Name_____ Math Level_____

Rocket City Math League

Gemini Test

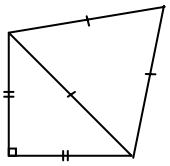
2006-2007
Round 2

Answers must be written inside the adjacent answer boxes. All answers must be written in exact, reduced, simplified, and rationalized form. All decimals, mixed numbers, and ratios must be written as common fractions (unless otherwise specified in the problem). **No calculators, books, or other aids may be used.**

1. A circle has radius of 3. What is its area? *(1 point)*

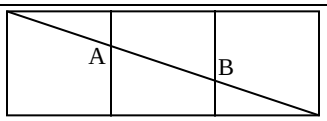
2. A regular tetrahedron is a solid with 4 faces that are congruent, equilateral triangles. How many edges does a regular tetrahedron have? (*1 point)*

3. An isosceles right triangle is drawn such that its hypotenuse coincides with a side of an equilateral triangle with side length 8 (as shown in the diagram to the right). Find the sum of the areas of the right triangle and the equilateral triangle. (*1 point)*

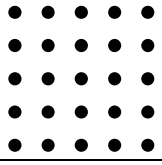


4. The solid steel nose guard of a used rocket is in the shape of a right circular cone with a base radius of 4 inches and a height of 24 inches. It is melted down into 12 equally sized spherical souvenir balls. What is the radius of one of these balls, in inches? (*1 point)*

5. A rectangle is divided into 3 congruent squares with side length 1. A diagonal of the rectangle is drawn as shown, and the diagonal intersects two opposite sides of the middle square at points A and B. Find the length of segment AB. (*2 points)*



6. How many squares of any size can be formed by connecting the dots in a 5-dot by 5-dot grid like the one shown to the right (all distances between horizontally and vertically neighboring dots are equal)? (2 *points)*



7. The vertices of a quadrilateral inscribed in a circle divide the circumference of the circle into 4 arcs whose measures are in the ratio of 3: 4: 5: 8 (in order around the circle). What is the measure of the smallest interior angle of the quadrilateral, in degrees? (2 *points)*

8. A 4-inch by 8-inch piece of rectangular paper is folded along one of its diagonals. Counting overlaps only once, find the area, in square inches, of the resulting figure. (2 *points)*

9. Deeply saddened by the demotion of Pluto from planet status, Nikhil graphs a two-dimensional map of Pluto's orbit using the equation $x(x-8)=-9-y(y-6)$. If D is the sum of all positive integers in the domain of the equation, and R is the sum of all positive integers in the range of the equation, what is $D+R$? (*3 points)*

10. What is the distance from the centroid to the hypotenuse of the right triangle defined by the points $(-2,4)$, $(-5,-2)$, and $(-1,-4)$? (3 *points)*

11. Three mutually tangent spheres, each with a radius of length 3/2, rest on a plane. A sphere with a radius of length 5/2 is placed on top of the three smaller spheres such that it is tangent to each one. Find the vertical distance from the highest point on the large sphere to the plane. (3 *points)*

12. In regular octagon SUPERMAN(as shown in the diagram to the right), $\overline{UM}$ is drawn. Find the area of the octagon if $UM=8\sqrt{2}$. *(4 points)*