

For all questions, *E* is *NOTA*, which denotes that “none of these answers” are correct. Assume all diagrams are not drawn to scale. Assume all angles are in degrees.

1. Find the area of an equilateral triangle with side length 6.

(A) $\frac{9\sqrt{3}}{2}$ (B) $9\sqrt{3}$ (C) $18\sqrt{3}$ (D) 36 (E) *NOTA*

2. An isosceles triangle has two sides of length 5 and 12. What is the length of the third side?

(A) 5 (B) 12 (C) 13 (D) 17 (E) *NOTA*

3. What is the difference in area between the circumcircle and the incircle of an equilateral triangle with side length of 6?

(A) $\sqrt{3}$ (B) 9π (C) 15π (D) 24π (E) *NOTA*

4. A dog has a leash with length 8 feet that is connected to the corner of a fence around a rectangular yard with dimensions of 10 feet and 6 feet. If the dog is outside the fence, what is the area that dog can cover (outside of the fence)?

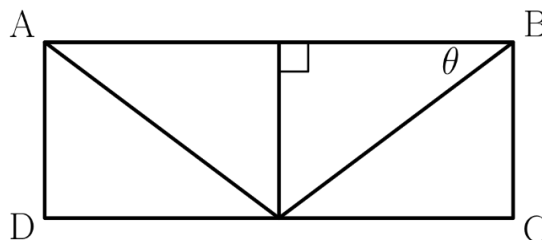
(A) 16π (B) 32π (C) 48π (D) 64π (E) *NOTA*

5. If an equilateral triangle has an area of $2\sqrt{3}$, then what is the length of one of the sides?

(A) $\frac{2\sqrt{3}}{3}$ (B) $\sqrt{2}$ (C) 2 (D) $2\sqrt{2}$ (E) *NOTA*

6. Given that the $\sin(\theta) = 3/5$ and that side *AB* is bisected by the altitude of the triangle (the side opposite angle θ), what is the area of rectangle *ABCD*?

(A) 12
(B) 15
(C) 24
(D) 30
(E) *NOTA*



7. Note that lines m , n , and l are parallel. The altitude from point A to side BC is 4, and the altitude from point D to side BC is 8. What is the ratio of the area of triangle DBC to the area of triangle ABC ?

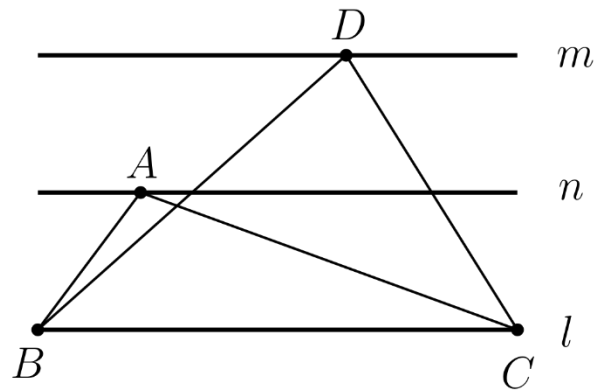
(A) $\frac{1}{2}$

(B) 1

(C) 2

(D) 4

(E) NOTA



8. If the length of segment AD is 6, what is the area of triangle ABC ?

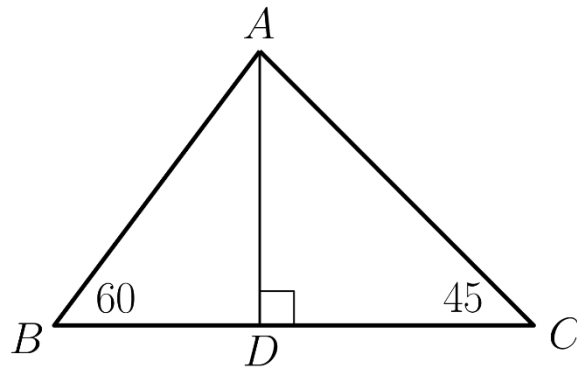
(A) $12\sqrt{3}$

(B) $18+6\sqrt{3}$

(C) 36

(D) $36+12\sqrt{3}$

(E) NOTA



9. In the semicircle, Arc AC has a measure of 120° . If $AB = 10$, what is the length of BC ?

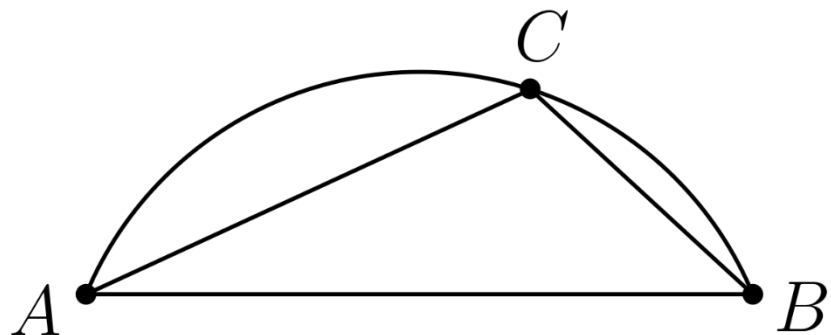
(A) 5

(B) $\frac{10\sqrt{3}}{3}$

(C) $\frac{25\sqrt{3}}{2}$

(D) 25π

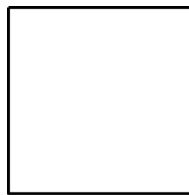
(E) NOTA



10. What is the complement of the supplement of the largest exterior angle of a right isosceles triangle?
- (A) -90 (B) 0 (C) 45 (D) 90 (E) NOTA
11. A triangle with three integral side lengths has two sides of length 4 and 1. What is the difference between the largest possible area and smallest possible area of the triangle?
- (A) -2 (B) 0 (C) 2 (D) 3 (E) NOTA
12. Points A , B , C , and D are collinear in that order. AB is 3 times CD . BC is the average of the length of AB and CD . If $AD = 24$, what's BC ?
- (A) 4 (B) 8 (C) 12 (D) 16 (E) NOTA
13. Aurora tries to show Samrah that she can balance a piece of pizza. She is a perfectionist, and so to ensure she doesn't mess up, she lays it flat and plots the vertices at $(1, 2)$, $(-3, 3)$, and $(-7, 7)$. Assuming the slice is a uniformly weighted triangle, at what point should she balance it?
- (A) $(-3, 3)$ (B) $(-3, 4)$ (C) $(-4, 4)$ (D) $(-4, 5)$ (E) NOTA
14. Sean has a circular room of diameter 14 feet and wishes to get a rug. However, his favorite pastime is collecting square rugs. Assuming he has infinitely many square rugs of every size, what is the area (in feet squared) of the largest rug he can fit in the room?
- (A) 49 (B) 98 (C) 196 (D) 392 (E) NOTA
15. Kian likes pixelated pictures enlarged. If he wants to expand a 3×4 inch picture onto a 75-inch television, what are the length and the width of the television? Note that the televisions are measured by the diagonal of the screen; thus, 75 inches is the length of the diagonal of the screen.
- (A) 25×50 inches (C) 73×74 inches (E) NOTA
(B) 45×60 inches (D) 75×100 inches

16. The image below is that of a square. A magnifying glass doubles the length the side of the image (i.e., 1 inch appears as 2 inches). What is the area of this square under a magnifying glass?

- (A) 12
(B) 36
(C) 72
(D) 144
(E) NOTA



17. How many sides does a regular polygon have if each interior angle is 175° ?

- (A) 12 (B) 24 (C) 48 (D) 72 (E) NOTA

18. If a circle is defined by $x^2 - 4x + y^2 + 6y - 23 = 0$, what is the circumference?

- (A) 6π (B) 12π (C) 23π (D) 36π (E) NOTA

19. What's the angle in degrees between the hour and minute hand of an analog clock at 5:26 PM?

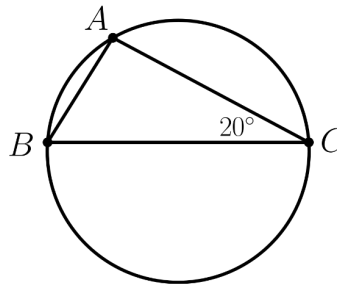
- (A) 0 (B) 1 (C) 6 (D) 10 (E) NOTA

20. In regular pentagon $ABCDE$, what is the measure of angle ABD in degrees?

- (A) 36 (B) 54 (C) 72 (D) 108 (E) NOTA

21. In the figure, the measure of arc BAC is 190° and the measure of $\angle C$ is 20° . Find the measure of $\angle B$ in degrees.

- (A) 60
(B) 65
(C) 70
(D) 75
(E) NOTA



22. Bailey, Fiona, and Hanna go out for pizza to prove who has the most effective eating method. They order two extra-large round pizzas each with a 16-inch diameter, which includes a two-inch uniform crust. They all claim different parts of the pizzas. Hanna claims just the crust of both pizzas. Bailey claims a square of side length 8 (the center of the square matches the center of the pizza, so none of the crust is eaten) from both pizzas. Fiona claims the rest (the leftover amount from both pizzas). If each person fully eats the amount they have claimed, what is the order of the amount eaten by each person in decreasing order? Consider the height of the pizza as negligible.

- (A) Hanna, Bailey, Fiona (C) Bailey, Hanna, Fiona (E) NOTA
(B) Fiona, Hanna, Bailey (D) Fiona, Bailey, Hanna

23. A regular polyhedron has twice as many edges as vertices. If it has 12 edges, how many faces does it have?

- (A) 4 (B) 6 (C) 8 (D) 10 (E) NOTA

24. Triangle ABC has a point D on side AB so that segment CD is an angle bisector of $\angle C$. If AB is 16, BC is 8, and AC is 10, find BD .

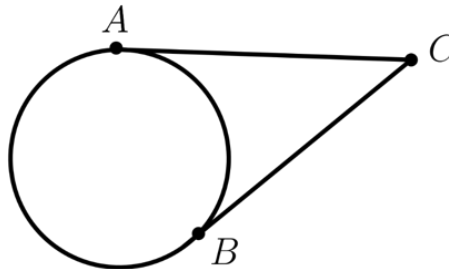
- (A) 7 (B) $\frac{64}{9}$ (C) 8 (D) $\frac{80}{9}$ (E) NOTA

25. Triangles BAC and FDE are similar. If $BA = 6$, $CA = 8$, and $DE = 12$, what is DF ?

- (A) 5 (B) 6 (C) 8 (D) 9 (E) NOTA

26. In the figure below, minor arc AB is 120 degrees. If \overline{CB} and \overline{AC} are tangent to circle O , what is $m\angle ACB$ in degrees?

- (A) 60
 (B) 90
 (C) 120
 (D) 240
 (E) NOTA

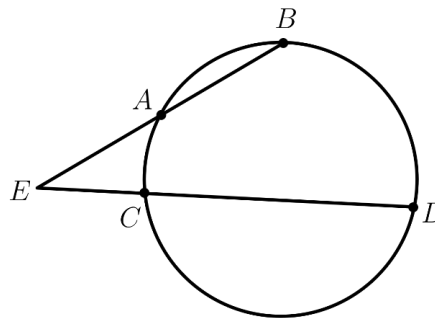


27. Duy goes to a group interview where there are 10 interviewees (including Duy). If everyone gives each other a handshake upon introduction, how many handshakes occur?

- (A) 5 (B) 10 (C) 45 (D) 90 (E) NOTA

28. In the figure below, AE is twice that of EC , and CD is equal to 8 times AB . If $AB = 7$, then what is the length of EC ?

- (A) 7
 (B) 14
 (C) 28
 (D) 49
 (E) NOTA



29. Who was first able to construct a regular heptadecagon?

- (A) Euler (B) Euclid (C) Gauss (D) Archimedes (E) NOTA

30. Amber is an expert at making cakes. For her next cake, she is making a cupcake cake, which consists of a rectangular cake with dimensions 20 inches wide by 30 inches long. The cupcakes go on top of the rectangular cake, and since this is a specialty cake, the cupcakes are hexagonal prisms such that the base of each cupcake lies on top of the rectangular cake. If each side of the base of each cupcake is 1 inch, what is the maximum number of cupcakes that can fit onto the top of the rectangular cake, assuming we can cut cupcakes as needed to make as many as possible fit and to take up the entire surface area of the top of the rectangular cake?

- (A) 30 (B) $\frac{200\sqrt{3}}{3}$ (C) $\frac{400\sqrt{3}}{3}$ (D) $\frac{2400\sqrt{3}}{3}$ (E) NOTA