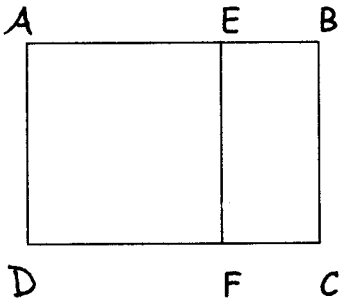
GEOMETRY – THETA LEVEL
Mu Alpha Theta National Convention 2003

For all questions, answer E. "NOTA" means none of the above answers is correct.
Figures are not drawn to scale.

1) Rectangle ABCD is 9 cm longer in length than it is wide. A line segment cuts the area enclosed into 2 pieces, one of which is a square. The area of the rectangle ABCD is 117 more than the area of the square AEFD. What is the width of the rectangle?



A. 10 B. 11 C. 12 D. 13 E. NOTA

2) Let A = set of all positive multiples of 3 between 3 and 24, and let B = set of all multiples of 4 between 4 and 30. Evaluate $n(A \cap B)$.

A. 0 B. 1 C. 2 D. 3 E. NOTA

3) If the distance MN is 200 cm, what is MN measured in meters?

A. 20,000 B. 2,000 C. 200 D. 20 E. NOTA

4) B, the midpoint of $\overline{AC}$, has coordinate 5. If the coordinate of A is greater than the coordinate of C, and if BC = 9, what are the coordinates of A and C?

A. A = -4, C = 14 B. A = 14, C = 23
C. A = -4, C = -13 D. A = 14, C = -4 E. NOTA

5) The sum of the measures of an acute angle and an obtuse angle is 140. The sum of twice the supplement of the obtuse angle and three times the complement of the acute angle is 340. What is the quotient of the obtuse angle and acute angle?

A. 11/3 B. 6 C. 13
D. Insufficient Information Provided E. NOTA

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6) Find the sum of the numbers of the true statements below:

1) -5 is a real number

2) $\sqrt{8}$ is a rational number

3) $|x| = x$ for $x \geq 0$

4) $-\sqrt{\frac{4}{9}}$ is a rational number

5) $\sqrt{9}$ is an integer

6) $\frac{\sqrt{2}}{4}$ is a rational number

A. 9 B. 13 C. 15 D. 21 E. NOTA

7) A ladder on a fire truck can be extended to a maximum length of 21 meters when elevated to its maximum angle of 70 degrees. The base of the ladder is mounted on the truck 2.15 meters above the ground. How high above the ground will the ladder reach to the nearest meter?

A) 19 m B) 20 m C) 21 m D) 22 m E) NOTA

8) The area of a square equals the area of a circle with diameter 2. How long is a side of the square.

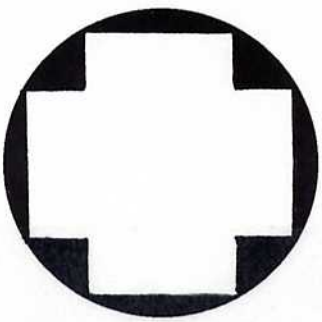
A) 1 B) π C) π^2 D) $\sqrt{\pi}$ E) NOTA

9) The length of a side of an equilateral triangle is 12. What is the circumference of its circumscribed circle?

A) 9π B) $6\pi\sqrt{3}$ C) 6π D) 27π E) NOTA

10) The 12-gon shown here, with 8 of its vertices on a circle, has all sides congruent, and all its angles are right angles. Given that the length of each side is 4, find the shaded area to the nearest tenth (use pi key).

A) 65.1 B) 53.1 C) 2.3 D) 45.7 E) NOTA



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11) The perimeter of a square is equal to the circumference of a circle. Which has the greater area?

A) square B) circle C) equal areas
D) not enough information given E) NOTA

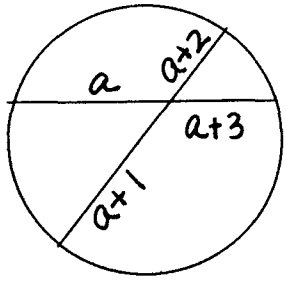
12) Given $\triangle ABC$ with points A(-4, 0), B(8, 0), and C(0, 10). If the equation of the altitude from side BC is written in standard form Ax + By = C, what is A + B + C?

A) -17 B) 25 C) -7 D) 15 E) NOTA

13) After finding the center (h, k) and radius (r) of the circle whose equation is $x^2+10x+y^2+16=0$, find the sum of h, k and r.

A) -2 B) 14 C) 8 D) 4 E) NOTA

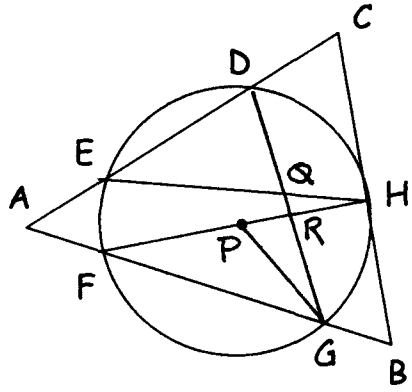
14) The lengths of the segments of two intersecting chords in a circle are four consecutive integers as shown. Find the value of a.



A) 1 B) 2 C) 3 D) 4 E) NOTA

15) In the circle below, ED = FG, m$\overset{\frown}{ED}$ = 96, $m\angle DEH = 30$, P is the center of the circle and $\overline{CB}$ is tangent at H. Find the sum of $m\angle EHF + m\overset{\frown}{GH} + m\angle ADG$.

A) 150 B) 180
C) 156 D) 256
E) NOTA



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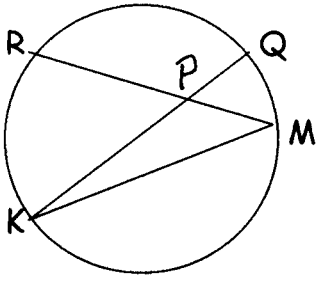
16) In the figure, if MR = MK, m$\overset{\frown}{MK}$ = 140, and m$\overset{\frown}{MQ}$ = 26, what is three and a half times the m$\angle RPK$ (to the nearest tenth if necessary)?



A) 53 B) 132.5
C) 159 D) 185.5 E) NOTA

17) A sphere with radius of 3 inches is melted down and cast into 72 identical circular disks, each of which has a radius of 2 inches. How many inches thick is each disk?

A. 0.125 B. 0.25 C. 0.5 D. 1 E. NOTA

18) Find the area to the nearest tenth of a square inscribed in the circle whose equation is $x^2+y^2+8x-10y+5=0$. (use the pi key).

A) 113.1 B) 452.4 C) 144.0 D) 72.0 E) NOTA

19) Two circles have radii 5 and 17, and a common external tangent segment of length 16. What is the distance between their centers?

A) 12 B) 16 C) 20 D) 25 E) NOTA

20) Two tangent segments to a circle are drawn from an external point. They determine an angle of 60 degrees. If the diameter of the circle is 10, find the sum of the lengths of the tangent segments to the nearest tenth.

A) 17.3 B) 8.7 C) 10.0 D) 20.0 E) NOTA

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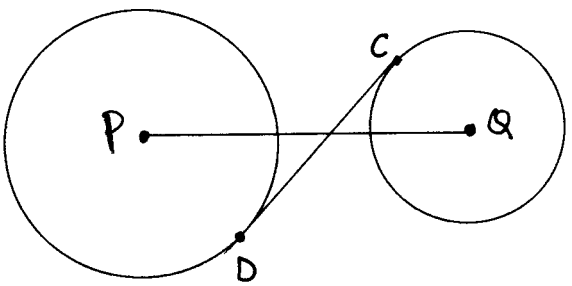
21) How long is $\overline{DC}$ to the nearest tenth?

PQ = 18
Circle P's diameter = 12
Circle Q's diameter = 6



A) 15.6 B) 8.5 C) 4.2 D) 15.0 E) NOTA

22) A chord 16 cm long is 15 cm from the center of a circle. What is twice the difference of the area of the circle and its circumference to the nearest tenth? (Use the pi key)

A) 53.4 B) 106.8 C) 801.1 D) 1602.2 E) NOTA

23) Find the coordinates of the midpoint of a segment joining the points $(3\sqrt{2}, 2\sqrt{15}, -5\sqrt{3})$ and $(-\sqrt{2}, 0, \sqrt{27})$.

A) $(2\sqrt{2}, \sqrt{15}, 4\sqrt{3})$ B) $(2\sqrt{2}, \sqrt{15}, \sqrt{3})$
C) $(\sqrt{2}, \sqrt{15}, -\sqrt{3})$ D) $(-\sqrt{2}, \sqrt{15}, \sqrt{3})$ E) NOTA

24) If the trisection points of the segment with endpoints (2, -3) and (8, 9) are (a, b) and (c, d), what is (a + c)(bd)?

A) 2 B) 5 C) 25 D) 50 E) NOTA

25) Find the perimeter of a triangle with vertices A(5, 7), B(1, 10), and C(-3, -8), to the nearest tenth.

A) 40.4 B) 30.4 C) 221.3 D) 654.0 E) NOTA

26) If the line containing points (-8, m) and (2, 1) is parallel to the line containing points (11, 1) and (7, m + 1), what it the value of m?

A) 2/3 B) 2/7 C) -2/3 D) -2/7 E) NOTA

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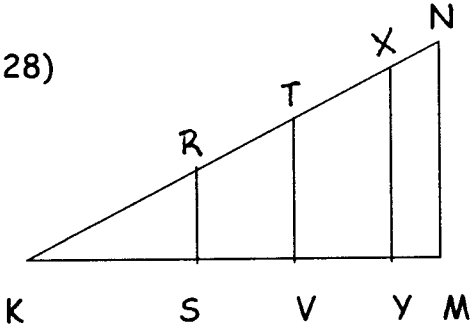
27) Among the following triplets of numbers, you will find the numbers that make an acute triangle. Add up these numbers and take the square root of this sum, rounded to the nearest tenth.

I. 3, 8, 12 II. 24, 38, 60 III. 6, 7, 8 IV. 14, 48, 50

A) 11.0 B) 10.6 C) 4.8 D) 4.6 E) NOTA

28) 

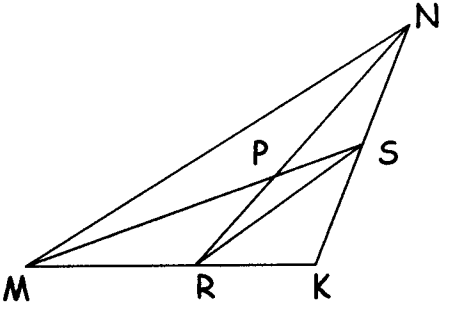
In ΔKMN, $\angle M$ is a right angle and $m\angle K = 30$. $\overline{RS}$, $\overline{TV}$, and $\overline{XY}$ are perpendicular to $\overline{KM}$ and KR = 6, KT = 10, KX = 13, AND KN = 16. Find

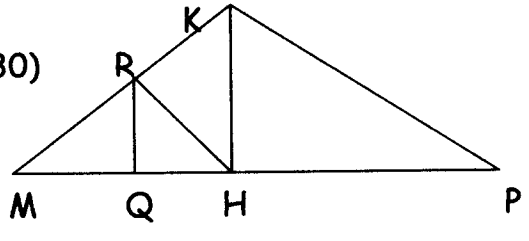
$$\sqrt[3]{(RS+TV)^2\,|XY-NM|+(RS+TV+2XY+NM)}$$

A) 5 B) 96 C) 125 D) 144 E) NOTA

29) $\overline{MS}$ and $\overline{NR}$ are medians of ΔMNK. If MS = 15, NR = 18, and MN = 21, what is the perimeter of ΔPRS to the nearest tenth?

A) 54.0 B) 27.0
C) 21.5 D) 13.5 E) NOTA



30) 

In Δ MPK, $\angle K$ is a right angle and $m\angle HKP = 60$. If $\overline{KH} \perp \overline{MP}$, $\overline{HR} \perp \overline{MK}$, $\overline{RQ} \perp \overline{MP}$, and MP = 80, find MQ + MR + MH + MK.

A) 15 B) 35 C) 75 D) 80 E) NOTA