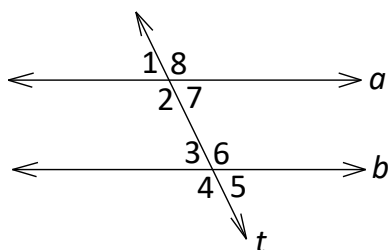


For each question, "E) NOTA" indicates that none of the above answers is correct.

- Find the area of the triangular region formed by connecting the points (0, 10), (5, 5), and the origin.
 A) 50 B) 25 C) 15 D) 10 E) NOTA
- In $\triangle ABC$, D and E are midpoints of \overline{AB} and \overline{BC} , respectively. If \overline{CD} intersects \overline{AE} at point P , find $\frac{CP}{CD}$.
 A) 1:1 B) 2:1 C) 2:3 D) 1:2 E) NOTA
- How many scalene triangles having all sides of integral length can be formed if the perimeter must be less than 12?
 A) 1 B) 2 C) 3 D) 4 E) NOTA
- Find the area of kite $ABCD$ if $m\angle ABC = 120^\circ$, $\angle BAD$ and $\angle BCD$ are right angles, and $BC = 3$.
 A) $5\sqrt{3}$ B) $3\sqrt{3}$ C) $\frac{9\sqrt{3}}{2}$ D) $9\sqrt{3}$ E) NOTA
- The sum of the measures of the interior angles of a convex polygon is 4860° . How many sides does the polygon have?
 A) 25 B) 27 C) 28 D) 31 E) NOTA
- Circle M and circle J are externally tangent. If the radius of circle M is 8 and the radius of circle J is 12, find the length of the common external tangent of circle M and circle J (the distance between the points of tangency).
 A) $20\sqrt{2}$ B) $8\sqrt{6}$ C) $8\sqrt{3}$ D) $6\sqrt{10}$ E) NOTA
- If $a \parallel b$, $m\angle 1 = (10x + 27)^\circ$, and $m\angle 6 = (12x + 21)^\circ$, find $m\angle 8$.



- A) 3° B) 6° C) 57° D) 87° E) NOTA

8. Points A , B , C , and D are collinear. Point B is the midpoint of \overline{AD} and point C is the midpoint of \overline{BD} . AB is 12 less than 8 times BC . Find AD .

- A) 2 B) 4 C) 8 D) 16 E) NOTA

9. If p is false, q is true, and r is true, then which of the following statements is/are true?

- I. $(p \vee q) \wedge r$ II. $p \vee (q \wedge r)$ III. $(p \wedge r) \vee (p \wedge q)$

- A) I only B) II only C) I and II only D) I, II, and III E) NOTA

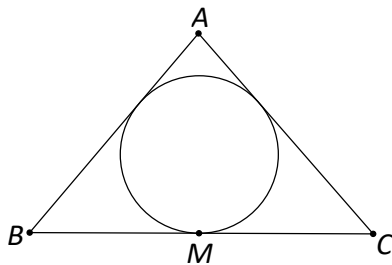
10. If two lines do not intersect, then

- A) the lines are always parallel. B) the lines are always skew.
C) the lines are sometimes coplanar. D) the lines are never parallel.
E) NOTA

11. The lengths of the sides of a triangle are 5, 6, and 9. Find the length of the altitude constructed to the shortest side.

- A) $\frac{20\sqrt{2}}{9}$ B) $\frac{10\sqrt{2}}{3}$ C) $4\sqrt{2}$ D) $10\sqrt{2}$ E) NOTA

12. The circle is inscribed in $\triangle ABC$ and is tangent to \overline{BC} at point M . If $AB = 5$, $AC = 6$, and $BC = 7$, then find BM .



- A) 2 B) 3 C) $\frac{7}{2}$ D) 4 E) NOTA

13. A circle has a radius of 3. Find the perimeter of the square inscribed in the circle.

- A) $3\sqrt{2}$ B) 6 C) $12\sqrt{2}$ D) 18 E) NOTA

14. Negate the statement, "All geometry students are freshmen."

- A) Some geometry students are not freshmen.
B) Some geometry students are freshmen.
C) No geometry students are freshmen.
D) At least one geometry student is a freshman.
E) NOTA

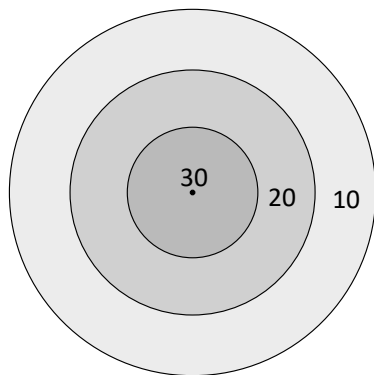
15. The base of a triangle is 4 times as long as the side of a square. If the triangle and the square have equal enclosed areas, find the ratio of an altitude (to the described base) of the triangle to the side of the square.

- A) 1:4 B) 1:2 C) 2:1 D) 4:1 E) NOTA

16. In $\triangle ABC$, $BC = 6$, $AC = 9$, and $m\angle ACB = 60^\circ$. Find the area enclosed by the triangle.

- A) $\frac{27\sqrt{3}}{2}$ B) $\frac{27}{2}$ C) $\frac{18\sqrt{95}}{5}$ D) $\frac{25\sqrt{7+2\sqrt{3}}}{2}$ E) NOTA

17. The dartboard pictured consists of 3 concentric circles with radii 2, 4, and 6. Find the probability that a dart thrown that hits the dartboard hits the region worth 10 points.



- A) $\frac{1}{3}$ B) $\frac{1}{9}$ C) $\frac{4}{9}$ D) $\frac{5}{9}$ E) NOTA

18. In $\triangle ABC$, point E is on \overline{AB} and point D is on \overline{BC} . Let $\overline{AD} \cap \overline{CE} = \{F\}$. If $\frac{AE}{EB} = \frac{1}{3}$ and

$$\frac{CD}{DB} = \frac{1}{2}, \text{ then find } \frac{EF}{FC} + \frac{AF}{FD}.$$

- A) $\frac{1}{2}$ B) $\frac{4}{5}$ C) $\frac{3}{2}$ D) 2 E) NOTA

19. In circle C , the area of a sector is 20π and the central angle of the sector measures 72° . Find the length of the radius of circle C .

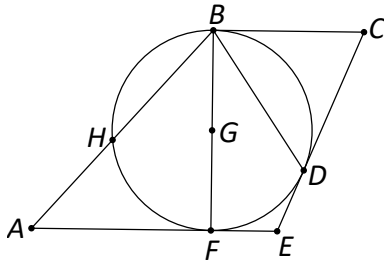
- A) 10 B) 20 C) 50 D) 100 E) NOTA

20. Find the y-intercept of the Euler line of the triangle with vertices $(1, -1)$, $(1, 5)$, and $(4, 5)$.

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

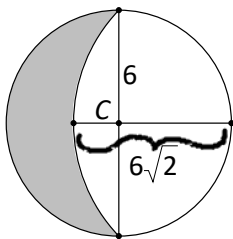
21. \overline{BC} , \overline{CE} , and \overline{AE} are tangents to circle G at B , D , and F , respectively. If

$m\angle BH = 96^\circ$, $BC = 5$, $CE = 7$, and $BG = 3$, find the perimeter of quadrilateral $BFEC$.



- A) 15 B) 17 C) 20 D) 23 E) NOTA

22. Find the area of the shaded lune in circle C , where length $6\sqrt{2}$ is a radius of the circle not shown in the picture.



- A) 36 B) 36π C) $18\pi - 36$ D) 18π E) NOTA

23. Suppose that a line intersects two sides of an equilateral triangle such that the line is parallel to the third side of the triangle. If the line divides the equilateral triangle into a trapezoid and a smaller triangle and if the trapezoid and smaller triangle have the same perimeter, find the ratio of the area enclosed by the trapezoid to the area enclosed by the smaller triangle.

- A) 2 : 3 B) 3 : 4 C) 9 : 16 D) 7 : 9 E) NOTA

24. In $\triangle ABC$, $m\angle ABC = 150^\circ$, $AB = 3\sqrt{3}$, and $BC = 4$. If a perpendicular line is constructed to \overline{AB} through point A and a perpendicular line is constructed to \overline{BC} through point C , the perpendicular lines intersect at point D . Find the area enclosed by the quadrilateral $ABCD$.

- A) $13\sqrt{3} + 21$ B) $50\sqrt{3}$ C) $\frac{91\sqrt{3}}{2}$ D) $\frac{109\sqrt{3}}{2}$ E) NOTA

25. Two tangents are drawn to a circle from an exterior point C . The tangents touch the circle at points A and B . A third tangent intersects the circle at point X , intersects \overline{BC} at point Y , and intersects \overline{AC} at point Z . If $AC = 20$, then find the perimeter of $\triangle CYZ$.

- A) 20 B) 30 C) 40 D) impossible to determine E) NOTA

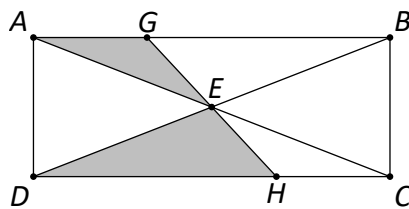
26. A triangle is inscribed in a semicircle. The length of the longest side of the triangle is twice as long as the length of the shortest side of the triangle. The semicircle has a circumference of $12\pi + 24$. If a circle is inscribed in the right triangle, find the radius of the inscribed circle.

- A) $6\sqrt{3} - 6$ B) 12 C) $12\sqrt{3}$ D) $12\sqrt{3} - 12$ E) NOTA

27. Find the image of the point $(-5, 7)$ after a 90° counterclockwise rotation about the origin.

- A) $(5, 7)$ B) $(-5, -7)$ C) $(7, 5)$ D) $(-7, -5)$ E) NOTA

28. In rectangle $ABCD$, \overline{AC} , \overline{BD} , \overline{GH} intersect at point E . If $AB=12$ and $AD=4$, find the area of the shaded region.

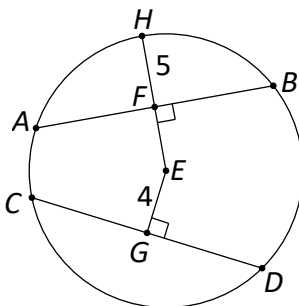


- A) 4 B) 6 C) 12 D) 24 E) NOTA

29. A trapezoid has bases that measure 5 and 13. The legs of the trapezoid measure $2\sqrt{21}$ and 10. Find the height of the trapezoid.

- A) $2\sqrt{3}$ B) $2\sqrt{6}$ C) $5\sqrt{3}$ D) $5\sqrt{6}$ E) NOTA

30. In circle E , $\overline{AB} \cong \overline{CD}$. Find AB .



- A) 9 B) $2\sqrt{65}$ C) $2\sqrt{41}$ D) 18 E) NOTA