2012 Hoover HS Math Tournament: Geometry Written Test

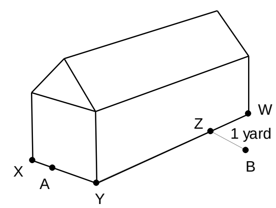
1. An equilateral triangle has a circle inscribed in it and a circle circumscribed about it. What is the ratio of the area enclosed by the smaller circle to that of the larger circle?

A. 1:2 B. 1:3 C. 1:4 D. 1:9 E. NOTA

2. Point Z is on side $\overline{PR}$ of ΔPQR such that $\measuredangle$ PZQ is congruent to $\measuredangle$PQZ and $m\measuredangle$PQR is 42° larger than $m\measuredangle$PRQ. What is the $m\measuredangle RQZ$?

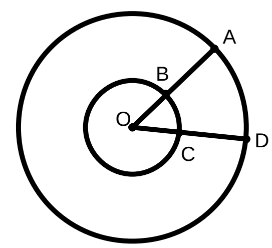
A. 21° B. 42° C. 84° D. 96° E. NOTA

3. You do not have access to the interior of the building pictured at the right. The building is 16 yards wide (side XY) and 36 yards long (side WY). XA:AY = 5:3 and WZ is one third of WY. What is the value of AB?



A. 18 B. 25 C. $6\sqrt{17}$ D. $\sqrt{265}$ E. NOTA

4. The larger circle in the diagram has a radius three times that of the smaller circle. The two circles are concentric. What is the ratio of the area of sector OBC to area of the partial ring ABCD?



A. 1:2 B. 1:4 C. 1:8 D. 1:9 E. NOTA

5. Find the area of the triangle bounded by 2x+5y = -10 and the x and y axes.

A. 10 B. 5 C. 5/2 D. ½ E. NOTA

6. Find, to the nearest pound, the resultant of 10 lbs of force and 10 lbs of force acting at 60°

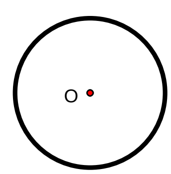
A. 27 B. 17 C. 14 D. 10 E. NOTA

7. A triangle has sides 8, 12, and 16. Find the segments into which the side of length 12 is divided by the bisector of the opposite angle.

A. 6, 6 B. $\frac{25}{3}, \frac{11}{3}$ C. $\frac{24}{7}, \frac{74}{7}$ D. 4, 8 E. NOTA

8. OA and OB are radii of circle O. The tangents to circle O at points A and B intersect at point P. If the $m\measuredangle AOB = 70°$ then the $m\measuredangle APB = ?$

Note: The sketch at the right is left for you to complete.



A. 100° B. 70° C. 110° D. 55° E. NOTA

9. If $\overline{AC}$ is the diagonal of parallelogram ABCD, then ________________.

A. it bisects $\measuredangle A$ B. it creates congruent triangles C. AC = BD D. AB = BC E. NOTA

10. How many sides does a regular polygon have if each exterior angle is $51\frac{3}{7}°$?

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

11. If $\overline{XA}$ and $\overline{XB}$ are two adjacent sides of a regular polygon, and $m\measuredangle ABX$ is one third as large as $m\measuredangle AXB$, how many sides does the polygon have?

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

12. Find the ratio of 3 hours to the month of February 2012.

A. 3:28 B. 15:58 C. 1:224 D. 1:232 E. NOTA

13. If $\frac{3ax}{b} = \frac{y}{d}$, then x:y equals

A. 3a:bd B. bd:3a C. b:3ad D. 3ad:b E. NOTA

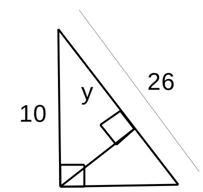
14. In ΔABC, AC = 14, AB = 10, BC = 12. If $\overline{CD}$ bisects $\measuredangle ACB$, then AD equals

A. $6\frac{1}{2}$ B. $6\frac{4}{11}$ C. $5\frac{5}{13}$ D. $5\frac{4}{7}$ E. NOTA

15. If $\frac{x^2-5x+1}{5x-1} = \frac{2x^2-3x+2}{3x-2}$ then $\frac{x^2}{5x-1} = ?$

A. $\frac{2x^2}{3x-2}$ B. $\frac{-3x+2}{5x-1}$ C. $\frac{-5x+1}{3x-2}$ D. $\frac{(x-1)(x-2)}{5x-1}$ E. NOTA

16. In the adjacent right triangle, what is the value of y?

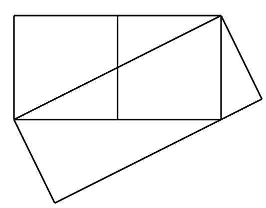


A. $\frac{7}{2}$ B. $\frac{44}{13}$ C. 5 D. 24 E. NOTA

17. In trapezoid ABCD with bases AB and CD, AB = 10, CD = 6 and the distance between the bases is 4. If legs AD and BC are extended to meet at P, P is what distance above DC?

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

18. The diagram at the right consists of two squares and a rectangle. The two squares have side length 1. Find the area enclosed by the rectangle



A. $2\sqrt{5}$ B. 1 C. $\sqrt{2}$ D. 2 E. NOTA

19. What is the area of a circle formed by passing a plane 5 inches from the center of a sphere whose radius is 10 inches?

A. $5\sqrt{3}\pi$ B. 75π C. $5\sqrt{2}\pi$ D. 50π E. NOTA

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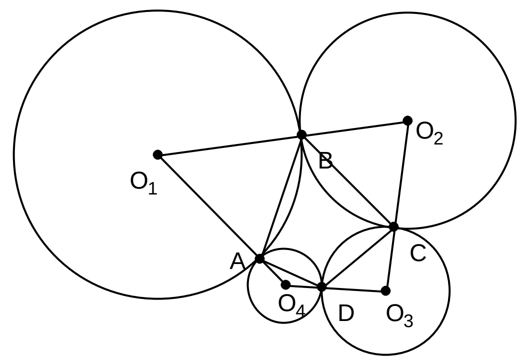
20. If an angle is inscribed in an arc (of a circle) whose measure is 150°, what is the angle's measure?

A. 105° B. 75° C. 300° D. 210° E. NOTA

21. A solid sphere of radius 4 centered at the origin is cut into 8 congruent pieces corresponding to the 8 octants. Find the surface area of one of these pieces.

A. 16π B. $20\,\pi$ C. $24\,\pi$ D. $28\,\pi$ E. NOTA

22. Four circles O_1, O_2, O_3, and O_4 are in the plane such that O_4 and O_1 are tangent at A, O_1 and O_2 are tangent at B, O_2 and O_3 are tangent at C, and O_3 and O_4 are tangent at D. If the measure of $\angle ABC$ is 80°, find the measure of $\angle ADC$ in degrees.

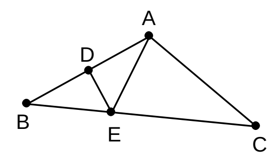


A. 120° B. 100° C. 90° D. 80° E. NOTA

23. In triangle ABC, D is the midpoint of $\overline{BC}$. A circle is tangent to $\overline{BC}$ at B and $\overline{AD}$ at E, and intersects $\overline{AB}$ at P. Similarly, another circle is tangent to $\overline{BC}$ at C and $\overline{AD}$ at F, and intersects $\overline{AC}$ at Q. If $m\measuredangle BAC = 60° \text{ and } m\measuredangle ABC = 70°$ find $m\measuredangle AQP$.

A. 50° B. 65° C. 62° D. 70° E. NOTA

24. In isosceles triangle ABC with AB=AC, D is the midpoint of AB, and E is on BC such that DE is a perpendicular bisector of AB. Given that two of the angles in ABC are both 30 degrees, and that BE=2, find EC.



A. 6 B. 4 C. $2\sqrt{3}$ D. $3\sqrt{3}$ E. NOTA

25. In triangle ABC, D is on BC such that AD is an angle bisector. E is on AD and F is on the extension of BC such that EF is the perpendicular bisector of AD. Given that FC = 4, FB = 9, find FD.

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

Tie Breakers

TB 1. From a point P in triangle ABC, altitudes are dropped to AB, BC, and CA at F, D, and E respectively. If AF = 17, FB = 5, BD=6, DC=13, and CE=5, find EA.

TB 2. A circle with center P is internally tangent to a larger circle with center O at a point A. Chords AB and AC are drawn in circle O such that BC is tangent to circle P at a point D. Find, in degrees, $\angle BDA$ if $\angle ABC = 77^\circ$ and $\angle BCA = 45^\circ$.

TB 3. In isosceles triangle ABC, with AB=AC, $\angle BAC = 36^\circ$ and a point D is on AC such that BD is an angle bisector of angle B. Find AB/BC.