Washington State Math Championship

$\sqrt{2013}$

Ferndale Refinery

Blaine School District

Geometry – 5th Grade

Bubble in your answers on the answer sheet. Be sure to erase all mistakes completely. You do not need to bubble in leading zeros – the answer of "7" does not need to be answered as "007". If your answer is a fraction like $\frac{3}{16}$, bubble in 316.

1. **2 points:** In the parallelogram $ABCD$, $\angle A$ has a measure of 72 degrees. What is the degree measure of $\angle D$?

2. **2 points:** If two sides of a triangle have lengths of 10 and 14, and the length of the third side must be an integer, what is the positive difference between the least and greatest possible perimeters of that triangle?

3. **2 points:** What is the area of a rhombus with diagonals of lengths 12 and 30?

4. **3 points:** Suppose that the midpoint of a line segment is $(3, -2)$. If one of the segment's endpoints is $(2, -9)$, what is the sum of the coordinates of the other endpoint?

5. **3 points:** When trying to test the myth that you can only fold a piece of paper in half 7 times, you manage to only make it to 6 folds, even using a large piece of paper. After those folds, the paper is 2 inches by 3 inches. Assuming the paper was folded in half three times in each direction, what was the perimeter, in inches, of the original piece of paper?

6. **3 points:** While wandering around Mount Baker, you discovered a perfectly groomed ski hill such that the slope was constant throughout the hill. When you arrived at the top of the hill, a sign alerted you that you were now at an elevation of 4800 feet. If you began at an elevation of 4400 feet, and know that you traveled a distance of 500 feet, what was the horizontal distance, in feet, that you traveled?

7. **3 points:** What is the sum of the greatest possible number of right angles in a convex quadrilateral, convex pentagon, convex hexagon, convex heptagon, and convex octagon?

8. **4 points:** A circle is circumscribed around a square, and a second circle is inscribed within the square. If the area of the inner circle is 25, what is the area of the outer circle?

9. **4 points:** A label maker for cylindrical soup cans decided to test out a new labeling system. Instead of having the label go once around the can, she decides to cover the top and bottom of the can and have exactly two layers of paper around the rest of the can. If the radius of the can is 3 inches, and the can has a height of 6 inches, how much paper will be required for each can? **Express your answer to the nearest square inch.**

10. **4 points:** A rectangle with an initial area of 125 has its height and width each increased in length by 20%. What is the area of the new rectangle?

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Blaine School District

Geometry – 6th Grade

Bubble in your answers on the answer sheet. Be sure to erase all mistakes completely. You do not need to bubble in leading zeros – the answer of "7" does not need to be answered as "007". If your answer is a fraction like $\frac{3}{16}$, bubble in 316.

1. **2 points:** Suppose that the midpoint of a line segment is $(3, -2)$. If one of the segment's endpoints is $(2, -9)$, what is the sum of the coordinates of the other endpoint?

2. **2 points:** When trying to test the myth that you can only fold a piece of paper in half 7 times, you manage to only make it to 6 folds, even using a large piece of paper. After those folds, the paper is 2 inches by 3 inches. Assuming the paper was folded in half three times in each direction, what was the perimeter, in inches, of the original piece of paper?

3. **2 points:** While wandering around Mount Baker, you discovered a perfectly groomed ski hill such that the slope was constant throughout the hill. When you arrived at the top of the hill, a sign alerted you that you were now at an elevation of 4800 feet. If you began at an elevation of 4400 feet, and know that you traveled a distance of 500 feet, what was the horizontal distance, in feet, that you traveled?

4. **3 points:** What is the sum of the greatest possible number of right angles in a convex quadrilateral, convex pentagon, convex hexagon, convex heptagon, and convex octagon?

5. **3 points:** A circle is circumscribed around a square, and a second circle is inscribed within the square. If the area of the inner circle is 25, what is the area of the outer circle?

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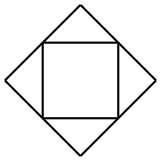
7. **3 points:** A rectangle with an initial area of 125 has its height and width each increased in length by 20%. What is the area of the new rectangle?

8. **4 points:** Beginning with a square that has an area of 1, a larger square is circumscribed about the previous square at a 45 degree rotation by using the vertices of the previous square as the midpoints of the larger square. The next square then uses the vertices of the larger square as midpoints at another 45 degree rotation, and so on. The figure below shows the first iteration. If the smallest square is considered to be the first square, what will the area of the 7^{th} square be?



9. **4 points:** What is the area of the figure with vertices at the coordinates $(2, 3)$, $(7, 15)$, and $(2, 13)$?

10. **4 points:** If the height of a mystery box is 6 feet, the width is 4 feet, and the surface area of the box is 208 square feet, what is the volume, in cubic feet, of the box?

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Blaine School District

Geometry – 7th Grade

Bubble in your answers on the answer sheet. Be sure to erase all mistakes completely. You do not need to bubble in leading zeros – the answer of "7" does not need to be answered as "007". If your answer is a fraction like $\frac{3}{16}$, bubble in 316.

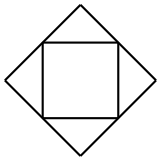
1. **2 points:** What is the sum of the greatest possible number of right angles in a convex quadrilateral, convex pentagon, convex hexagon, convex heptagon, and convex octagon?

2. **2 points:** A circle is circumscribed around a square, and a second circle is inscribed within the square. If the area of the inner circle is 25, what is the area of the outer circle?

3. **2 points:** A label maker for cylindrical soup cans decided to test out a new labeling system. Instead of having the label go once around the can, she decides to cover the top and bottom of the can and have exactly two layers of paper around the rest of the can. If the radius of the can is 3 inches, and the can has a height of 6 inches, how much paper will be required for each can? **Express your answer to the nearest square inch.**

4. **3 points:** A rectangle with an initial area of 125 has its height and width each increased in length by 20%. What is the area of the new rectangle?

5. **3 points:** Beginning with a square that has an area of 1, a larger square is circumscribed about the previous square at a 45 degree rotation by using the vertices of the previous square as the midpoints of the larger square. The next square then uses the vertices of the larger square as midpoints at another 45 degree rotation, and so on. The figure below shows the first iteration. If the smallest square is considered to be the first square, what will the area of the 7^{th} square be?



6. **3 points:** What is the area of the figure with vertices at the coordinates $(2, 3)$, $(7, 15)$, and $(2, 13)$?

7. **3 points:** If the height of a mystery box is 6 feet, the width is 4 feet, and the surface area of the box is 208 square feet, what is the volume, in cubic feet, of the box?

8. **4 points:** If two circles are drawn on a piece of paper such that they do not touch or overlap, how many lines can be drawn such that each line is tangent to both circles?

9. **4 points:** Suppose that 64 cubes, each with a volume of 1 cubic inch, are formed together to make a larger cube. If the 8 smaller cubes at the vertices of the larger cube are removed, and the remaining figure is dipped in a pool of neon green paint, how many unit cubes will have at least three faces covered in paint?

10. **4 points:** A 4-foot-tall boy was standing outside on a sunny day and noticed that the sun cast a 6 foot shadow of him. Remarkably, the sun cast a shadow of the flagpole that ended in the same spot as his shadow. If the boy was standing 12 feet away from the flagpole, how tall, in feet, is the flagpole?

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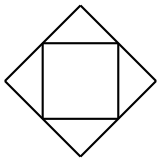
Geometry – 8th Grade

Bubble in your answers on the answer sheet. Be sure to erase all mistakes completely. You do not need to bubble in leading zeros – the answer of "7" does not need to be answered as "007". If your answer is a fraction like $\frac{3}{16}$, bubble in 316.

1. **2 points:** A rectangle with an initial area of 125 has its height and width each increased in length by 20%. What is the area of the new rectangle?

2. **2 points:** Beginning with a square that has an area of 1, a larger square is circumscribed about the previous square at a 45 degree rotation by using the vertices of the previous square as the midpoints of the larger square. The next square then uses the vertices of the larger square as midpoints at another 45 degree rotation, and so on. The figure below shows the first iteration. If the smallest square is considered to be the first square, what will the area of the 7^{th} square be?



3. **2 points:** What is the area of the figure with vertices at the coordinates $(2, 3)$, $(7, 15)$, and $(2, 13)$?

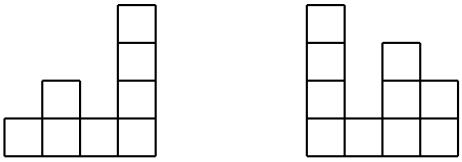
4. **3 points:** If the height of a mystery box is 6 feet, the width is 4 feet, and the surface area of the box is 208 square feet, what is the volume, in cubic feet, of the box?

5. **3 points:** If two circles are drawn on a piece of paper such that they do not touch or overlap, how many lines can be drawn such that each line is tangent to both circles?

6. **3 points:** Suppose that 64 cubes, each with a volume of 1 cubic inch, are formed together to make a larger cube. If the 8 smaller cubes at the vertices of the larger cube are removed, and the remaining figure is dipped in a pool of neon green paint, how many unit cubes will have at least three faces covered in paint?

7. **3 points:** A 4-foot-tall boy was standing outside on a sunny day and noticed that the sun cast a 6 foot shadow of him. Remarkably, the sun cast a shadow of the flagpole that ended in the same spot as his shadow. If the boy was standing 12 feet away from the flagpole, how tall, in feet, is the flagpole?

8. **4 points:** A 4-by-4 square grid is drawn on the ground and an unknown number of blocks are placed on each of the 16 squares. The left figure below shows the perspective from the front. The right figure below shows the perspective from one of the sides. What is the maximum number of cubes that could have been placed on the grid?



9. **4 points:** Joseph is on a break at his dance studio and just partially filled up his cone-shaped water glass. He was so tired that he didn't notice that the water started leaking out at the bottom because of a miniscule hole. The water began at a height of 4 inches with a radius of 3 inches, and the volume of the water in the glass decreased by 10% before he was able to drink the water. What was the height of the water when he went to drink the water? **Express your answer to the nearest hundredth of an inch.**

10. **4 points:** Suppose that two larger spheres of equal volume are both placed on a table such that they are touching at a single point. A third smaller sphere is placed underneath the larger spheres such that it is tangent to the two spheres, the plane containing the centers of the three spheres is perpendicular to the table, and the point where the smaller sphere touches the table is equidistant from the centers of the two larger spheres. If the radius of the smaller sphere is 5, what is the radius of one of the larger spheres?