Directions: Select the correct answer for each question and bubble it in the appropriate spot on your Scantron. For all questions, “E) NOTA” means “None of These Answers.” Good Luck!

1. Before their journey begins, Rahul and Cyrus have to create their time machine! Their time machine is in the shape of an octagonal prism. How many sides does an octagon have?

**A) 3 B) 6 C) 8. D) 10 E) NOTA**

2. Rahul and Cyrus’s first stop on their Eastern Civilization adventure is the 12th century - the time of Genghis Khan. They notice that the Mongolian yurts (huts) are in the shape of a hexagonal prism with a hexagonal pyramid stacked on top. All edges of the hexagonal prism have length 8m and the height of the entire yurt is 12m. What is the total volume of *two* of these yurts in cubic meters? (Hint: formula for the area of a hexagon is where s is the side length of the hexagon)

**A) 896 B) 1792 C) 896 + 896 D) 1792 E) NOTA**

3. Oh no! In Rahul and Cyrus’s absence, Genghis Khan has discovered the time machine! To save their time machine, Rahul and Cyrus must find the negative difference between the least and greatest degree measures of the angles of triangle , with angles and .

**A) -88° B) -84° C) 88° D) The triangle does not exist E) NOTA**

4. After saving their time machine, Rahul and Cyrus decide to wander around. They find a man with a strange triangular shaped head that can be modeled by the right triangle ∆ BRY (with hypotenuse BY). If BR = 6 and BY = 8, what is the length of the altitude to the hypotenuse?

**A) B) C) 3 D) E) NOTA**

5. Continuing their adventure, Rahul and Cyrus find a man named Brighten who is obsessed with the Sun. Coincidentally, Brighten’s head is shaped like a regular sphere (sun!) with diameter inches. What is the surface area of Brighten’s head (in square inches)?

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

6. If Angle R has a measurement of and the complement of the supplement of Angle R has a measurement of , what is the measure of Angle R?

**A) 14° B) 36° C) 122° D) 154° E) NOTA**

7. The silk road connects many important points in the eastern civilizations. Do you know what also connects 3 important points? Euler’s line! Which of the following does NOT always lie on Euler’s line?

**A) Circumcenter B) Orthocenter C) Incenter D) Centroid E) NOTA**

8. Rahul and Cyrus take their time machine to the 13th century where they meet Marco Polo during his adventures to the east. Marco Polo has a giant triangular-shaped painting with an inscribed circle (assume the painting is flat). The side lengths of the triangle are 4 meters, 6 meters, and 8 meters. What is the area (in square meters) of the inscribed circle?

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

9. After some extensive time travelling, Rahul and Cyrus are tired and decide to take a lunch break in a town. The town is shaped like a triangle with vertices (3,4), (5,7), and (8,2). What is the centroid of the triangle?

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

10. The points (0,0), (2,0), and (0,8) form a triangle. If this triangle is rotated about the y-axis a full 360°, it has volume X. If a sphere has the same volume as X, what is the diameter of the sphere?

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

11. Cyrus goes to the bathroom and notices a strange, triangular shaped tile. If the tile can be modeled by a triangle with two known angles measuring 30° and 60° and the shortest side of the triangle has length cm, what is the area (in cm2) of the triangle?

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

12. As Rahul and Cyrus continue on their adventure, they encounter an old man who has a garden in the shape of a hexagon with area . What is the length of the apothem of the hexagon?

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

13. In the old man’s backyard, there are four Buddhas – each standing at a vertex of a quadrilateral ABCD, with vertices A (3,4), B (7,9), C (5,1), and D (8,2) – protecting the enclosed sacred area. What is the area of this quadrilateral?

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

14. What is the perimeter of the quadrilateral ABCD, from question 13?

**A) B)**

**C) D)**

**E) NOTA**

15. Thrilled with new visitors, the hexagonal garden man invites Rahul and Cyrus to meet his lonely son, Ben. Ben’s favorite chess piece (the rook) is in the shape of a frustum of a cone with large radius 4, and small radius 2. What is the sum of the areas of the smaller circle on top and the larger circle on the bottom of the rook?

**A) 12π B) 20π C) 4π D) 16π E) NOTA**

16. What is the inverse of the contrapositive of the inverse of the converse of the following statement:

If it is raining, then I will not visit the Great Wall of China.

**A) If it is not raining, then I will visit the Great Wall of China.**

**B) If I do not visit the Great Wall of China, then it is raining.**

**C) If I visit the Great Wall of China, then it is not raining.**

**D) If it is raining, then I will not visit the Great Wall of China.**

**E) NOTA**

17. Bored of the current timeline, Rahul and Cyrus decide to travel back to Ben’s home country, China. During the 17th century, silver was widely used in China as their currency. The silver coins were in a shape of a cylinder with a radius of 4 cm and a height of 6 mm. What is the surface area of this coin?

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

18. You, Rahul, and Cyrus were captured by the Mongol leader Genghis Khan! Rahul and Cyrus are unconscious so you are the only one that can save them! Genghis Khan will set you guys free if you can answer this question:

Isosceles triangle ∆ ABC has and degrees. Also, can’t be equal to . Which CANNOT be an angle measure of ?

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

19. Genghis Khan has suddenly been resurrected! While Genghis Khan was wandering down the Yahtzee River, he found a cargo box in the shape of a perfect cube with side lengths measuring 2 feet 4 inches. What is the volume of the box?

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

20. Continuing down the Yahtzee River, Genghis Khan sees Rahul in the far distance. Genghis Khan is located on the coordinate (4,7) and Rahul is located on the coordinate (-1,-4). What is the distance that Genghis Khan has to run to reach Rahul?

**A) B) 6 C) 8 D) E) NOTA**

21. Oops! Genghis Khan is *thirsty* and has to head to the Yahtzee river to get a drink before meeting up with Rahul. Similar to question 20, Genghis Khan is located at the coordinate (4,7) and Rahul is located at (-1,-4) with the Yahtzee River running along the vertical line . Genghis Khan must travel to the river first before going to where Rahul is located. What is the shortest distance that he can travel?

**A) 24 B) 25 C) 2 D) 11 E) NOTA**

22. On his way to see Rahul, Genghis ran into a wild Wesley. Wesley was going to a math competition, and as usual, he had his 4 lucky mechanical pencils. His lead is in the shape of a cylinder and has a diameter of 0.9mm and a height of 0.06 m. What is the volume of his piece of lead in ? (Hint: 1 m = 1000 mm)

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

23. Rahul and Cyrus are trapped in two triangles! Which of the following theorems do not prove that two triangles are congruent?

**A) AAA B) ASA C) SSS D) SAS E) NOTA**

***For questions 24-25, use the following information:***

In order to achieve enlightenment, Kaitlyn must meditate for a time and perform a number of good deeds. Use the following variables:

V = The perimeter of an triangle with side lengths 2, 2.5, and 3.5

W = The number of diagonals in a triangle

X = The number of sides in a heptagon

Y = The number of diagonals in a nonagon

Z = The number of sides in a dodecagon

24. Kaitlyn has performed terrible acts. To atone for her deadly sins, she must perform an equal number of good deeds. What is this number?

**A) 672 B) 336 C) 240 D) 576 E) NOTA**

25. She needs to meditate for at least minutes. Being her usual lazy self, she always does the minimum. How long does she meditate for?

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

26. Rahul and Cyrus decide to visit the Terracotta army museum in China. From the front, the museum is in the shape of a semi-circle with a radius of . What is the area of this semi-circle in ?

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

27. Bhuvaneshvari is a Hindu god with 20 faces and 30 limbs. An icosahedron also has 20 faces and 30 edges. Using this information, how many vertices does an icosahedron have?

**A) 20 B) 15 C) 12 D) 8 E) NOTA**

28. Triangle ∆ ABC has angles . What is the complement of

**A) 40 B) 50 C) 35 D) 140 E) NOTA**

29. Quadrilateral circumscribes circle in a way that all sides of the quadrilateral are tangent to the circle. What is the length of side if , , and ?

**A) 23 B) 25 C) 27 D) 29 E) NOTA**

30. Brighten craves a triangular-shaped onigiri. It is a perfect triangle with side lengths AC = 5 feet, AB = 6 feet, and BC = 7 feet, shown below. Segments AD, BE, and CF in the diagram represent three pieces of carrot in the onigiri which all go from a vertex to the opposite side and which are concurrent and point G. Segment AF is 4 feet long and segment BD is 2 feet long. What is the length of segment AE?

B

C

A

F

D

E

G

**A. feet B. 2 feet C. feet D. 3 feet E. NOTA**