

1999 Mu Alpha Theta National Convention
GEOMETRY
THETA DIVISION

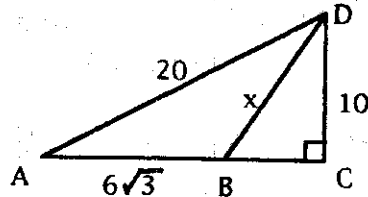
NOTA stand for none of these answers.

- Given $\triangle ABC$, with the measures of angles A, B, and C in the ratio of 6:5:4 respectively, find the measure of the complement of $\angle C$.
A) 42 B) 30 C) 48 D) 12 E) NOTA
- The median drawn to the hypotenuse of a right triangle forms two triangles which are?
A) congruent B) scalene C) right D) isosceles E) NOTA
- How many more diagonals does a 40-gon have than a 20-gon?
A) 450 B) 570 C) 650 D) 740 E) NOTA
- Two poles are set in level ground 45 feet apart. Wires are attached from the top of each to the base of the other pole. If one pole is eight feet tall and the wires cross three feet above the ground, how tall is the other pole?
A) $24/11$ ft B) $24/5$ ft C) $11/3$ ft D) $11/8$ ft E) NOTA
- The upper base of an isosceles trapezoid, which is 8, equals one half the lower base. Each leg is equal to the upper base. What is the height of this trapezoid?
A) $2\sqrt{2}$ B) $2\sqrt{3}$ C) 2 D) $4\sqrt{3}$ E) NOTA
- For M to be the midpoint of segment PR, $PM = MR$ is
A) necessary but not sufficient B) sufficient but not necessary
C) necessary and sufficient D) Not necessary and not sufficient
E) NOTA
- The name of the point of concurrency of the angle bisectors of a triangle is called the _____.
A) centroid B) circumcenter C) incenter D) orthocenter E) NOTA
- The converse of the contrapositive is the _____ the original statement.
A) same as B) converse of C) contrapositive of D) inverse of
E) NOTA
- The sum of the interior angles of a convex n-gon is between 5500 and 5600. How many sides are there?
A) 33 B) 32 C) 31 D) 30 E) NOTA

10. What is half the supplement of a $101^{\circ}34'18''$ angle?
 A) $39^{\circ}12'51''$ B) $39^{\circ}12'21''$ C) $78^{\circ}25'42''$ D) $159^{\circ}51'24''$ E) NOTA

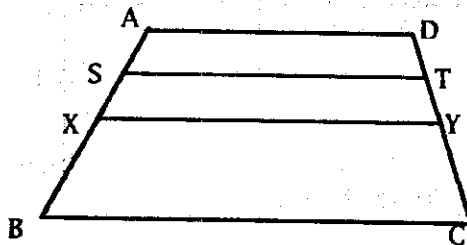
11. If $\angle PAS = 48^{\circ}$ and $\angle SAT = 37^{\circ}$, what does $\angle PAT = ?$
 A) 85 B) 11 C) 24 D) 50 E) NOTA

12. Find the length of x .



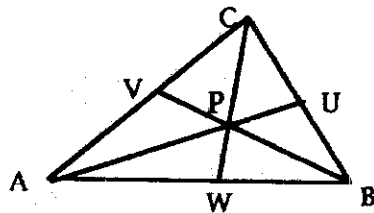
A) $4\sqrt{3}$ B) $2\sqrt{13}$ C) $2\sqrt{37}$ D) $4\sqrt{37}$ E) NOTA

13. ABCD is an isosceles trapezoid and segment XY is a median. S is the midpoint of AX and T is the midpoint of DY. $AD = 4x - 5$, $BC = 3x + 8$, and $XY = 2x + 9$. What does ST equal?



A) 11 B) 17 C) 19 D) 33
 E) NOTA

14. Segments AU, BV, and CW are medians of $\triangle ACB$. If $CW = 2x^2 - 5x - 12$, and $CP = x^2 - 15$, then $PW = ?$



A) 21 B) 17 C) 7 D) 3 E) NOTA

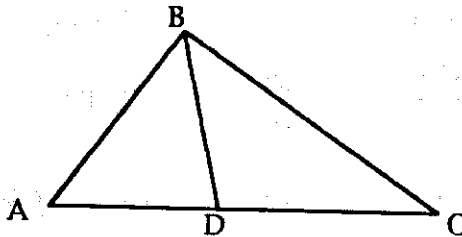
15. A right circular cone of altitude 8 is inscribed in a sphere of radius 5. What is the volume outside of the cone but inside of the sphere?

A) $\frac{500\pi}{3}$ B) $\frac{128\pi}{3}$ C) 124π D) 372π E) NOTA

16. A sphere is circumscribed around a cube. If the radius of the sphere is 6, what is the volume of the cube?

- A) $24\sqrt{3}$ B) 72 C) $192\sqrt{3}$ D) 216 E) NOTA

17. Segment BD bisects $\angle ABC$, $AB = 7$; $BC = 9$; and $AC = 8$. What is



the length of AD?

- A) $\frac{9}{2}$ B) $\frac{7}{2}$ C) $\frac{56}{9}$ D) $\frac{63}{8}$ E) NOTA

18. The areas of two similar triangles are 96 and 6 respectively. If the perimeter of the first triangle is 48, find the perimeter of the second.

- A) 12 B) 6 C) 4 D) 3 E) NOTA

19. The measures of the sides of a right triangle are 12, 16, and 20. What is the measure of the altitude drawn to the hypotenuse?

- A) 4.8 B) 7.0 C) 8.4 D) 9.6 E) NOTA

20. A line m passes through the $(5,4)$ and the midpoint of Segment XY. If X is $(-6,3)$ and Y is $(2,-3)$, find the slope of the line perpendicular to m .

- A) $-\frac{7}{4}$ B) $-\frac{4}{7}$ C) $\frac{4}{7}$ D) $\frac{7}{4}$ E) NOTA

21. Find the area of a triangle with vertices $(11,10)$, $(-12,3)$ and $(3,-5)$.

- A) 289 B) $204\sqrt{2}$ C) 144.5 D) $102\sqrt{2}$ E) NOTA

22. The bases of an isosceles trapezoid are 5 and 15 respectively. The altitude is 8. Find the length of the line segment inside the trapezoid, parallel to the bases and 1 unit from the shorter base.

- A) $\frac{45}{8}$ B) 6 C) $\frac{25}{4}$ D) 10 E) NOTA

23. What is the equation of the line through $(-3,5)$ and perpendicular to the line $3x + 5y = 6$?

- A) $y = -\frac{5}{3}x$ B) $y = \frac{5}{3}x$ C) $3y - 5x = -3$ D) $5y - 3x = 0$ E) NOTA

24. The equation of the circle $x^2 + y^2 - 10x - 12y = 0$ has its center located where?

- A) (-6,5) B) (5,6) C) (12,6) D) (-5,-6) E) NOTA

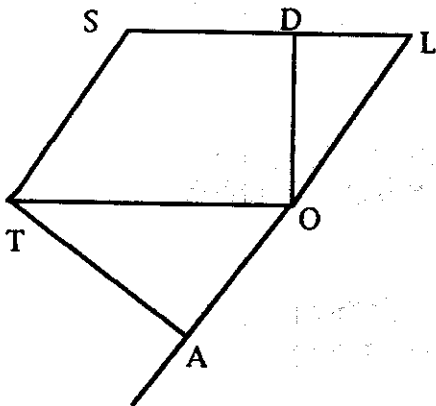
25. If the radius of the base of a cone is 7, and the height of the cone is 8, what is the area of the cross section formed by a plane parallel to the base and cutting through 6 units from the base?

- A) $\frac{49\pi}{9}$ B) $\frac{441\pi}{18}$ C) $\frac{55\pi}{2}$ D) $\frac{49\pi}{16}$ E) NOTA

26. What is the coordinate of the centroid of a triangle with vertices (6,1), (5,4) and (1,7)?

- A) (-6,5) B) (4,4) C) (4,3) D) (3,4) E) NOTA

27. In parallelogram SLOP, $\overline{DO} \perp \overline{TO}$, $ST = 6$, $DL = 4$, $TO = 15$, and $\overline{LA} \perp \overline{AT}$. Find the length of AT.

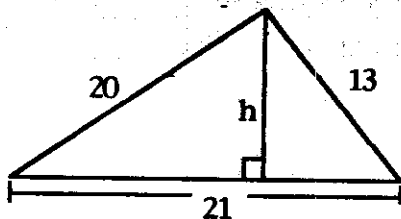


- A) $9\sqrt{5}$ B) $6\sqrt{5}$ C) 10 D) $5\sqrt{5}$ E) NOTA

28. A circle has a central angle of 67.5° , which intercepts an arc that's 24π units long. How long is the radius?

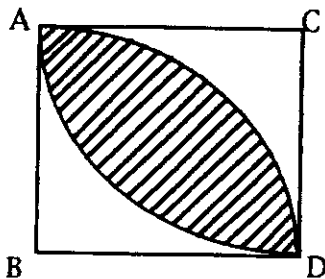
- A) 8 B) 16 C) 32 D) 64 E) NOTA

29. Find h



- A) 16 B) 17 C) 12 D) 5 E) NOTA

30. $ABDC$ is a square with side 10. The arcs are parts of circles with centers at B and C . Find the shaded area.



- A) $50\pi - 100$
- B) $100 - 50\pi$
- C) 25π
- D) $100\pi - 25$
- E) NOTA

Tiebreaker Questions

- 1) If a cubic foot of water is added to an empty plastic wading pool that is in the shape of a right cylinder whose base has an area of 1 square yard, then how high will the water be on the sides of the wading pool in inches?
- 2) If the edge length of a regular tetrahedron is 12 units, then find the volume of the tetrahedron.
- 3) Write the equation of the circle in quadrant I, which is tangent to the line $x - y = -4$ and which is also tangent to both coordinate axes.