The abbreviation "NOTA" found in choice E of each question means "None of the Above" and should be chosen if choices A, B, C and D are not correct. Diagrams may not be drawn to scale. Angle measures are in degrees. If no units are stated in a problem, linear measures are assumed to be cm, area in square cm and volume in cubic cm.

1. The point at coordinates $(-2,3)$ is the midpoint of the segment with endpoints at $(1,-8)$ and (a,b). Find $a+b$.

   A. 5   B. 6   C. 9   D. 12   E. NOTA

2. A triangle has side lengths 4, 4 and 6. Find the <u>square</u> of the area of the triangle.

   A. 21   B. 42   C. 54   D. 63   E. NOTA

3. A regular polygon has 720 sides. What is the measure of one interior angle?

   A. 179.5°   B. 179°   C. 178.5°   D. 178°   E. NOTA

4. A regular hexagon is inscribed in a circle of radius 6. Find the area of the hexagon.

   A. $48\sqrt{3}$ B. $54\sqrt{3}$ C. $60\sqrt{3}$ D. $66\sqrt{3}$ E. NOTA

5. A triangle has sides with lengths 22, 30, and 38. Which best describes the triangle?
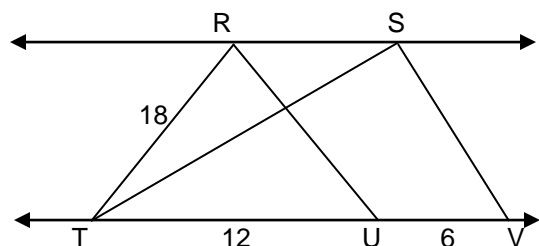
   A. Acute   B. Right   C. Obtuse   D. Isosceles   E. NOTA

6. A circle is circumscribed about a triangle with side lengths 16, 30 and 34. What is the circumference of the circle?
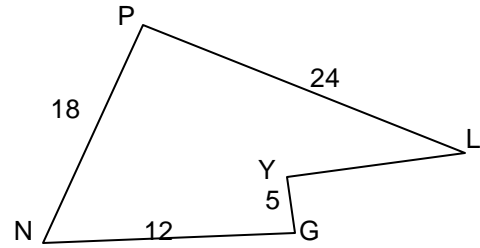
   A. 30π B. 34π C. 225π D. 289π E. NOTA

7. Lines $\overleftrightarrow{RS}$ and $\overleftrightarrow{TV}$ are parallel, and U is on $\overleftrightarrow{TV}$.
   If TU=12, UV=6, TR=18, and the area of
   $\triangle TRU$ is 120, then give the area of $\triangle TSV$.

   A. 200   B. 180
   C.160   D. 120
   E. NOTA

8. In the non-convex polygon to the right, vertices N,
   Y and L are collinear. $\overline{PL} \perp \overline{PN}$. $\overline{YG} \perp \overline{YL}$.
   $\overline{YG} \perp \overline{GN}$. Find the perimeter of the polygon.
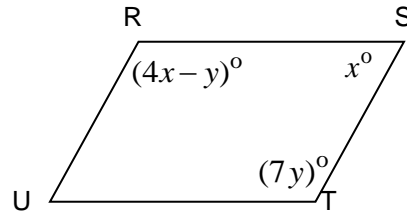
   A. 76   B. 74
   C. 72   D. 70
   E. NOTA

9. A circle has radius 15. Chord $\overline{PQ}$ is a distance of 9 from the center, and chord $\overline{RS}$ is
   a distance of 12 from the center. What is the positive difference of the lengths of these
   two chords?

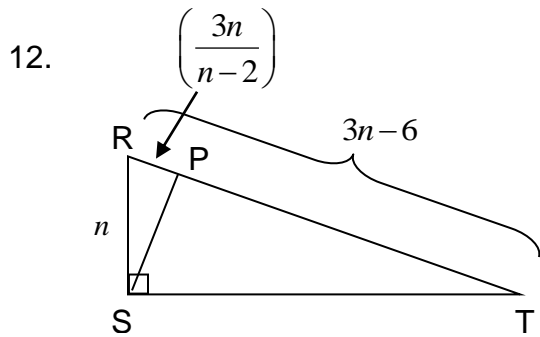   A. 1   B. 3   C. 4   D. 6   E. NOTA

10. In parallelogram RSTU, $m\angle R = (4x - y)^\text{o}$, $m\angle S = x^\text{o}$
     and $m\angle T = (7y)^\text{o}$.   Find the value of $x + y$.

     A. 50   B. 60
     C. 68   D. 72
     E. NOTA

11. A rhombus has diagonals of lengths 10 and 24. What is the height of the rhombus?

     A. $\dfrac{120}{13}$ B. $\dfrac{60}{13}$ C. $\dfrac{60}{7}$ D. $\dfrac{120}{7}$ E. NOTA

12.

In right triangle RST, $\overline{SP}$ is the altitude to the
hypotenuse $\overline{RT}$. P is on $\overline{RT}$.   RS = n cm,
$RT = (3n - 6)$ cm and $RP = \dfrac{3n}{n-2}$ cm. The
length of $\overline{ST}$ in cm is $a\sqrt{b}$ when in simplest
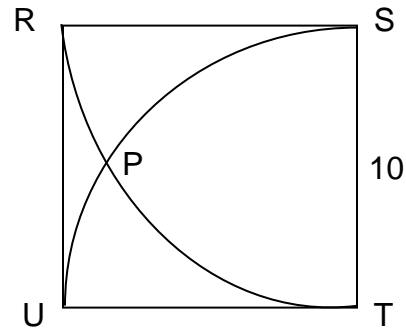radical form. Find $a + b$.

A. 21   B. 19
C. 16   D. 13
E. NOTA

13. A regular hexagon HEXAGN has each side of length 6. M is the midpoint of $\overline{HE}$. Find the length of $\overline{GM}$.
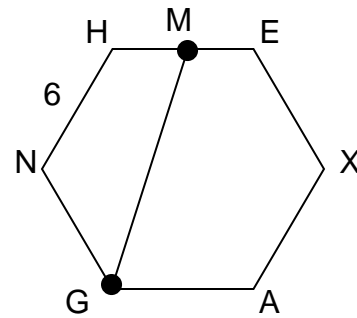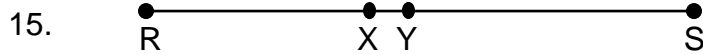
    A. $3\sqrt{13}$ B. $\sqrt{107}$

    C. $6+12\sqrt{3}$ D. $6+6\sqrt{3}$

    E. NOTA

14. Square RSTU has side length 10. Quarter-circles are drawn with radii 10 and centers S and T respectively. The arcs meet at point P. Find the distance from P to side $\overline{RU}$.

    A. $10-5\sqrt{3}$ B. $10-5\sqrt{2}$

    C. $10\sqrt{3}-5\sqrt{2}$ D. $10\sqrt{2}-5\sqrt{3}$

    E. NOTA

15. Line segment $\overline{RS}$ contains X and Y. X divides $\overline{RS}$ into lengths in the ratio of 2:3, for $RX < XS$, and Y divides $\overline{RS}$ into the ratio of 3:4, for $RY < YS$. XY=4. Find the length of $\overline{RS}$.

    A. 70   B. 80   C. 140   D. 210   E. NOTA

16. A right circular cone has vertex point P, radius 6, and height 8. A plane K parallel to the plane which contains the base of the cone intersects the cone at a cross section which is a distance of 6 from the base of the cone. Find the total surface area of the smaller cone with base on K and vertex point P.
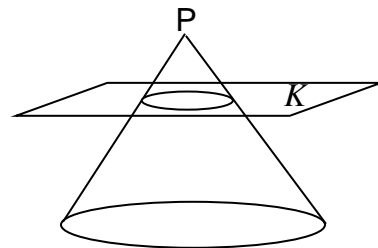
    A. 12π B. 10π C. 8π D. 6π E. NOTA

Segment $\overline{RS}$ has endpoints R$(-5,4)$ and S$(4,-2)$. Points T and U are points that trisect $\overline{RS}$ (RT=TU=US). Point P is at (2,3). **Use this information for questions 17-18**.
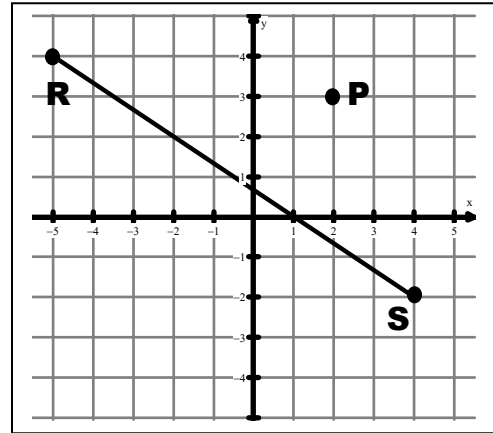
17. Find the coordinates of point U.

    A. $(2,-0.8)$ B. $(-1,3)$
    C. $(-2,2)$ D. (1, 0)
    E. NOTA

18. Lines $\overline{RS}, \overline{PT}$ and $\overline{PU}$ bound a triangular region on the plane. The perimeter of the region is $\sqrt{a}+\sqrt{b}+\sqrt{c}$, for positive integers $a, b,$ and c. Find $a+b+c$.

   A. 70   B. 60   C. 50   D. 40   E. NOTA

19. A square RSTU has side length 8 and a second square RTPQ has one side which is the diagonal $\overline{RT}$ of the first square. What is the ratio of the areas of the first square to the second square?

    A. 4:1   B. 2:1   C. 1: 2   D. 1: 4   E. NOTA

20. A right pyramid has a square base. Base edges are each 120 yards. A lateral edge of the pyramid is 100 yards. Find the volume of the pyramid in cubic yards.

    A. $144000\sqrt{7}$ B. $96000\sqrt{7}$ C. $45000\sqrt{3}$ D. $38000\sqrt{5}$ E. NOTA

21.
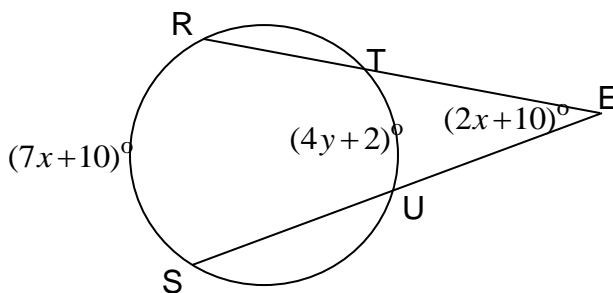
Secant segments $\overline{RE}$ and $\overline{SE}$ intersect the circle shown at T and U, respectively.
$m\angle E = (2x+10)^\circ$, $mTU = (4y+2)^\circ$
$mRS = (7x+10)^\circ$. If $x+y = 32$ then find $x-y$.

    A. 12   B. 11   C. 10   D. 8   E. NOTA

22. A right triangle with legs of lengths 7 and 24 has a circle inscribed in it. Find the
    radius of that circle.
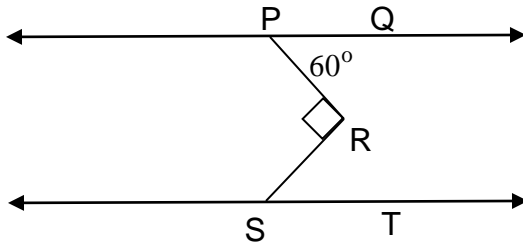
    A. 2   B. 3   C. 4   D. 5   E. NOTA

23. A semicircle with diameter $\overline{ST}$ contains P on the arc.
    The perimeter/circumference of the semicircle (arc SPT
    and diameter) is 12. The area of a 60 degree sector of the

    semicircle (shaded) is $\dfrac{a\pi}{\pi^2 + b\pi + c}$ for positive integers a, b and c. Find $a+b+c$.
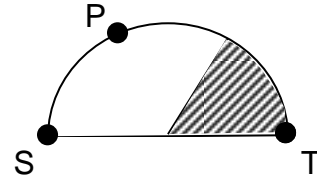
    A. 32   B. 34   C. 36   D. 38   E. NOTA

24.

    60°

    Lines $\overleftrightarrow{PQ}$ and $\overleftrightarrow{ST}$ are parallel.
    R is between the lines, on the plane,
    and $\overline{PR} \perp \overline{SR}$. $m\angle QPR = 60^\circ$.
    Find $m\angle RST$.

    A. 60° B. 50°
    C. 40° D. 30° E. NOTA

25. Chords $\overline{AB}$ and $\overline{CD}$ intersect in a circle, at point P. CP=10, DP=6, and AB=19.
    If $AP < PB$ then find the length of $\overline{AP}$.

    A. 4   B. 5   C. 6   D. 12   E. NOTA
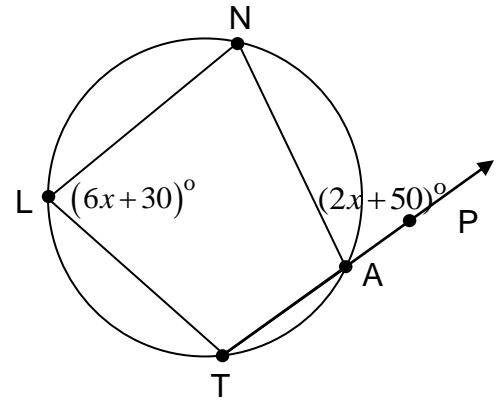
26. $\triangle RST$ has RS=ST. $m\angle S = (5n+20)^\circ$ and $m\angle T = (2n+35)^\circ$. Find $m\angle R$.

    A. 87.5° B. 80° C. 55° D. 10° E. NOTA

27. A cube has all of its vertices on a sphere of volume 36π cubic cm. What is the total
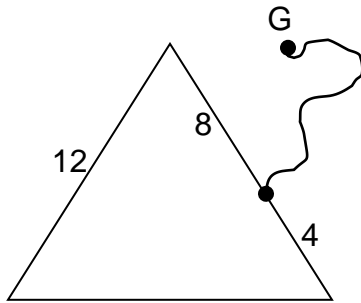   surface area of the cube in square cm?

    A. 36   B. 48   C. 72   D. 144   E. NOTA

28. Quadrilateral NATL is inscribed in a circle as shown. Side $\overline{TA}$ is extended past A to point P, so points T, A and P are collinear. $m\angle NAP = (2x+5)^o$ and $m\angle NLT = (6x+30)^o$. Find the value of x.

    A. 8   B. 7
    C. 6   D. 5
    E. NOTA

N

$(6x+30)^o$ L

$(2x+50)^o$ P

A

T

29.

G

8

12

4

A goat, Gregory, is attached to a 12-foot long leash. The other end of the leash is attached to a storage shed which has a floor that is an equilateral triangle with each side 12 feet long. Gregory can roam outside of the shed to the extent that the leash allows. Disregard the dimensions of Gregory (height, etc.). The area of ground, in square feet, that Gregory can roam is $\dfrac{a}{b}\pi$, for $a>0, b>0$ and a,b relatively prime integers. Give the value of $a+b$.

  A. 293   B. 297   C. 299   D. 301   E. NOTA

30.

S   Q

4

M

E   R
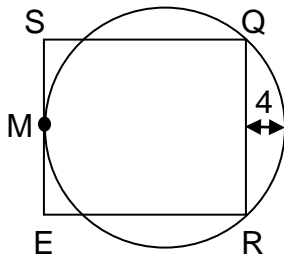
Square SQRE has two vertices, Q and R, on a circle as shown. Side $\overline{SE}$ is tangent to the circle at the midpoint M of $\overline{SE}$. The circle extends 4 cm past $\overline{QR}$ at its midpoint, as shown. What is the area of the square, in sq. cm?

  A. 324   B. 256
  C. 225   D. 64
  E. NOTA