

MATH FIELD DAY 2004 RELAYS

**Relay A**

A1. Find the slope of the line  $6x - 3y - \sqrt{2} = 0$ .

A2. Let  $k$  be the number you receive. Find the sum of  $12k + 11k + \cdots + 2k + k$ .

A3. Let  $k$  be the number you receive. Find the largest integer  $n$  such that  $4n^5 < k$ .

A4. Let  $k$  be the number you receive. Find the area of the right triangle with one leg of length  $k$  and the other of length  $k + 2$ .

A5. Let  $k$  be the number you receive. Find the  $y$ -coordinate of the point where the line of slope  $k$  through the point  $(1, 2)$  intersects the line  $x = 3$ .

1. 2

2. 156

3. 2

4. 4

5. 10

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**Relay B**

B1. Find  $x$  if  $\frac{4}{2^x} = 8$ .

B2. Let  $k$  be the number you receive. Find the value of  $(k + 2)(k^2 - 2k + 4)$ .

B3. Let  $k$  be the number you receive. Find the larger of the two consecutive integers whose sum is  $k$ .

B4. Let  $k$  be the number you receive. Find the radius of a circle whose area is  $k\pi$ .

B5. Let  $k$  be the number you receive. Find the  $x$ -value of the solution of the system:

$$\begin{cases} 6x + 4y = k \\ y - x = 4k \end{cases}$$

1. -1

2. 7

3. 4

4. 2

5.  $\textcircled{-3}$

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**Relay C**

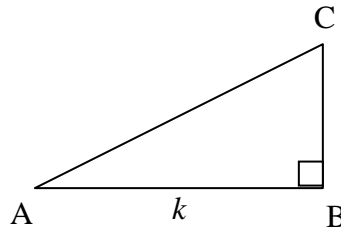
C1. In how many different ways can we arrange three objects in a row?

C2. Let  $k$  be the number you receive. Suppose there are  $k$  people, labeled with the numbers 1, 2, ...,  $k$ , sitting clockwise around a circle. If we start counting clockwise from person 1, what is the label of the 45<sup>th</sup> person counted?

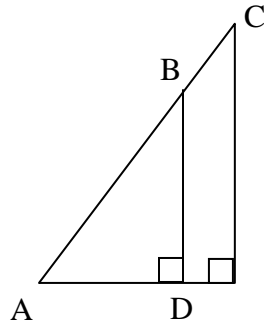
C3. Let  $k$  be the number you receive. Calculate the following:

$$\frac{1}{\frac{1}{k-1} - \frac{1}{k+1}}$$

C4. Let  $k$  be the number you receive. In the following figure,  $AB = k$ ,  $\angle ABC = 90^\circ$ , and  $\frac{BC}{AB} = \frac{3}{4}$ . Find  $AC$ .



C5. Let  $k$  be the number you receive. In the following figure,  $AB = k$ ,  $BD = 4$ , and  $DE = 1$ . Find  $CE$ .



1. 6

2. 3

3. 4

4. 5

5.  $\frac{16}{3}$

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**Relay D**

- D1. Find the area of an isosceles right triangle whose hypotenuse has length  $\sqrt{10}$ .
- D2. Let  $k$  be the number you receive. If a rectangle's length is 2 more than its width and the rectangle has an area of  $6k$ , find the rectangle's width.
- D3. Let  $k$  be the number you receive from the front and  $m$  be the number you receive from the rear. If Fran can paint a room in  $k$  days and Ollie can paint a room of equal size in  $m$  days, how many days will it take the two of them working together to paint 5 rooms?
- D4. Let  $k$  be the number you receive. If the quadratic equation  $x^2 + bx + c = 0$  has  $k$  and  $-11$  as roots, find  $b$ .
- D5. How many CDs can you buy from an online store if you have \$100 to spend, the CDs cost \$9.99 apiece, and there is a fixed shipping cost of \$6.95 for any order?

1.  $5/2$

2. 3

3. 6

4. 2

5. 9