

Choose the letter of the correct answer. If the correct answer is not listed, choose e. NOTA

NOTES: All angle measures and arc measures are in degrees. Figures are not drawn to scale.

1. Find the ratio of the measure of one angle of a regular nonagon to the measure of one angle of a regular dodecagon.

- a. $\frac{14}{15}$
- b. $\frac{7}{10}$
- c. $\frac{7}{9}$
- d. $\frac{35}{54}$
- e. NOTA

2. The radii of two circles are 2 cm and 7 cm and their centers are 13 cm apart. How long in centimeters is their common external tangent?

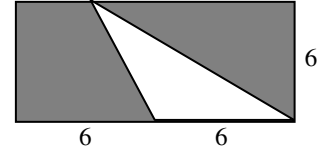
- a. 13
- b. $\sqrt{53}$
- c. $\frac{\sqrt{961}}{9}$
- d. 12
- e. NOTA

3. Find the perimeter of trapezoid $ABCD$ if base $AB = 8$, base $CD = 16$, $m\angle D = 60$ and $m\angle C = 30$.

- a. $32\sqrt{3}$
- b. $28 + 4\sqrt{3}$
- c. $24 + 2\sqrt{3}$
- d. $24 + 4\sqrt{3}$
- e. NOTA

4. In the diagram, the unshaded triangle has its vertices on the rectangle and one vertex coincides with a vertex of the rectangle. What is the area of the shaded portion of the given rectangle?

- a. 54
- b. 36
- c. 24
- d. 18
- e. NOTA

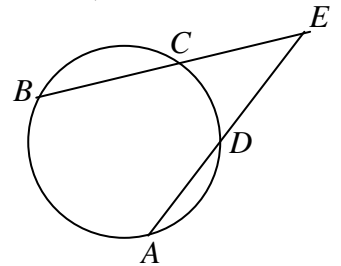


5. The complement of an angle is one-fourth of its supplement. Find the sum of the digits in the measure of the angle.

- a. 6
- b. 7
- c. 8
- d. 9
- e. NOTA

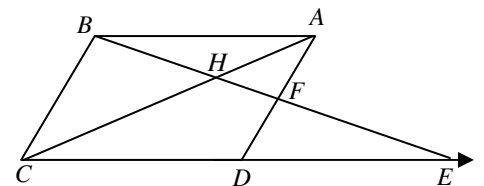
6. In the given figure, $m\widehat{AD} = 75$, $m\widehat{BC} = 85$ and $m\angle AEB = 45$. If $m\widehat{AB} = x$, find the sum of the digits of x .

- a. 4
- b. 6
- c. 8
- d. 10
- e. NOTA



7. In the given figure, $ABCD$ is a parallelogram and E is a point on \overline{CD} . \overline{BE} intersects \overline{AD} at point F and diagonal \overline{AC} at point H . If $BF = 6$ and $BE = 12$, find BH .

- a. $2\sqrt{3}$
- b. $3\sqrt{2}$
- c. 3
- d. $2\sqrt{5}$
- e. NOTA



8. $\triangle ABC$ is a right triangle with the right angle at A . $\overline{AD} \perp \overline{BC}$ with D a point on \overline{BC} . If $BC = 15$ and $BD = 3$, find AC .

- a. $3\sqrt{5}$
- b. $6\sqrt{5}$
- c. 6
- d. 12
- e. NOTA

9. The sum of the areas of two similar polygons is 68 square inches. Their corresponding sides are in the ratio of 3:5. Find the absolute value of the difference of the areas of the two similar polygons.

- a. 50
- b. 32
- c. 28
- d. 18
- e. NOTA

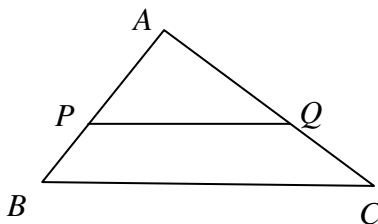
10. The perimeter of a 54 degree sector in a circle of radius 14 is $a\pi + b$. Find $\frac{b}{a}$.

- a. $\frac{10}{3}$
- b. 6
- c. 6
- d. $\frac{20}{3}$
- e. NOTA

11. In the figure, points P and Q lie on the sides of $\triangle ABC$ such that $\overline{PQ} \parallel \overline{BC}$,

$\frac{AQ}{QC} = \frac{3}{4}$, and $AB = 21$. Find PB .

- a. 8
- b. 9
- c. 10
- d. 12
- e. NOTA



12. A triangle whose perimeter is $36\sqrt{3}$ is circumscribed about a circle of radius $2\sqrt{3}$. Find the area of the triangle.

- a. $108\sqrt{3}$
- b. $54\sqrt{3}$
- c. 108
- d. 54
- e. NOTA

13. A sphere is inscribed in a right circular cylinder. Find the ratio of the volume of the cylinder to the volume of the sphere.

- a. 2:1
- b. 4:3
- c. 3:2
- d. 9:4
- e. NOTA

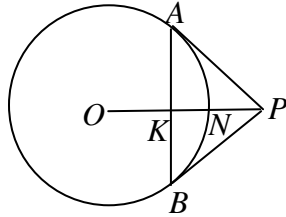
14. Which of the following is not necessarily true in Euclidean Geometry?

- a. Two lines perpendicular to the same line are parallel.
- b. Two lines parallel to the same line are parallel.
- c. Through a point not on a given line, there is exactly one line parallel to the given line.
- d. Through a point not on a line, there is exactly one line perpendicular to the given line.
- e. NOTA

15. \overline{AB} is the base of isosceles $\triangle ABC$. Side \overline{AC} is extended through point C to any point D and \overline{BD} is drawn. Through C a segment is drawn parallel to \overline{AB} meeting \overline{BD} at E . Which of the following is necessarily true?

- a. \overline{CE} bisects \overline{BD} .
- b. \overline{CE} bisects \overline{AD} .
- c. \overline{CE} bisects $\angle DCB$.
- d. $CE = \frac{1}{2}AB$.
- e. NOTA

16. In the diagram P is 4 units from circle O which has a radius 6. \overline{PA} and \overline{PB} are tangent to the circle at points A and B respectively. Points N and K are points where \overline{PO} intersects the circle and chord \overline{AB} . Find NK .



- 2
- $12/5$
- $15/4$
- 4
- NOTA

17. The vertex angle of an isosceles triangle is bisected and the bisector is drawn to meet its base which is 6 inches in length. If the triangle is rotated about this bisector as an axis, and the resulting solid has a volume of 66 cubic inches, use $\pi \doteq \frac{22}{7}$ to find an approximation of the height of the triangle in inches.

- 4
- 5
- 6
- 8
- NOTA

18. A circle has its center at the origin of a coordinate plane and a chord has endpoints at $(3,4)$ and $(-4,3)$. How far is the chord from the center of the circle?

- $\frac{7\sqrt{2}}{2}$
- $\frac{5\sqrt{2}}{2}$
- $3\sqrt{2}$
- $\frac{3\sqrt{2}}{2}$
- NOTA

19. Find the area in square inches of an equilateral triangle whose perimeter is 2 inches.

- $\sqrt{3}$
- $\frac{2\sqrt{3}}{3}$
- $\frac{\sqrt{3}}{9}$
- $\frac{4\sqrt{3}}{9}$
- NOTA

20. The sides of a triangle are 12, 14, and 16. If the bisector of the angle opposite the side which is 14 is drawn to meet that side, find the length of the longest segment that is formed on that side.

- 6
- 7
- 8
- 9
- NOTA

21. The area of the base of a right rectangular prism is 441 in^2 , the area of one lateral face is 144 in^2 , and the area of another lateral face is 100 in^2 . Find the volume in in^3 of the prism.

- $420\sqrt{6}$
- $840\sqrt{6}$
- $840\sqrt{5}$
- $420\sqrt{7}$
- NOTA

22. Find the area of a parallelogram whose sides are 12 and 8 and one of whose angles is 150° .

- 96
- 48
- 40
- 24
- NOTA

23. A square and a regular hexagon each have a perimeter of 12. Find the ratio of the area of the square to the area of the hexagon.

- $\frac{\sqrt{3}}{2}$
- $\frac{2\sqrt{3}}{3}$
- $\frac{3\sqrt{3}}{4}$
- $\frac{3\sqrt{3}}{2}$
- NOTA

24. Chords \overline{AB} and \overline{CD} of a circle intersect at point E . If $AB = 14$, $CE = 4$, $DE = 5$, and $AE > EB$, find AE .

- $7 + 3\sqrt{129}$
- $7 + \sqrt{149}$
- $7 + 2\sqrt{29}$
- $7 + \sqrt{29}$
- NOTA

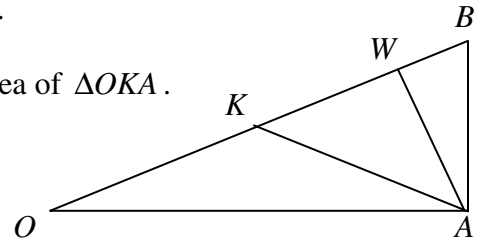
25. Each angle of an equiangular polygon measures 135 degrees. How many diagonals does the polygon have?

- 18
- 19
- 20
- 21
- NOTA

26. In $\triangle ABC$, points P and Q lie on \overline{AB} such that $AP = PQ = QB$. Points R and S lie on \overline{AC} such that $\overline{PR} \parallel \overline{QS} \parallel \overline{BC}$. If $BC = 12$, find $PR + QS$.

- 10
- 11
- 12
- 14
- NOTA

Use this figure for problems 27 and 28. $\triangle OAB$ is a right triangle with a right angle at A . $OA = 24$, $AB = 7$, K is the midpoint of \overline{OB} and $\overline{AW} \perp \overline{OB}$ with W on \overline{OB} .



27. Find the area of $\triangle OKA$.

- 42
- 36
- 32
- 28
- NOTA

28. Find AW .

- 8
- $\frac{84}{25}$
- $\frac{96}{25}$
- $\frac{168}{25}$
- NOTA

29. In $\triangle ABC$, \overline{BD} bisects $\angle B$ and D lies on \overline{AC} . Compare the area of a rectangle with base \overline{BC} and altitude \overline{AD} to the area of a rectangle with base \overline{CD} and altitude \overline{AB} .

- The area of one is twice the area of the other.
- The areas are equal to each other.
- Their areas are twice the area of the triangle.
- There is no relationship between the areas.
- NOTA

30. A man says, "I shall stay at home if it rains." It did not rain. Which of the following is necessarily true based on these statements?

- The man stayed home.
- The man went out.
- The man stayed home and it was a clear day.
- It cannot be determined if the man stayed home.
- NOTA