Theta Geometry **2003 FAMAT State Convention**

NOTA stands for None Of These Answers

1. Find the area of a rhombus with diagonals length 6 and 8.

   A) 12 B) 20 C) 24 D) 48 E) NOTA

2. If this test were 8" by 12", and if you were to fold it in half symmetrically two times, what is the smallest possible perimeter of the resulting smaller rectangle?

   A) 8" B) 12" C) 20" D) 24" E) NOTA

3. A circle is tangent to a chord length 2 of a second, concentric circle. Find the area between the two circles.

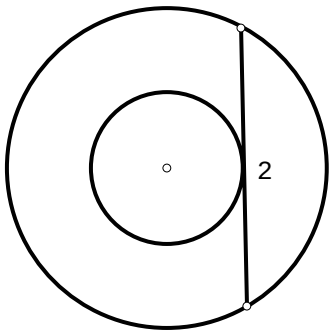
   A) $\frac{\pi}{2}$

   B) π

   C) 2π

   D) Not enough information

   E) NOTA



4. Are there any right triangles whose side measures and angle degree measures are all whole numbers?

   A) Yes B) No C) NOTA

5. The sum of the interior angles in a certain polygon is 2340 degrees. Find the sum of the exterior angles in a polygon with one less side, in degrees.

   A) 13^{o} B) 360^{o} C) 2160^{o} D) 2520^{o} E) NOTA

6. Please find the total area, in square meters, that a monkey can climb on if it is enclosed in a flat-roofed, regular hexagonal cage with square walls of height 6 meters. Note: monkeys can climb on any surface, even upside down.

   A) $9\sqrt{3}+108$ C) $18\sqrt{3}+108$ E) NOTA

   B) $54\sqrt{3}+216$ D) $108\sqrt{3}+216$

7. Find the greatest number of sides a regular polygon can have while still having a whole number for its interior angle measure.

   A) 180 B) 256 D) 360 D) No upper limit E) NOTA

8. In the figure below, $\overline{ZK}$ and $\overline{JK}$ are tangent to circle O. Quadrilateral $QZXJ$ is inscribed in the circle. The measure of $\angle K$ is 70 degrees. Find the measure of $\angle ZQJ$ in degrees.

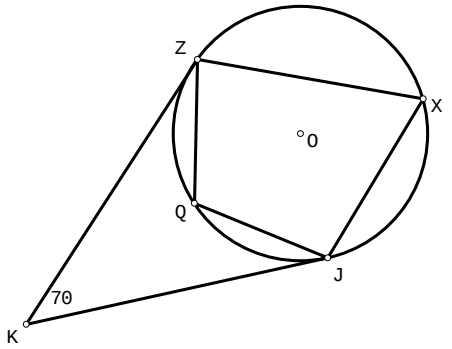
A) 55^o

B) 110^o

C) 125^o

D) 250^o

E) NOTA



9. Find the missing number in the table:

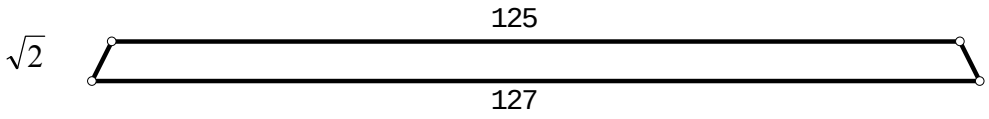
3	20	28
4	21	45
5	29	?

A) 53 B) 47 C) 41 D) 39 E) NOTA

10. Find the area of a regular quadrilateral with apothem length 2.

A) 4 B) 8 C) $4\sqrt{2}$ D) 16 E) NOTA

11. In a standard Scrabble game, playing under official tournament rules, the minimum number of uncovered spaces that can exist on the board at one time at the completion of a game is equivalent to the area of this isosceles trapezoid:



Find the area of the trapezoid.

A) 124 B) 125 C) 126 D) 127 E) NOTA

12. A rectangle has an interesting property. If it is cut in half by area, the two halves are each similar to the original rectangle. What is the ratio of the longer side of the rectangle to the shorter side?

A) $\sqrt{2}:1$ B) $2:1$ C) $\sqrt{2}:2$ D) $\frac{1+\sqrt{5}}{2}$ E) NOTA

13. What is the maximum number of circles of radius 1that can fit inside a circle of radius 3 without overlapping?

A) 4 B) 6 C) 7 D) 8 E) NOTA

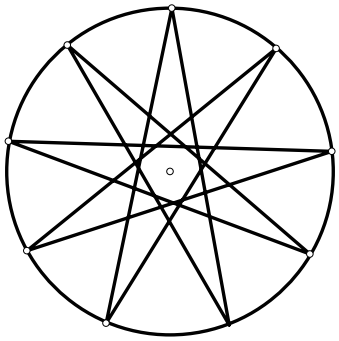
14. A certain mean of 3 and 12 is 6. What type of mean is this?

A) Arithmetic Mean C) Really Mean E) NOTA

B) Geometric Mean D) Harmonic Mean

15. Mrs. Harlow gave her geometry class the following assignment:

> Draw a radially symmetric 9-pointed star by drawing 9 straight lines of equal length without lifting your pencil. Each of the star's points must have the same interior angle, and each line must cross some other lines.

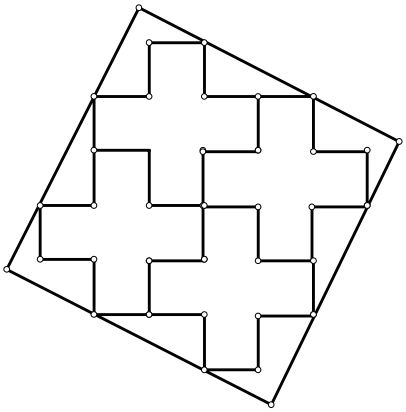


Sandra's star had an interior angle of 20 degrees. It is shown on the right: Jimmy's star had a different interior angle. What was Jimmy's angle?

A) 40° C) 80° E) NOTA

B) 60° D) 100°

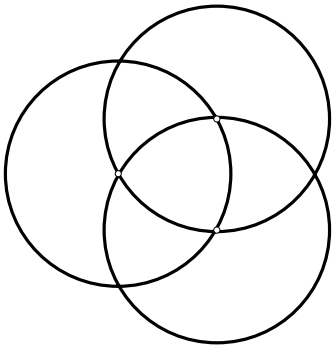
16. The figure shown on the right is made up of four plus signs inscribed within a square. Each plus sign is constructed by gluing together 5 squares of side length 1. Find the area of the large square.



A) 28.8 C) 32.5 E) NOTA

B) 29 D) 36

17. Three circles of radius r are arranged as shown on the right. The center of each circle is a distance r away from the centers of the other two circles. Find the area of the intersection of the interiors of all three circles, in terms of the radius r.



A) $\frac{r^2(\pi - \sqrt{3})}{2}$ C) $\frac{r^2(2\pi - 3\sqrt{3})}{12}$ E) NOTA

B) $\frac{r^2\pi}{6}$ D) $\frac{r^2(2\pi - 3\sqrt{3})}{4}$

18. If the product of the side lengths of triangle ABC is 480, and the radius of its circumscribed circle is 5, what is the area of triangle ABC?

A) 24 B) 48 C) 96 D) Not enough information. E) NOTA

19. A circle contains six chords. What is the maximum number of distinct regions these chords can divide the interior of the circle into?

A) 16 B) 22 C) 29 D) 37 E) NOTA

20. A regular tetrahedron with corners A, B, C, and D is inscribed in a sphere with center Q. Find angle AQB to the nearest degree.

A) 108^{o} B) 109^{o} C) 120^{o} D) 135^{o} E) NOTA

21. If the area of the face of a regular octahedron is $\sqrt{3}$ and its volume is $\frac{4}{3}$, then the volume of a regular octahedron with face area $2\sqrt{3}$ is what?

A) $\frac{8}{3}$ B) $\frac{2\sqrt[6]{2}}{\sqrt[3]{3}}$ C) $\frac{4\sqrt{2}}{3}$ D) $\frac{8\sqrt{2}}{3}$ E) NOTA

22. Find the lateral area of a right circular cone with radius 2 and height 6.

A) 4π B) 8π C) $2\pi\sqrt{10}$ D) $\frac{2\pi\sqrt{10}}{3}$ E) NOTA

23. What is the length of the longest pole that could fit in a 5' by 4' by 3' box? (Ignore the width of the pole.)

A) $5\sqrt{2}$' B) $\sqrt{41}$' C) 6' D) 5' E) NOTA

24. Find the measure, in degrees, of arc ADB, as given in the figure below. The measure of $\angle C$ is 30 degrees, and arc BE is 100 degrees.

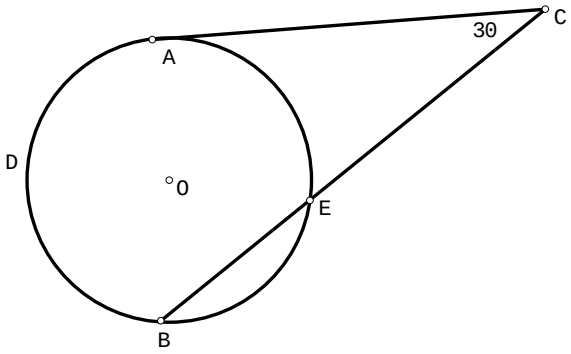
A) 70^{o}

B) 130^{o}

C) 160^{o}

D) 260^{o}

E) NOTA



25. The corners of a triangle are located at the coordinates (-1, 1), (2, 3), and (5, 8). Find the coordinates of the centroid.

A) (2, 2) B) (3, 6) C) (3, 3) D) (2, 4) E) NOTA

26. Circle A of radius 3 and circle B of radius 5 are connected by two tangent lines as shown. If GH is 6, how far apart are the centers of the two circles?

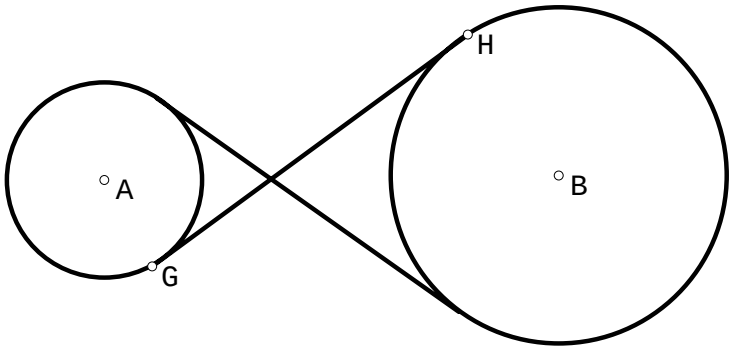
A) $6\sqrt{2}$

B) $4\sqrt{3}$

C) 9

D) 10

E) NOTA



27. An ant is standing on the midpoint of an edge of a regular octahedron with side length x. Find the shortest distance it must travel across the surface of the octahedron to get to a grain of sugar that is fixated to the midpoint of the opposite edge.

A) x B) $\frac{3x}{2}$ C) $2x$ D) $x\sqrt{3}$ E) NOTA

28. Which of the following, when inscribed in a circle, will have at least two interior angles that measure 90 degrees?

I. Parallelogram
II. Rhombus
III. Kite
IV. Quadrilateral

A) I, II, III, and IV
B) II and III only
C) I, II, and III only
D) I and II only
E) NOTA

29. Find the area of the figure below, whose border is made entirely of semicircles of radius 4.

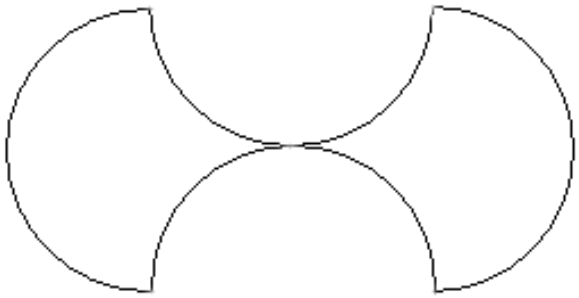
A) $64-16\pi$

B) $64+16\pi$

C) 64

D) 16π

E) NOTA



30. What is the fourth triangular number?

A) 10 B) 12 C) 14 D) 15 E) NOTA

2003 Theta Geometry Answers

1. C
2. C
3. B
4. B
5. B
6. D
7. D
8. C
9. A
10. D
11. C
12. A
13. C
14. B
15. D
16. A
17. A
18. A
19. B
20. B
21. D
22. E
23. A
24. C
25. D
26. D
27. B
28. C
29. C
30. A