

Mu Alpha Theta 2026 – Theta 2-D Geometry

Note: NOTA means “none of these answers”

1. $\triangle ABC$ is isosceles with $\overline{AB} \cong \overline{AC}$. If $m\angle A = 5x - 3$ and $m\angle B = 3x + 9$, find $m\angle C$ (measurements are in degrees).

- (a) 27 (b) 45 (c) 54 (d) 72 (e) NOTA

2. Find the area enclosed by an equilateral triangle whose perimeter is 36cm.

- (a) 36 cm^2 (b) $36\sqrt{3}\text{ cm}^2$ (c) 72 cm^2 (d) $72\sqrt{3}\text{ cm}^2$ (e) NOTA

3. Find the total surface area of a right circular cylinder whose radius and height are equal and whose volume is $512\pi\text{ in}^3$.

- (a) $256\pi\text{ in}^2$ (b) $128\pi\text{ in}^2$ (c) $144\pi\text{ in}^2$ (d) $576\pi\text{ in}^3$ (e) NOTA

4. In trapezoid WXYZ, $WX = 4$, $XY = WZ = 10$, and $YZ = 20$. Find the sum of the lengths of the diagonals of WXYZ.

- (a) $20\sqrt{5}$ (b) $20\sqrt{3}$ (c) $12\sqrt{5}$ (d) 20 (e) NOTA

5. Regular dodecagon PRODUCTIVELY is inscribed in a circle. Find the measure of angle RDT.

- (a) 90° (b) 105° (c) 120° (d) 135° (e) NOTA

6. Find the length of the longest altitude of a triangle whose sides are 7, 8, and 9.

- (a) $\frac{24\sqrt{5}}{7}$ (b) $\frac{12\sqrt{7}}{5}$ (c) $12\sqrt{5}$ (d) $\frac{8\sqrt{5}}{3}$ (e) NOTA

7. Ten concentric circles share a center. If the innermost circle has radius 1ft and each successive circle has a radius 1ft longer than the circle before it, find the sum of the circumferences of all ten circles.

- (a) $100\pi\text{ ft}$ (b) $110\pi\text{ ft}$ (c) $120\pi\text{ ft}$ (d) $140\pi\text{ ft}$ (e) NOTA

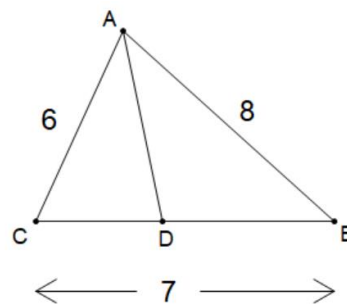
8. Given a triangle with sides 48, 56, and 72, classify the triangle by its angles.

- (a) acute (b) right (c) obtuse (d) scalene (e) NOTA

9. Find the length of angle bisector $\overline{AD}$ in the triangle to the right.

(a) $3\sqrt{3}$ (b) 9 (c) $\sqrt{41}$

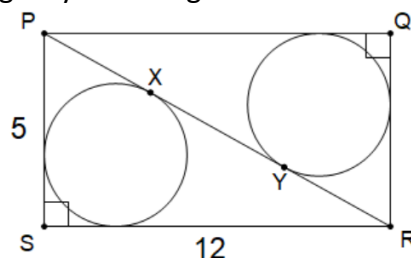
(d) 6 (e) NOTA



10. Diagonal $\overline{PR}$ is drawn in rectangle $PQRS$ forming two right triangles. A circle is inscribed in each of the triangles. Find the length of $\overline{XY}$, where X and Y are the points of tangency with diagonal $\overline{PR}$.

(a) $\frac{13}{3}$ (b) 4 (c) 6

(d) 7 (e) NOTA



11. A sphere is inscribed in a cylinder. Find the ratio of the volume enclosed by the sphere to the volume enclosed by the cylinder.

(a) 1:2 (b) 1:3 (c) 2:3 (d) 3:4 (e) NOTA

12. Triangle ABC has vertices $A(1, 3)$, $B(-4, -1)$, and $C(-2, 5)$ on the coordinate plane. Find the equation of the line that contains the triangle's altitude drawn to side $\overline{AB}$.

(a) $y = -8x - 11$ (b) $y = -\frac{5}{4}x + \frac{5}{2}$ (c) $y = \frac{4}{5}x + \frac{33}{5}$ (d) $y = -\frac{5}{4}x - \frac{7}{8}$ (e) NOTA

13. The supplement of the complement of an angle is 122° . Find the measure of the angle.

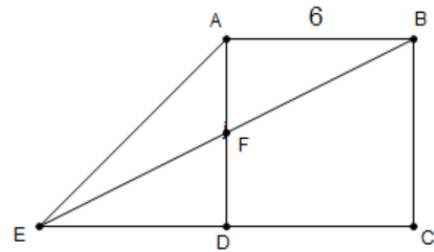
(a) 32° (b) 58° (c) 90° (d) 122° (e) NOTA

14. The diagonals of rhombus $ABCD$ meet at point E . If $m\angle DBC = 16$, find $m\angle BCD$ (measurements are in degrees).

(a) 16 (b) 32 (c) 74 (d) 90 (e) NOTA

15. In the figure to the right, quadrilateral $ABCD$ is a square with side length 6, and triangle ADE is an isosceles triangle.

If E and C are collinear, and if F is the intersection of $\overline{BE}$ and $\overline{AD}$, find the length of $\overline{EF}$.



- (a) $6\sqrt{2}$ (b) 6 (c) $3\sqrt{5}$
 (d) $6\sqrt{5}$ (e) NOTA

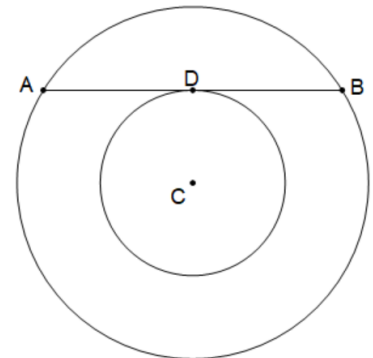
16. Find the measure of an interior angle of a regular polygon with 3915 diagonals.

- (a) 171° (b) 172° (c) 175° (d) 176° (e) NOTA

17. Find the area of a convex polygon with vertices at $(2, 4)$, $(-3, -3)$, $(8, -1)$, and $(-6, 6)$.

- (a) 19.5 (b) 30.5 (c) 37.5 (d) 66.5 (e) NOTA

18. In the figure to the right, $\overline{AB}$ is a chord of the larger circle and a tangent to the smaller circle at point D . Both circles have the same center. If the length of $\overline{AB}$ is 16, what is the area of the region between the two circles?



- (a) 16π (b) 64π (c) 32π
 (d) 128π (e) cannot be determined

19. You are driving your car on a flat road and notice a mountain directly in front of you. The angle of elevation to the top of the mountain is 30° . After you drive 2 miles closer to the mountain, the angle of elevation to the top is 45° . What is the height of the mountain, in miles?

- (a) $\sqrt{3}-1$ (b) $\frac{\sqrt{3}-1}{2}$ (c) $\frac{\sqrt{3}+1}{2}$ (d) $\sqrt{3}+1$ (e) NOTA

20. How many different planes are determined by 100 unique points in space, no four of which are coplanar?

- (a) 4950 (b) 161700 (c) 405100 (d) 970200 (e) NOTA

26. Four congruent spheres, each with radius of 1, are positioned such that each sphere is tangent to the other 3 spheres. Find the radius of the largest sphere that could fit in the space between the 4 given spheres and also must be tangent to the 4 given spheres.

- (a) $\frac{2\sqrt{6}-3}{2}$ (b) $\frac{2\sqrt{6}-3}{3}$ (c) $\frac{\sqrt{6}-2}{2}$ (d) $\frac{6-\sqrt{6}}{6}$ (e) NOTA

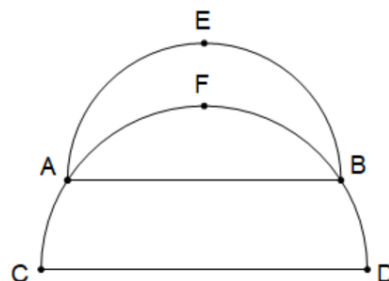
27. A given square is made from a metal wire. The sides of the wire square are stretched so that the wire forms a circle. What is the ratio of the area enclosed by the wire square to the area enclosed by the wire circle?

- (a) $\pi:1$ (b) $\pi:2$ (c) $\pi:4$ (d) $1:1$ (e) NOTA

28. Rectangle $RECT$ has diagonals that meet at a 120° angle. If $\overline{RC}$ has length 12, find the area enclosed by the rectangle.

- (a) $72\sqrt{3}$ (b) 72 (c) 36 (d) $36\sqrt{3}$ (e) NOTA

29. In the figure to the right, $\overline{AB}$ is the diameter of a semicircle through point E , and $\overline{CD}$ is the diameter of another semicircle through points A , F , and B . $\overline{AB}$ has length 2, and $\overline{CD}$ has length 4. Find the area of the lune (crescent moon shape) bounded by AEB (from the semicircle with diameter $\overline{AB}$) and AFB (from the semicircle with diameter $\overline{CD}$).



- (a) $\frac{6\sqrt{3}-\pi}{6}$ (b) $\frac{3\sqrt{3}-\pi}{3}$ (c) $\frac{3\pi-\sqrt{3}}{2}$ (d) $\frac{3\pi-2\sqrt{3}}{3}$ (e) NOTA

30. The sum of the volumes enclosed by two non-intersecting spheres is $140\pi\text{cm}^3$. Their surface areas are in the ratio 4:9. Find the radius of the larger sphere, in centimeters.

- (a) $\sqrt[3]{3}$ (b) $2\sqrt[3]{3}$ (c) $3\sqrt[3]{3}$ (d) $4\sqrt[3]{3}$ (e) NOTA