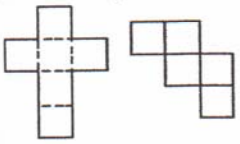
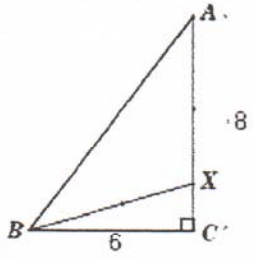
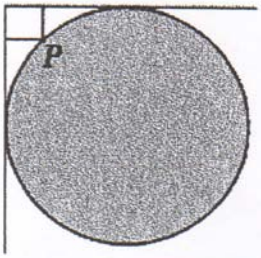
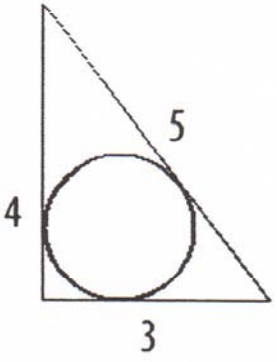
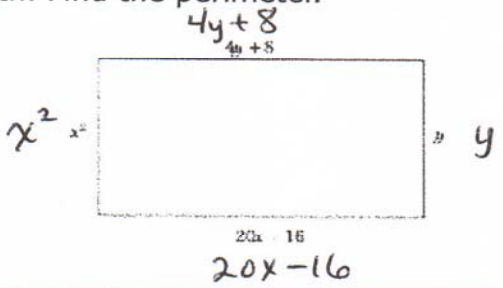
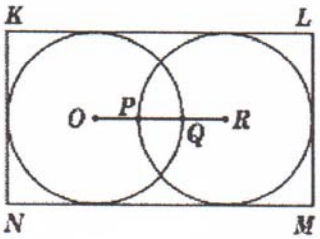
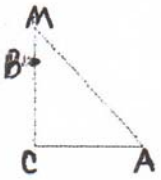
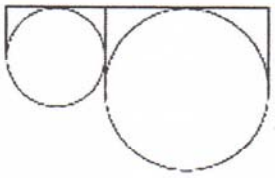
Measurement/Geometry

Problems:

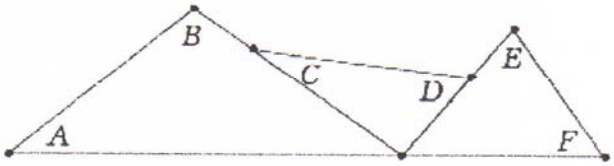
1	If you cut out the figure on the left, then fold it along the dotted lines, you get a hollow cube. This figure is called a *net* of a cube. Find all locations at which you can add a square to the figure on the right so that it will fold into a cube. 
2	Esmé is 60 m east and 80 m south of Rodrigue. Rodrigue cycles due east at 10 m/s. Esmé, who can bicycle at the same speed, instantaneously calculates whether she can intercept Rodrigue. Can she reach him by traveling in a straight line? If so, where will they be when they collide? If not, why not?
3	What is the radius of a circle in which a chord of length 10 is 5 units from the center?
4	This tessellation consists of congruent obtuse triangles arranged in a regular hexagon. What is the number of isosceles triangles of any size in the figure? 
5	A room that has two walls measuring 8 feet by 12 feet and two walls measuring 8 feet by 14 feet needs wallpaper. The wallpaper is sold in 40-square-foot rolls. The room has two windows—one is 4 feet by 5 feet, and the other is 3 feet by 5 feet—and one door, which is 4 feet by 7 feet. How many rolls of wallpaper must be purchased?
6	Given the nine-sided regular polygon $A_1A_2A_3A_4A_5A_6A_7A_8A_9$, how many distinct

	equilateral triangles in the plane of the polygon have at least two vertices in the set $\{A_1, A_2, \ldots, A_9\}$? (A) 30 (B) 36 (C) 63 (D) 66 (E) 72
7	In right triangle ABC, with right angle ACB, $AC = 8$ inches and $BC = 6$ inches. Point X is on $\overline{AC}$, equidistant from A and B. Find CX. 
8	A circular table is pushed into the corner of a square room so that a point P on the edge of the table is 8 inches from one wall and 9 inches from the other wall, as shown. Find the radius of the table in inches. 
9	What is the area of the region bounded by the graph of $\lvert x+y\rvert+\lvert x-y\rvert=4$?
10	What is the radius of the inscribed circle in a 3-4-5 triangle? 
11	You have a rectangular garden twenty meters long and ten meters wide. A one-meter-wide path fills up the garden. If you walk along the center of the path from beginning to end, how far will you walk?
12	In the figure, the smaller circle has a radius of two feet and the larger circle has a radius of four feet. What is the total area of the four shaded regions? Express your answer as a decimal to the nearest hundredth.

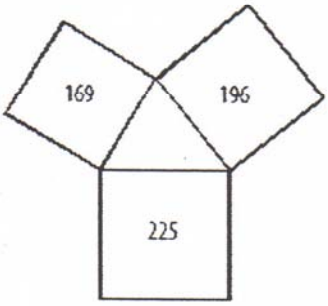
	have an odd integer length. Find the perimeter.  $20x - 16$
19	In the figure shown, the circles with centers O and R each have a radius of 2. If $PQ = 1$, then what is the perimeter of rectangle $KLMN$? 
20	In the right triangle shown, $MB + MA = BC + AC$. If $BC = 8$ and $AC = 10$, compute MB. 
21	If the price is the same, which is the better buy-a 10-inch round pizza or a 9-inch square pizza?
22	The inhabitants of the moon have a unit of distance called a *lunar*. The number of square lunars in the moon's surface area is the same as the number of cubic lunars in the moon's volume. Assume the moon's diameter to be 2160 miles. How long is a lunar in miles?
23	An 8.5 × 11-inch sheet of paper is cut in half lengthwise, while an identical sheet of paper is torn in half widthwise. Do the resulting half sheets have the same area, the same perimeter, or both?
24	If the perimeter of an isosceles triangle is 36 cm and if the altitude to its base is 12 cm, what is the triangle's area?



13 Find the value in degrees of the sum of the six angles indicated in the diagram.

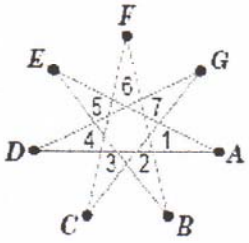


14 A triangle is bordered by three squares. If the areas of the squares are 225, 196, and 169, what is the area of the triangle?



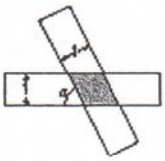
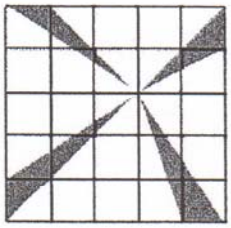
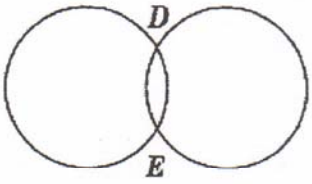
15 Exactly three of the interior angles of a complex polygon are obtuse. What is the maximum number of sides of such a polygon?

16 What is the sum of the measures of the numbered angles in the regular seven-pointed star shown below? (*ABCDEFG* is a regular heptagon.)



17 Let C be a cube where the length in inches of its long diagonal is the same as its volume in cubic inches. What is the length in inches of each side?

18 A rectangle has sides as shown [$4y + 8$, y, $20x - 16$, and x^2]. One pair of sides must

25	Two strips of width 1 overlap at an angle of a, as shown. Express the shaded area in terms of a. 
26	A circle of raidus 4 is centered at the origin. Its radius increases 3 units every second. Another circle of radius 12 is centered at (30,0). its radius decreases 1 unit every second. When the circles meet, where will the point (27,4) lie? (a) in the first circle, (b) on the first circle, (c) in the second circle, (d) on the second circle, or (e) between the circles
27	The figure is composed of twenty-five unit squares. What is the area of the unshaded region? 
28	In the figure, each of the circles has a radius of 6 and $DE = 6$, where D and E are the points of intersection of the two circles. What is the area of the region where the interiors of the circles overlap? 
29	A criminal is at the center of a circular pool. A police officer, who cannot swim, is standing at the edge of the pool. The police officer can run four times faster than the criminal can swim. Can the police officer capture the criminal before he escapes from the pool?
30	Given ΔABC with right angle C and a second right triangle ABD such that both

	triangles share the same hypotenuse. If $BC = 1$, $AC = b$, and $AD = 2$, find BD in terms of b.
31	A cube with edge 5 is cut by a plane to create quadrilateral $ABCD$, where B and D are midpoints of two edges of the cube. Find the area of $ABCD$.