

2006 BATH Relays Heat 1

1. You have 32768 giraffes roaming in your backyard. In addition, each giraffe occupies a square meter of area. Fortunately, you are rich and have a 32768 square meter backyard. Find the sum of the distinct prime factors of 32768.

2006 BATH Relays Heat 1

2. Let $T = TNYWR$. There are 180 long days of school in a long school year. However, we are lucky that it is almost over. Write 180 in base T .

2006 BATH Relays Heat 1

3. Let $T = TNYWR$. Take the number of 1's in T , subtract 1, cube it, add 73, take the square root, and subtract 2. Let the new number be K . Find the reciprocal of the reciprocal of the reciprocal of the reciprocal of K .

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4. Let $T = TNYWR$. There are T boxes numbered 1 to T , each with T balls inside. Find the smallest number of balls you must take so that the box numbered n has at most n balls.

2006 BATH Relays Heat 2

1. You have 3 apples. I want to eat an orange. Farmer Bob owns 10 cows. If every cow wants to eat an apple and I give you a pineapple, how many pieces of fruit do mammals want to eat in this problem?

2006 BATH Relays Heat 2

2. Let $T = TNYWR$. Take T to the 4th power. Oh! What's it look like? Add up all its digits.

2006 BATH Relays Heat 2

3. Let $T = TNYWR$. I see T penguins on that iceberg. A polar bear sees the tasty penguins, but unfortunately doesn't live in the same hemisphere as them. Half of the penguins die of laughter. The remaining penguins pair up and each pair has a baby, but then a single baby dies. How many living penguins are left?

2006 BATH Relays Heat 2

4. Let $T = TNYWR$. I have T trees in my backyard, each with T squirrels. Each squirrel buries T nuts in the backyard. You love nuts and can find buried nuts at the rate of one nut every T minutes (due to attacking squirrels). To the nearest hour, how many hours will it take you to find half of the nuts?

2006 BATH Relays Heat 3

1. You have 3 squares, 5 triangles, 7 pentagons, 11 hexagons, 13 heptagons, 17 octagons, 19 nonagons, 23 decagons, and an enormous army of badgers at your disposal. If you choose 2 squares and 1 triangle, how many possible combinations are there?

2006 BATH Relays Heat 3

2. Let $T = TNYWR$. If $f(x) = \frac{x^4 - 33}{x + T^2} + x + \frac{x + 72}{x^2 - (T + 1)} + 99(x - T)^2$, for what positive value of x is $f(x)$ not defined?

2006 BATH Relays Heat 3

3. Let $T = TNYWR$. A mooing number is a number that can be written as the sum of distinct positive factorials (e.g. $7 = 3! + 1!$ so 7 is mooing). Evaluate $(T + 1)! - \frac{(2T - 1)!}{120} - T^3$.

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4. Let $T = TNYWR$. Sarah runs T meters. Bobbie runs $T - 8$. Steve then runs $2T$ meters, Emily runs $8T + 7$ meters, Paris runs $7T + 5$ meters, Patricia runs $T + 4$ meters, Roxas runs T^2 meters, and Sora runs $(T - 10)!$ meters. Given that Roxas and Sora are really the same person, find the average distance run by people with the letter 'i' in their names.

2006 BATH Relays Heat 4

1. I am walking up a flight of stairs at 2 strides per second, with 3 steps per stride. And these are no ordinary stairs, they move down like an escalator at 2 steps per second. If I want to go up a net distance of 12 steps, how many seconds will it take?

2006 BATH Relays Heat 4

2. Let $T = TNYWR$. Hedgehogs like to eat bugs, but I don't. A cylinder with height T^2 and radius T is shrunk to $\frac{4}{9}$ the original volume and changes in shape to a sphere. Find the radius of the sphere.

2006 BATH Relays Heat 4

3. Let $T = TNYWR$. There are T trees in my front yard that I want to cut and T woodpeckers making a ton of noise. Fortunately, I am superhuman and able to move a cut tree and cut another tree at the same time. If it takes $T - 2$ seconds to cut down a tree and another $T - 2$ seconds to move it, how long does it take to cut and move all T of them?

2006 BATH Relays Heat 4

4. Let $T = TNYWR$. There are T gears on my machine, numbered 1 through T . Gear n has n spokes. They are connected to each other in order by number of spokes (e.g. gear 1 connects to gear 2, gear 2 to gear 3, etc.). How many revolutions does gear 1 go through if gear T goes through one full revolution?

2006 BATH Relays Final Round

1. Find the smallest value of n such that if you have $11n^3$ koalas of volume $3n^2$, you can fit them in a cube of side length n^2 . Koalas can be changed into any shape that preserves their volume because they're just cool like that.

2006 BATH Relays Final Round

2. Let $T = TNYWR$. Find the number of triples of positive integers (x, y, z) such $xyz = T$. In this case the order of x, y, z does matter (e.g. $(1, 2, 3) \neq (3, 2, 1)$).

2006 BATH Relays Final Round

3. Let $T = TNYWR$. Take the largest square divisor of T , square root it, and call it K . You are in a room with K doors. However, only 1 of these doors leads you to your destination. Another leads you to death. The rest lead you back into the same room. If you can keep going through doors indefinitely (unless you die), what is the probability that you survive and reach your destination?

2006 BATH Relays Final Round

4. Let $T = TNYWR$. Let K be the cube of the reciprocal of T . If x_1, x_2, \dots, x_k are positive reals that sum to the square of the smallest positive prime number, find the minimum value of $\frac{1}{x_1 x_2 \cdots x_k}$.