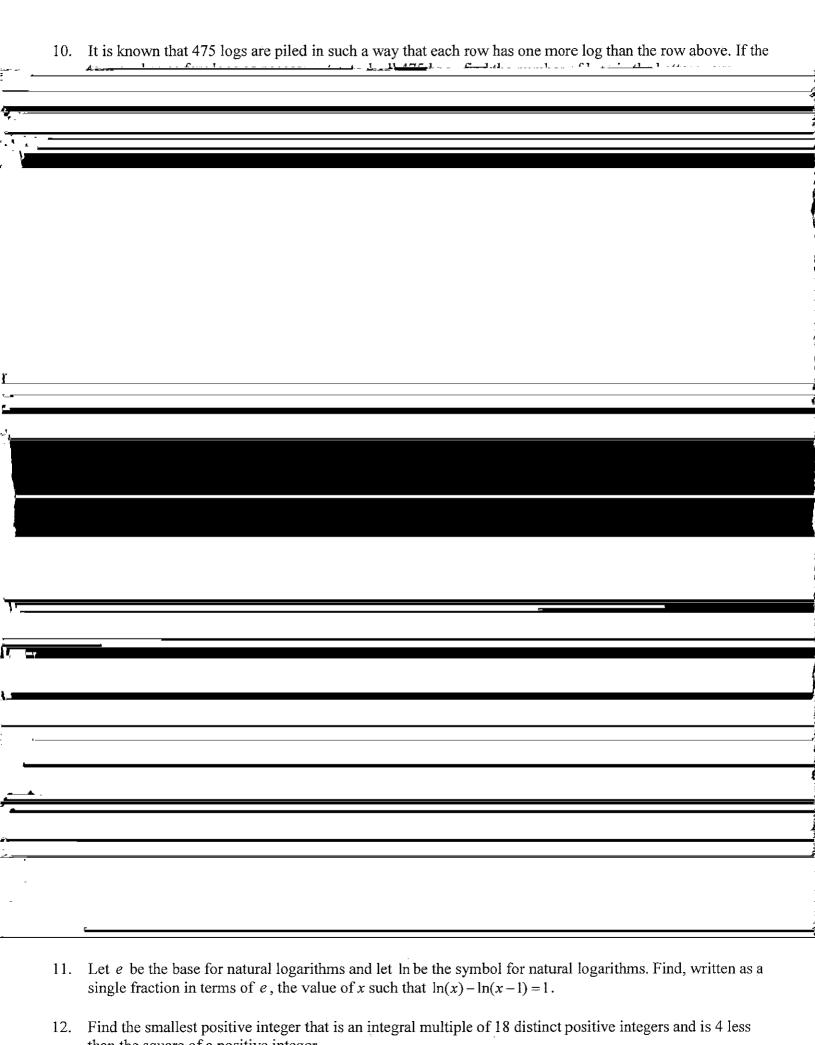
## 2013 John O'Bryan Mathematical Competition Junior-Senior Individual Test

**Directions:** Please answer all questions on the answer sheet provided. All answers must be written legibly and in simplest form. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required. Each problem has the same point-value.

- 1. If  $x^4 x^2 20 = 0$ , how many of the distinct roots are non-real?
- 2. Let  $i = \sqrt{-1}$ . If (3i)(ki) = -12, find the value of k.
- 3. Let k be an integer such that 30 < k < 45. Find the sum of all distinct values of k such that k is **not** the sum of 2 or more consecutive **odd** natural numbers.
- 4. Find the sum of all distinct positive integer multiples of 7 if each multiple of 7 is less than 2013.
- 5. If x < 0, then find the value of x such that |2 3x| = 23.
- 6. One circle has an equation of  $(x-8)^2 + (y+2)^2 = 25$ . A second circle has an equation of  $2x^2 + 2y^2 + 12y = 1$ . Find the slope of a line that is perpendicular to the line that joins the centers of the two given circles.
- 7. The circumference of a circle is  $38.74\pi x$ . The area of this same circle is  $kx^2$ . Find the value of k rounded to the nearest integer.
- 8. An observer in a building that rises vertically notes that two objects on a horizontal road below have respective angles of depression of 26° and 19° respectively. If the distance from the base of the building to



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