**Directions:**

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

- You may only use calculators that are permitted on the SAT Tests.

- 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 problems in this contest. Work quickly and with accuracy.

Problems:

1. The dimensions *a, b* and *c* of a rectangular prism are in the ratio 3:5:7. If the length of the diagonal is $3\sqrt{83}$ units, what is the value of $a+b+c$?

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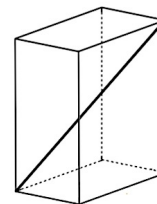
2. Given positive integers *m* and *n* that differ by 35, such that $m^2 + n^2 = 2017$.
Find the value of *m* + *n.*

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3. Find the *y*-coordinate of the point on the line $y = 2x + 3$ that is closest to the point $(0,7)$.

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4. Some values of a function *f* are shown in the following table:

x	−5	−3	−1	1	3	5	7	9
f(x)	−54	−20	−2	0	−14	−44	−90	−152

If $g(x) = -\frac{2}{3}f(1-2x) + f(|x|)$, what is the value of $g(-3)$?

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5. What is <u>the largest possible</u> number of intersections between eight distinct lines in a plane?

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6. If you randomly arrange 5 different math books and 5 different art books on a shelf, what is the probability that you will have two math books at the two ends?

7. Find the exact value of the infinite continued fraction $2 + \cfrac{1}{1 + \cfrac{1}{2 + \cfrac{1}{1 + \cfrac{1}{2 + ...}}}}$.
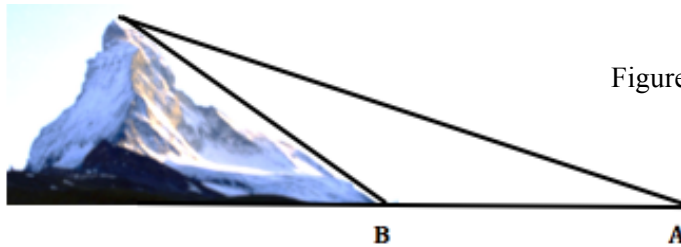

Figure not drawn to scale

8. The peak of a mountain can be seen from points A and B that are both 5,200 feet above sea level, and are 500 feet apart. The angle of elevation at A and B are 20° and 32° respectively. Find the elevation from sea level at the mountain peak. Round your answer to the nearest foot.

9. In the figure shown on the right, $\overline{FB}$ is tangent to the circle with center C, and $\overline{AB}$ intersects the circle in point H. If AH = 7cm and HB = 3cm, find the exact length of $\overline{FB}$.
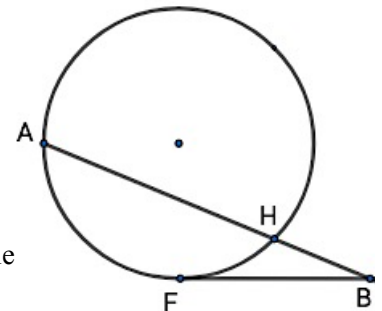
    Figure not drawn to scale

10. How many integer solutions does the inequality $|n - 9| < 6$ have?

11. In quadrilateral $QUAD$, QU=21, UA=20, AD=15, UD=25 and AQ=29. Find the area of $QUAD$.

12. A coin with diameter 1 inch is tossed onto a 24×18 in^2 flat surface covered with black and white square tiles as shown. The side of each tile is 3 inches.

What is the probability that the coin lands entirely inside a white tile?
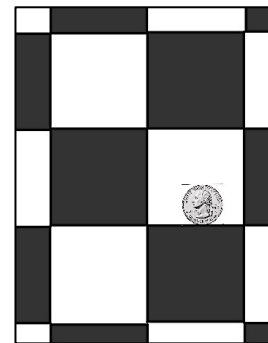
Here's a partial view of the surface:

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13. How many points do the graphs of $f(x) = x^3 + 1$ and $g(x) = e^{0.3x}$ have in common?

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14. A *look and say sequence* is a sequence of integers that begins with a single digit, in which the next term is obtained by describing the previous term.

For example, the sequence starting with the single digit 1 is $1, 11^*, 21^{**}, 1211^{***}, ...$

      *there is one 1 in the previous term,

      **there are two 1's in the previous term,

      ***there is one 2 and one 1 in the previous term.

      The fourth term of this sequence has 4 digits.

How many digits are in the seventh term of the *look and say sequence* that begins with 2?

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15. The image shows an equilateral triangle with perimeter 30 units. Each circular arc is centered at a vertex, and has radius that is half the length of each side. Find <u>the exact value</u> for the area of the shaded region with vertices *A, B,* and *C.*