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. Find the area of the region in the *xy*-plane bounded by the three lines $y=-\frac{5}{4}x$, $y=\frac{3}{4}(x-4)-5$ and $x=0$.

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2. If $\frac{2}{x^2-3x+2}=\frac{n}{x-2}-\frac{m}{x-1}$ for integers *n* and *m,* and real numbers *x,* $(x \neq 1, 2)$, find the value of $m + n$.

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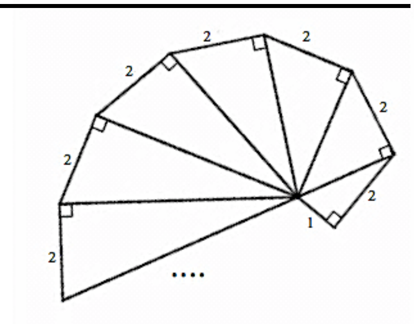
3. The first seven triangles in a sequence of right triangles are shown. The first triangle has legs that are 1 and 2 units long. All other triangles have one leg that is 2 units long, and another leg that is the hypotenuse of the previous triangle in the sequence. What is the <u>exact length</u> of the hypotenuse of the seventeenth triangle in this sequence?



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4. If *f* is defined such that $f(2)=1$ and $f(2n)=n+f(2n-2)$ for positive integers *n* greater than 1, find $f(8)$.

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5. The curve defined by $x+\frac{3}{y-4}=7$ intersects the coordinate axes at (*a,* 0) and (0, *b*).

   If $a+b=\frac{B}{28}$, find the value of *B*.

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6. Your friend starts tapping his desk to a tune with four beats using five fingers. How many different fingering sequences with four beats are possible if he avoids double tapping? For example, if you label the pinky P, ring finger R, middle M, index I and thumb T, the sequence PMPI counts, but PPMI doesn't count because P is a double.

P R M I T

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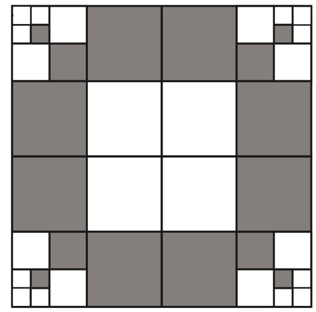
7. If the unit square is divided into smaller squares as shown on the right, what is the area of the shaded region? Write your answer as a fraction in reduced form.



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8. What is the degree measure of the acute angle formed by the line $3x+2y=7$ and the y-axis? Round your answer to the nearest hundredth.

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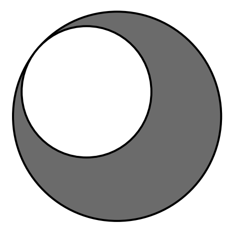
9. The two circles shown on the right are tangent to each other. If the area of the shaded region is 20π square units, and the sum of the perimeters of the two circles is 20π units, find the ratio $\frac{R}{r}$, where $R > r$.



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10. If $2x+1$ is a factor of $3x^3-2kx^2+7x-3$, what is the exact value of k ?

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11. In a tennis tournament with 8 players, each player is randomly assigned to their first-round match in the tournament bracket. Assume that the better player always wins the match. In this ideal setting, what is the probability that the second best player reaches the finals?

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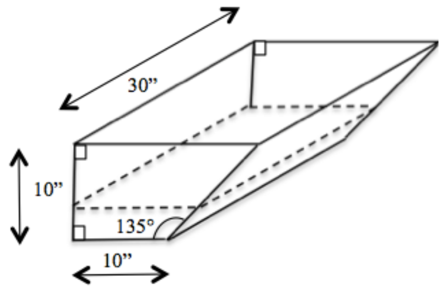
12. The trough shown on the right has a rectangular base, a slanted rectangular side and right trapezoidal faces with measurements as shown.
How much water is in the trough when the water in it is 4” deep?



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13. A function g has exactly 4 distinct zeros at –5, 2, 4 and 15.
If $h(x) = -3g\left(\frac{x}{2}\right)$, what is the sum of the zeros of h ?

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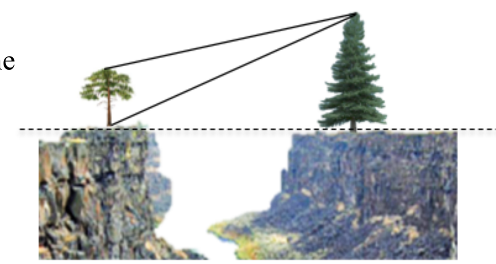
14. Two trees are opposite each other across a level gorge. The tall pine tree on the right is 60 feet tall, and the angle of depression from the top of the pine tree to the top of the tree on left is 15º, and the angle of depression to the bottom of the tree is 23º.
How tall is the tree on the left side of the gorge?
Round your answer to <u>the nearest foot</u>.



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15. In the diagram on the right, $\overline{AB}$ is a diameter of the circle and chord $\overline{CD}$ is parallel to $\overline{AB}$. $\overline{AD}$ and $\overline{BC}$ intersect in E, and $\angle DEB = 40°$.
Find the ratio of the area of triangle AEB to the area of triangle CED.
Round your answer to <u>the nearest tenth</u>.