

MATH FIELD DAY 2012 RELAYS

Relay A

A1. How many ordered pairs (a, b) of positive integers are there such that $a^2 + b^2 \leq 7$?

A2. Let k be the number you receive. Find a positive integer x such that $x^2 + x = k^2 - k$.

A3. Let k be the number you receive. Find the sum of the x - and y -intercepts of the line $kx - 3y = 6$.

A4. Let k be the number you receive. Find the y -intercept on the line of slope k through the point $(3, 2k + 4)$.

A5. Let k be the number you receive. Find the area of a square with diagonal length $2k$.

1. 3

2. 2

3. 1

4. 3

5. 18

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Relay B

B1. If $f(x+1) = 2x+3$, find $f(1)$.

B2. Let k be the number you receive. Find the slope of the line $6x - ky + 3 = 0$.

B3. Let k be the number you receive. Evaluate $1 + \frac{1}{1 + \frac{1}{k}}$.

B4. Let k be the number you receive. If a right triangle has a hypotenuse of length $3k$ and a side of length 3, find the length of the other leg.

B5. Find the radius of the circle $x^2 + y^2 - 2x + 2y = k$.

1. 3

2. 2

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

4. 4

5. $\sqrt{6}$

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Relay C

C1. Find the largest prime that divides 1001.

C2. Let k be the number you receive. If a right triangle has a hypotenuse of length k and one leg of length 12, find the length of the other leg.

C3. Let k be the number you receive. If $a_0 = 0$, $a_1 = 1$, and $a_{n+1} = a_n + a_{n-1}$, find a_{2k} .

C4. Let k be the number you receive. Find the larger root of $x^2 - 6x - k = 0$.

C5. Let k be the number you receive. Find the sum of the first k positive integers.

1. 13

2. 5

3. 55

4. 11

5. 66

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Relay D

- D1. How many integers x with $1 \leq x \leq 60$ are divisible by 2 or 3 (or both)?
- D2. Let k be the number you receive. If an isosceles right triangle has a hypotenuse of length $\frac{k\sqrt{2}}{4}$, what is the length of each of its legs?
- D3. Let h be the number you receive from the front and k be the number you receive from the back. If the point (h, k) lies on a circle centered at $(6, 5)$, what is the circle's radius?
- D4. Let k be the number you receive. If $(x - k)^2 = 9$ and $(x + k)^2 = 1$, find x .
- D5. Find the y -coordinate of the point in Quadrant IV where the line $x + y = 1$ intersects the parabola $x + 4y^2 = 6$.

1. 40

2. 10

3. 5

4. 2

5. -1