**Directions:**

- Your answers should be in the form specified in the problem to receive credit. <u>Approximate answers must be at least three decimal places rounded or truncated</u> (ex: $\frac{2}{3} \approx 0.666$ *or* 0.667), and <u>exact answers must be in simplest form</u> (ex: $\frac{5}{15}$ will not be accepted for $\frac{1}{3}$, and $\sqrt[3]{48}$ will not be accepted for $2\sqrt[3]{6}$).

- Only **scientific calculators** are allowed on this contest.

- Do **NOT** use calculators that**:**
  - can access the internet,
  - can communicate with other devices,
  - store programs, formulas, or notes,
  - use a computer algebra system
  - have dynamic geometry software

- You may write on this contest and use additional paper you receive from your teacher, but you should write your answers on the **Individual Student Cover Page** to be official and receive credit.

- You will have exactly 45 minutes to complete the 9 problems in this contest.
 Work carefully and with accuracy.

Problems:

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1. For how many different positive integers n does $\sqrt{n}$ differ from $\sqrt{100}$ by less than 1?

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2. The two roots of the quadratic equation $x^2 - 85x + c = 0$ are prime numbers. What is the value of c?

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3. A class has three girls and three boys. These students line up at random, one after another. What is the probability that no boy is right next to another boy, and no girl is right next to another girl? Write your answer as a fraction in simplest form.

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4. Mary paid $480 to purchase a certain number of items, but the nice vendor gave her two extra. This decreased the price per item by $1. How many items did she receive (including the two extra)?

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5. A ladder is leaning against a house with its bottom 15 feet from the house. If the bottom is pulled 9 feet farther away from the house, the upper end would slide 13 feet down. How many feet long is the ladder?

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6. You have two boxes. Each of them has a square base and is half as tall as it is wide. If the larger box is two inches wider than the smaller box, and has a volume 244 in³ greater, what is the width of the smaller box?

7. A large equilateral triangle is constructed by using toothpicks to create rows of small equilateral triangles. For example, in the figure, we have 3 rows of small congruent equilateral triangles, with 5 small triangles in the base row. How many toothpicks would be needed if the triangle consists of 2023 small equilateral triangles?
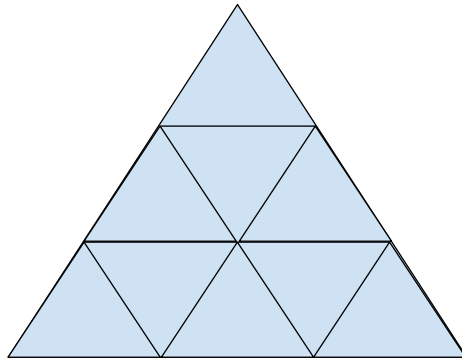
8. Circles with Centers O and P have radii of 4 and 8, respectively, and are externally tangent. Points A and B are on the circle centered at O, and points C and D are on the circle centered at P, such that $\overline{AD}$ and $\overline{BC}$ are common external tangents to the circles. What is the area of the hexagon AOBCPD?
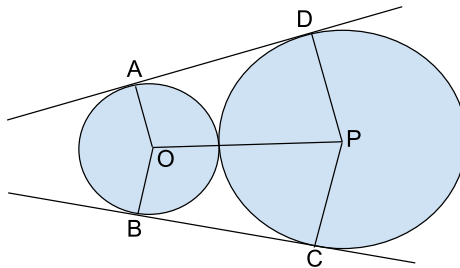
9. A rectangular fish tank has the base dimensions 4 feet by 2 feet, and height 3 feet. The tank is initially half full. A solid steel ball of diameter 1 foot is dropped into the tank, which sinks to the bottom. By approximately how many inches will the tank rise? Note: 1 foot = 12 inches. (Practice exam 8 #4)