

MATH FIELD DAY 2010 RELAYS

**Relay A**

- A1. Find the hypotenuse of a right triangle each of whose legs has length  $\sqrt{2}$ .
- A2. Let  $k$  be the number you receive. Find the remainder you get when  $k+500$  is divided by 7.
- A3. Let  $k$  be the number you receive. Calculate the value of  $k^3 - 4k^2 - 20k + 80$ .
- A4. Let  $k$  be the number you receive. If a regular polygon has  $k$  sides and each of its angles measures  $x^\circ$ , find  $x$ .
- A5. Let  $k$  be the number you receive. If the length of a rectangle is three times its width and its area is  $k$ , find its perimeter.

MATH FIELD DAY 2010 RELAYS

**Relay B**

B1. Find  $k$  if  $4^5 = k2^9$ .

B2. Let  $k$  be the number you receive. Find the smaller solution to  $|x - k| = 1$ .

B3. Let  $k$  be the number you receive. Find the y-coordinate of the midpoint of  $(k, k)$  and  $(-k, k + 2)$ .

B4. Let  $k$  be the number you receive. Find the y-intercept of the line  $2x + ky - 6 = 0$ .

B5. Let  $k$  be the number you receive. Simplify  $1 + \frac{1}{1 + \frac{1}{k}}$

1. 2

2. 1

3. 2

4. 3

5.  $\frac{7}{4}$

MATH FIELD DAY 2010 RELAYS

**Relay C**

C1. The parabola  $y = 2 + (x + 1)^2$  has y-intercept  $(0,k)$ . Find  $k$ .

C2. Let  $k$  be the number you receive. How many positive integers less than 2010 are evenly divisible by  $100k$ ?

C3. Let  $k$  be the number you receive. Evaluate the sum

$$1 + 2 + 2^2 + \dots + 2^{k-1}.$$

C4. Let  $k$  be the number you receive. A math class and an English class have 35 students apiece. If  $k$  students are in at least one of the two classes, how many students are in both?

C5. Let  $k$  be the number you receive. Find the area of the square with vertices  $(k,0)$ ,  $(0,k)$ ,  $(-k,0)$ , and  $(0,-k)$ .

MATH FIELD DAY 2010 RELAYS

**Relay D**

- D1. How many arrangements of the letters in the word SEAT start with a consonant?
- D2. Let  $k$  be the number you receive. If the lines  $hx + 18y = 6$  and  $4x + ky = -1$  are parallel, find  $h$ .
- D3. Let  $k$  be the number you receive from the front and  $h$  be the number you receive from the back. A square sheet of paper  $k$  inches by  $k$  inches contains a colored region surrounded by a border  $h$  inches wide. Find the area of the border.
- D4. Let  $h$  be the number you receive. Find the remainder when the polynomial  $x^3 - 4x^2 + 8x + h$  is divided by  $x - 3$ .
- D5. Find the  $x$ -coordinate of the point on the line  $y = 2x + 30$  whose  $y$ -coordinate is 2.

1. 12

2. 6

3. 20

4. 1

5. -14