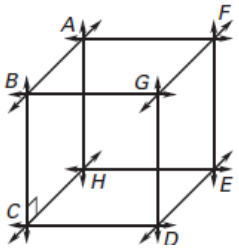
For all questions, answer choice "E) NOTA" means none of the above answers is correct.

1. $\angle A$ and $\angle B$ are supplementary; $\angle C$ and $\angle B$ are supplementary also. Given that $m\angle A = (3x+16)^\circ$ and $m\angle C = (5x-24)^\circ$, what is the value of $m\angle B$?

A) 20° B) 23.5° C) 76° D) 104° E) NOTA

2. The points A, B, C, D, E, F, G, and H are shown in the diagram to the right and are the vertices of a right rectangular prism. Which point is not coplanar with G and H?



A) A B) B C) C D) D E) NOTA

3. What is the midpoint of segment $\overline{JD}$, given points $J(-4,-14,27)$ and $D(19,-10,3)$?

A) $(3,4)$ B) $(7.5,-12,15)$ C) $\left(\sqrt{377},2\sqrt{74},3\sqrt{82}\right)$ D) $(11.5,2,-12)$ E) NOTA

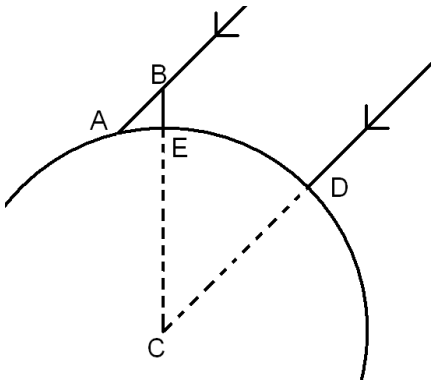
4. Which of the following statements is equivalent to the following conditional statement: "Mr. Snube is happy only if the weather is not good."?

A) Mr. Snube is happy if and only if the weather is not good.
B) If the weather is not good, then Mr. Snube is happy.
C) If Mr. Snube is not happy, then the weather is good.
D) If Mr. Snube is happy, then the weather is not good. E) NOTA

5. In spherical geometry, which of the following could not be the measures of the angles of a triangle?

A) $30^\circ, 30^\circ, 30^\circ$ B) $60^\circ, 60^\circ, 61^\circ$ C) $90^\circ, 90^\circ, 90^\circ$ D) $120^\circ, 120^\circ, 120^\circ$ E) NOTA

6. Eratosthenes used properties of parallel lines, angles, and circles to estimate the circumference of the earth in the third century BCE. Relive his accomplishment by using the following diagram (not drawn to scale) to find the circumference of the circle, centered at C, given that the length of DE is 60 miles, $m\angle ABE = 8^\circ$, and $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are parallel.



A) 480 miles B) 2600 miles C) 2700 miles D) 10320 miles E) NOTA

7. Which line contains an error in the following algebraic proof?

(1) Let $a=b$.
(2) $a^2=ab$ by the multiplication property of equality
(3) $a^2+a^2=a^2+ab$ by the addition property of equality
(4) $2a^2=a^2+ab$ by combining like terms
(5) $2a^2-2ab=a^2+ab-2ab$ by the subtraction property of equality
(6) $2a^2-2ab=a^2-ab$ by combining like terms
(7) $2\left(a^2-ab\right)=1\left(a^2-ab\right)$ by factoring
(8) $2=1$ by the division property of equality

A) line (4) B) line (6) C) line (8) D) there is no error E) NOTA

8. Define statement K as $p\to q$. If p is true and q is false, how many of the following conditional statements are true?
I) K II) the converse of K III) the inverse of K IV) the contrapositive of K

A) 0 B) 1 C) 2 D) 3 E) NOTA

9. Points $A(12,5)$, $B(24,14)$, and $C(0,k)$ form a right triangle. The hypotenuse of the triangle is perpendicular to the line $24x-7y=0$. What is the x-intercept of $\overleftrightarrow{BC}$?

A) 21 B) 24 C) 15.75 D) 72 E) NOTA

10. The three-dimensional graph $x^2+y^2+z^2\le 36$ is a solid ball centered at the origin. Let R be the region of the graph in the first octant ($x,y,z\ge 0$). Find the total surface area of region R.

A) 36π B) 18π C) 45π D) 54π E) NOTA

11. In $\triangle FWB$, $\left|\overline{FW}\right|=3$, $\left|\overline{BW}\right|=4$, $m\angle F=67^\circ$, and $m\angle B=57^\circ$. Which side of the triangle is shortest?

A) $\overline{FW}$ B) $\overline{BW}$ C) $\overline{FB}$ D) not enough information E) NOTA

12. Which of the following transformations is not an isometry?

A) translation B) reflection C) dilation D) rotation E) NOTA

13. Circles J and D have radii of lengths $\sqrt[3]{2}$ and $\sqrt[10]{10}$, respectively. Which circle encloses more area?

A) J B) D C) they have the same area D) not enough information E) NOTA

14. Which of the following is sufficient to prove that $\triangle ABC \cong \triangle XYZ$?

A) $\angle A \cong \angle X,\ \angle B \cong \angle Y,\ \angle C \cong \angle Z$ B) $\angle A \cong \angle X,\ \overline{AB} \cong \overline{XY},\ \overline{BC} \cong \overline{YZ}$
C) $\angle A \cong \angle X,\ \overline{AB} \cong \overline{XZ},\ \overline{AC} \cong \overline{XY}$ D) $\angle A \cong \angle X,\ \overline{AB} \cong \overline{XY},\ \overline{AC} \cong \overline{XZ}$ E) NOTA

15. Find the sum of the slopes of the altitudes of a triangle with vertices at the points $(1,4)$, $(7,-2)$, and $(-3,6)$.

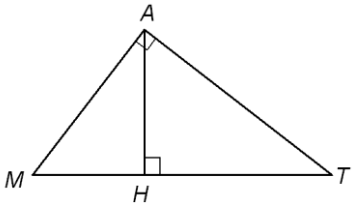
A) $-23/10$ B) $17/4$ C) 0 D) the given vertices do not form a triangle E) NOTA

16. A circular coin with radius of length 1 is dropped on an 8×8 checkerboard of squares with sides of length 3. The coin lands so that no part of it is hanging off the checkerboard. What is the probability that the coin lands entirely within one of the 64 squares on the checkerboard (i.e., it doesn't cross any lines between squares)?

A) $1/9$ B) $1/8$ C) $256/529$ D) $16/121$ E) NOTA

17. Fill in the blank in step 3 of the proof with the appropriate reason:

Given: $\angle MAT$ and $\angle AHM$ are right angles
Prove: $\triangle HAM \sim \triangle ATM$



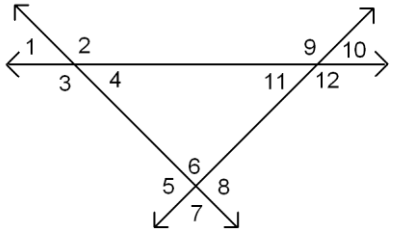
Statement	Reason
1. $\angle MAT$ and $\angle AHM$ are right angles	1. Given
2. $\angle MAT \cong \angle AHM$	2. Right angle congruence
3. $\angle HMA \cong \angle TMA$	3. _____
4. $\triangle HAM \sim \triangle ATM$	4. Angle-Angle Similarity Postulate

A) Transitive Property of Congruence
B) Symmetric Property of Congruence
C) Reflexive Property of Congruence
D) Third Angle Theorem
E) NOTA

18. The centers of two pulleys are 18 feet apart. One pulley's radius has measure 12 feet while that of the other is 3 feet. A belt is wrapped tightly around the two pulleys without any slack. What is the belt's length, in feet?

A) $18\sqrt{3}$ B) 30π C) $30\pi+18\sqrt{3}$ D) $18\pi+18\sqrt{3}$ E) NOTA

19. In the diagram to the right, which two angles are alternate interior angles?



A) $\angle 6$ and $\angle 3$ B) $\angle 10$ and $\angle 11$ C) $\angle 12$ and $\angle 8$
D) $\angle 6$ and $\angle 11$ E) NOTA

20. Cincinnati, OH is 400 miles due west of Washington, DC. Tallahassee, FL is 700 miles from Washington, DC, and 500 miles from Cincinnati, OH. Is Tallahassee, FL due south of Cincinnati, OH?

A) yes B) no C) sometimes D) not enough information E) NOTA

21. The region enclosed by a trapezoid with bases of lengths 14 inches and 20 inches and height of 7 inches is revolved around the longer base to create a three-dimensional figure. What is the volume of this figure, in cubic inches?

A) 686π B) 784π C) 882π D) 980π E) NOTA

22. If the orthocenter, circumcenter, and centroid of a triangle are collinear, then the triangle must be of what type?

A) right B) scalene C) isosceles D) equilateral E) NOTA

23. Given that $HIJK$ is a quadrilateral with $\left|\overline{HI}\right|=5$, $\left|\overline{IJ}\right|=4$, and $\left|\overline{JK}\right|=10$, how many integer values could the length of $\overline{HK}$ take?

A) 17 B) 18 C) 19 D) infinitely many E) NOTA

24. Point X is one vertex of a regular dodecagon. What is the measure of the smallest angle formed by the diagonals of the dodecagon that pass through X, in degrees?

A) 12.5° B) $\left(150/11\right)^\circ$ C) 15° D) $\left(50/3\right)^\circ$ E) NOTA

25. A frustum has bases with areas 12 and 27 and height 6. What is the volume of the frustum?

A) 114 B) 117 C) 117π D) 120 E) NOTA

26. A very tired spider is standing at one vertex of a cubical box with edges of length 15 inches. The spider wants to walk along the box's exterior and reach the opposite vertex. What is the shortest distance this trip could cover?

A) $15\sqrt{3}$ inches B) $15\sqrt{5}$ inches C) $\left(15\sqrt{2}+15\right)$ inches D) 45 inches E) NOTA

27. In quadrilateral $ABCD$, $\overline{AB}\cong\overline{CD}$, $\overline{AB}\|\overline{CD}$, and $\overline{AB}\neq\overline{CD}$. Which best describes $ABCD$?

A) rectangle B) rhombus C) parallelogram D) the figure is not possible E) NOTA

28. Quadrilateral $PQRS$ is inscribed in a circle. Which could not describe $PQRS$?

A) kite B) trapezoid C) rhombus D) rectangle E) NOTA

29. In $\triangle ABC$, $\left|\overline{BC}\right|=3$ and $\left|\overline{AC}\right|=5$. How many possible values of $\left|\overline{AB}\right|$ makes $\triangle ABC$ a right triangle?

A) 0 B) 1 C) 2 D) 3 E) NOTA

30. In $\triangle ABC$, $\left|\overline{AC}\right|=4$, $\left|\overline{BC}\right|=4\sqrt{2}$, and $\left|\overline{AB}\right|=2\sqrt{2}+2\sqrt{6}$. If the angles of the triangle are measured in degrees, what is the value of $\left(m\angle A+m\angle C\right)\cdot m\angle B$?

A) 4500 B) 6075 C) 7200 D) $150\sin^{-1}\left(\frac{\sqrt{6}}{4}\right)$ E) NOTA