | $\overline{\phantom{x}100}$ |

**Problem 1**                                                **5 pts**

Today, December 9, 2012, is a Sunday. What day of the week is December 9, 2013, going to be? (The year 2013 is not a leap year.)
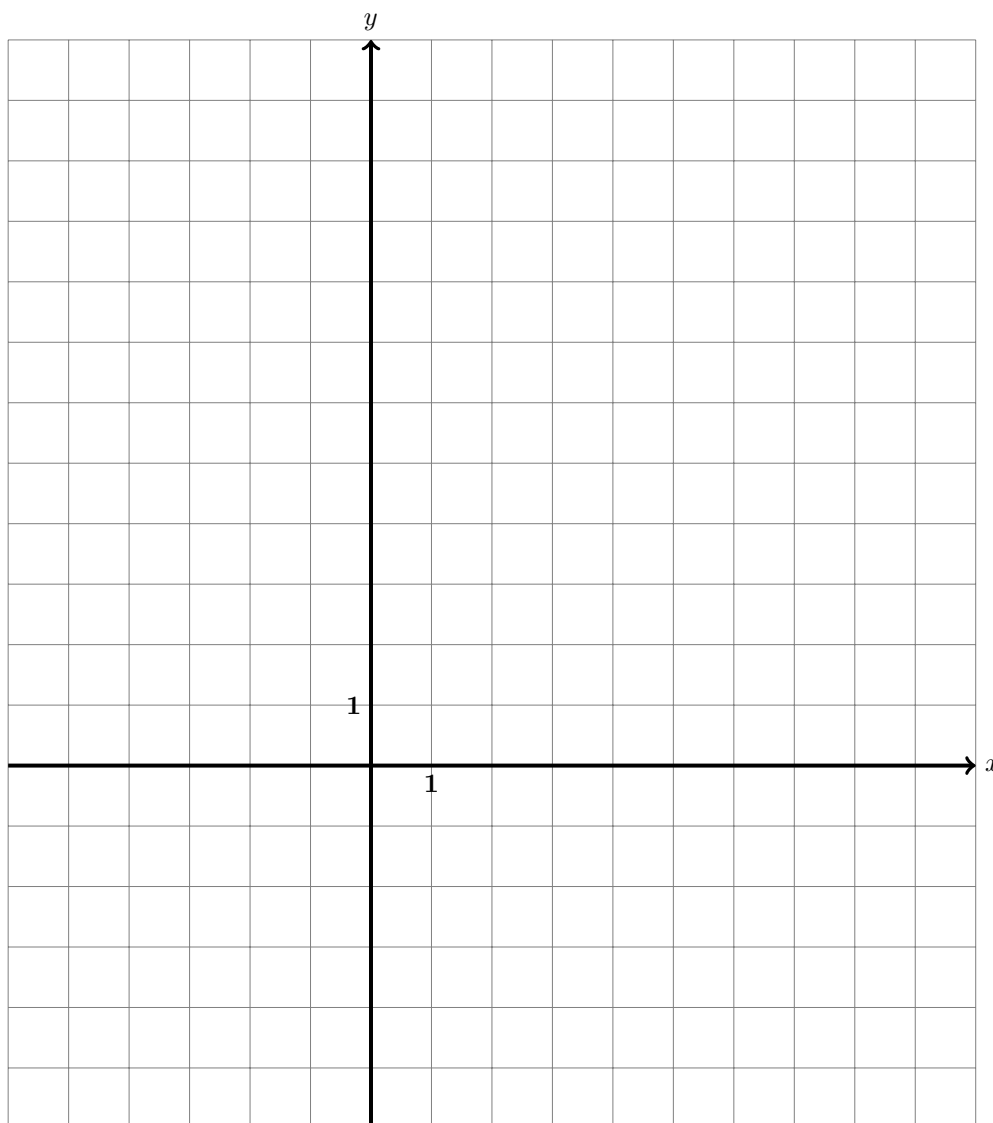
**Problem 2**                                                **5 pts**

$$2 \div 3 \equiv \qquad\qquad (mod\ 7)$$

**Problem 3** 10 pts

Draw the graph of the function $y = |x + 3|$ on the grid below.



What is $y(-20)$? $y(-20) =$

## Problem 4                                                    10 pts

A flight from Moscow, Russia, to Los Angeles, California, departs Moscow at 9:00 AM, Moscow time, and lands at LAX, Los Angeles International Airport, at 12:00 noon PST (Pacific Standard Time). On the way back, the plane leaves Los Angeles at 9:00 AM PST and lands in Moscow at 10:00 AM, Moscow time, the next day. How long is the flight?

## Problem 5                                                    10 pts

Prove that among any six integral (whole) numbers, there exist two such that their difference is a multiple of five.

**Problem 6** 10 pts
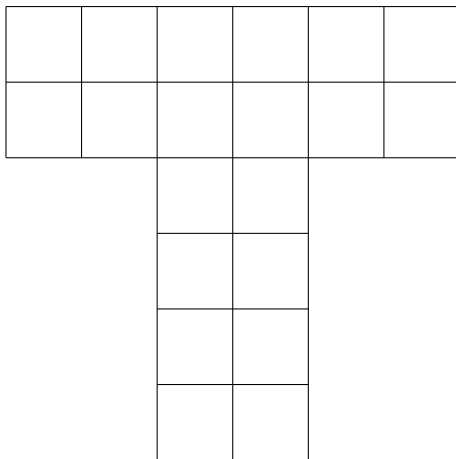
Write down a number composed of the digits

$$1, \ 1, \ 2, \ 2, \ 3, \ 3, \ 4, \ 4$$

in such a way that there is one digit between the ones, two digits between the twos, three digits between the threes, and four digits between the fours.
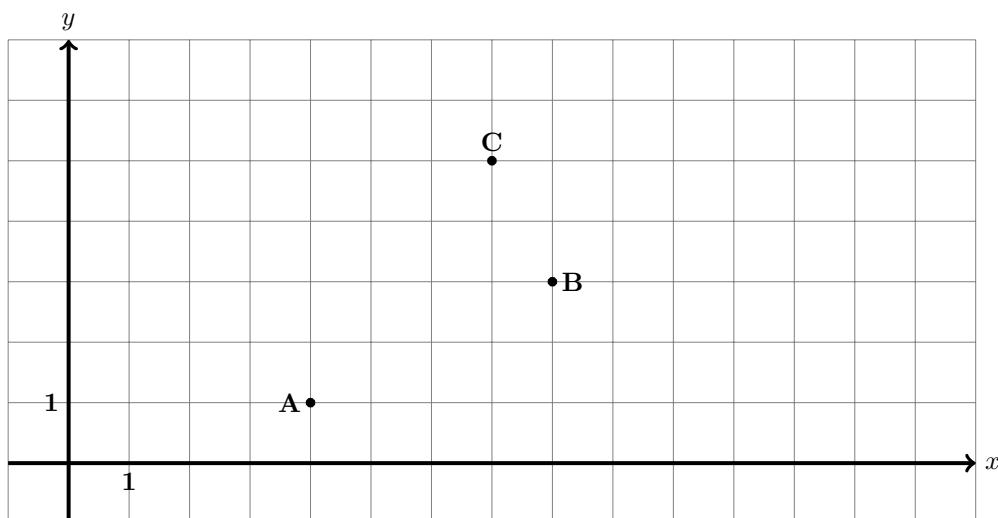
**Problem 7** 10 pts

The following figure is built of four equal parts. Draw the part.

- Find the area of the square built on the segment $AB$ as a side.

$$|AB|^2 =$$

- Find the area of the square built on the segment $AC$ as a side.

$$|AC|^2 =$$

- Find the area of the square built on the segment $BC$ as a side.
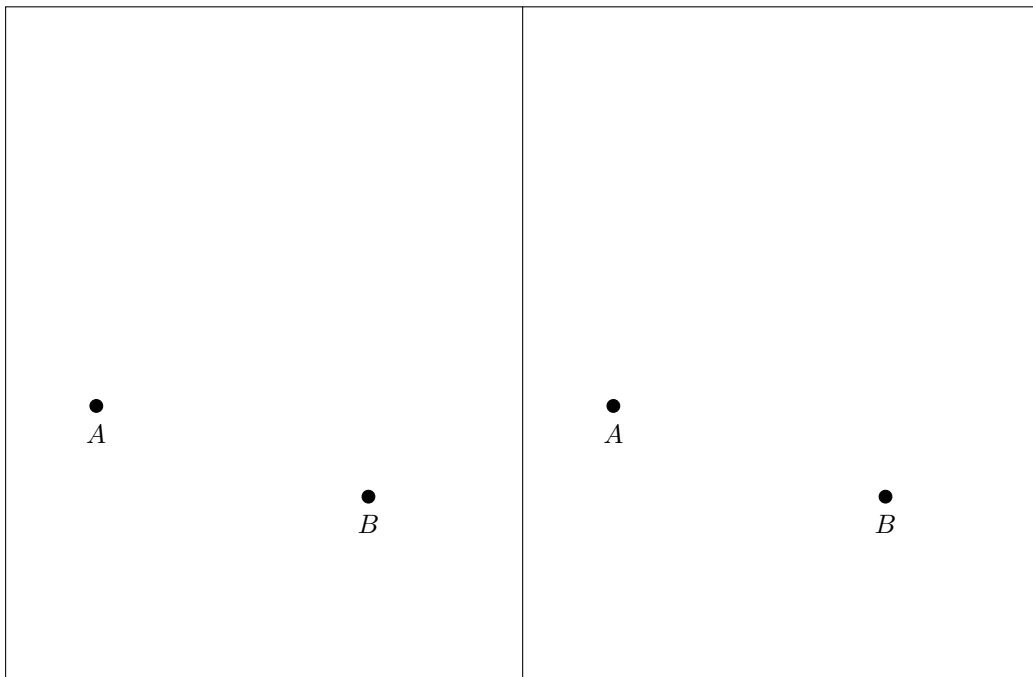
$$|BC|^2 =$$

- What is the size of the angle $ABC$ in degrees? Why?

$$\angle ABC =$$

## Problem 9                                                     10 pts

Consider two rectangles below as two identical copies of a cylinder. (The cylinder is obtained from either rectangle by glueing together its vertical sides.) Consider the left cylinder as the main copy. Using a ruler and, if needed, a compass, draw the shortest possible path from point $A$ to point $B$ on the main copy of the cylinder.

**Problem 10**                                             **10 pts**

The following table represents the number of articles from the *Scientific American* magazine Prof. Gleizer has read every month of the year 2011.

| Month | |
|---|---|
| January | 2 |
| Februry | 1 |
| March | 3 |
| April | 1 |
| May | 3 |
| June | 4 |
| July | 0 |
| August | 2 |
| September | 3 |
| October | 2 |
| November | 1 |
| December | 2 |

*a.*    How many *Scientific American* articles did Prof. Gleizer, on average, read every month?

*b.*    Based on your solution to part *a* of this problem, how many *Scientific American* articles would you expect Prof. Gleizer to read throughout the year 2012?