



Contest #3      Bergen County Math League      2019–2020

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**Part I**    *Time Limit:* 12 minutes

**Calculators Allowed**

Answers must be exact or have 4 (or more) significant digits, correctly rounded.

- 3–1. The area of a trapezoid is 12 times the length of the shorter base. The longer base is 3 times as long as the shorter base. Find the length of an altitude of this trapezoid.
- 3–2. Factor 11100111 as a product of four primes.
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**Part II**    *Time Limit:* 12 minutes

**Calculators Allowed**

Answers must be exact or have 4 (or more) significant digits, correctly rounded.

- 3–3. A man with \$10000 invests \$4000 at 5% simple interest, \$3500 at 4%, and the remainder at  $P\%$ . His yearly interest income is \$500. Find  $P$ .
- 3–4. In isosceles right triangle  $\triangle ABC$ ,  $M$  is the midpoint of hypotenuse  $\overline{AB}$ . An equilateral triangle has one vertex on  $\overline{AC}$ , one on  $\overline{BC}$ , and one at  $M$ . If  $AB = 24$ , the length of a side of the equilateral triangle is  $k(\sqrt{3} - 1)$ . Find  $k$ .
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**Part III**    *Time Limit:* 12 minutes

**Calculators Allowed**

Answers must be exact or have 4 (or more) significant digits, correctly rounded.

- 3–5. According to NCAA data, 54% of all student-athletes graduate, 55% of female student-athletes graduate, and 48% of male student-athletes graduate. What is the ratio of the number of male student-athletes to the number of female student-athletes?
- 3–6. A unit fraction is a fraction of the form  $1/n$ , where  $n$  is an integer greater than 1. Find the two largest unit fractions if each is the square of a rational number and if their sum is also the square of a rational number.
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**Answers**

- 3–1. 6
- 3–2.  $3 \cdot 11 \cdot 37 \cdot 9091$
- 3–3. 6.4 or 6.4%
- 3–4. 12
- 3–5.  $\frac{3}{4}$
- 3–6.  $\frac{1}{9}, \frac{1}{16}$