1. Constellations are arrangements of stars that appear relatively fixed in the night sky. What is the prime factorization of the number of ways in which the letters in the word “constellation” can be arranged?

(A) (B)

(C) (D)

(E) NOTA

2. Orion’s Belt contains three collinear stars. Let those stars be at (3,4), (5,14), and (7,24). What is the equation of the line perpendicular to (3,4) and (7,24) that goes through (5,14)?

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

3. There is a constellation for each of the 12 zodiac signs. Find the 12th term of an arithmetic sequence with first four terms .

(A) 261 (B) 258 (C) -3 (D) 264 (E) NOTA

4. The Winter Circle is a group of six stars arranged somewhat in a circle. Find the circumference of a circle with area 5.

(A) 10 (B) (C) (D) (E) NOTA

5. I am thinking of a number. The positive difference between 11/8 of my number and 8/11 of my number is equal to 31 less than my number. What number am I thinking of? (This number happens to be the number of modern constellations recognized by the International Astronomical Union.)

(A) 84 (B) 85 (C) 86 (D) 87 (E) NOTA

6. Let the answer to the previous question be N. Find the sum of the first N odd numbers.

(A) 7056 (B) 7744 (C) 7225 (D) 7396 (E) NOTA

7. Define the star operation as ☆ . Calculate (7☆2)☆(3☆5).

(A) 145 (B) 161 (C) 253 (D) 433 (E) NOTA

8. Pegasus is a constellation in the northern sky, named after the mythical winged horse. The body of the horse is made up of four stars arranged in a square, referred to as the Great Square of Pegasus. What is the smallest positive integer such that is a perfect square?

(A) 14 (B) 21 (C) 42 (D) 84 (E) NOTA

9. A group of six friends are trying to count stars in the night sky, but it is hard to do this. They each count a different number of stars: 1, 2, 6, 15, 31, and 56. What comes next in the sequence 1, 2, 6, 15, 31, 56? (Hint: Look at the differences between consecutive terms)

(A) 94 (B) 141 (C) 143 (D) 92 (E) NOTA

10. The night sky seems to have an infinite number of stars. What is the value of the infinite continued fraction ?

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

11. I sent a survey to the 50 people in my school’s astronomy club asking if they have ever seen the constellations Orion or Cassiopeia before. 2 did not respond. 27 of those who responded have seen Orion and 5 have seen both. How many people have only seen Cassiopeia?

(A) 16 (B) 18 (C) 26 (D) 28 (E) NOTA

12. Katharine thinks constellations are imaginary. If , find .

(A) -2 (B) -2 (C) 728 (D) 728 (E) NOTA

13. Farhana likes constellations because she enjoys spotting patterns in the stars. The following sequence also follows a pattern: , , .... If every consecutive term from to were added together, we get a sum of 11. What is n?

(A) 1105 (B) 1104 (C) 1012 (D) 264 (E) NOTA

14. Farhana wants to go stargazing with Katharine to change her mind about constellations, but Katharine will only agree to go if Farhana can solve this question: How many integer solutions does |5x+12|have?

(A) 19 (B) 18 (C) 17 (D) 16 (E) NOTA

15. Farhana answered correctly! They agree to meet at Farhana’s favorite field to stargaze at 2:36am. At 2:36, what is the measure of the larger angle formed by the minute and hour hands of a clock in degrees?

(A) 222 (B) 138 (C) 276 (D) 84 (E) NOTA

16. Katharine drives from her home to the field. She drives 15 miles in the first 1 hour but realizes she will be 30 minutes late if she continues at this speed. She doubles her speed for the rest of the way to the field and arrives 1 hour early. How many miles is the field from her home?

(A) 22.5 (B) 52.5 (C) 60 (D) 120 (E) NOTA

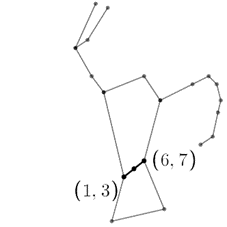
17. The “ladle” of the Big Dipper is a quadrilateral with three angles measuring 105°, 100° and 70°. What is the degree measure of the fourth angle?

(A) 60° (B) 75° (C) 85° (D) 100° (E) NOTA

18. Linsey wants to make her own constellation. If she selects 3 stars from a group of 5 stars, how many constellations can she make? (Assume that the order in which she selects them does not matter.)

(A) 20 (B) 25 (C) 40 (D) 50 (E) NOTA

19. James’ favorite constellation is Orion, and he wants to draw a picture of it. He draws Orion’s belt as a line segment between Alnitak at (1,3) and Minitaka at (6,7) on the Cartesian plane, as shown below. If Alnilam is the midpoint of this line segment, what are the coordinates of Alnilam?



(A) (1,2) (B) (3,5) (C) (1,7) (D) (6,3) (E) NOTA

20. While James was busy drawing Orion, Yimo stole his phone. James is at (-3,2) on the Cartesian plane, and Yimo is at (-7,-1). How far must James travel to retrieve his phone?

(A) -5 (B) 2 (C) 5 (D) 10 (E) NOTA

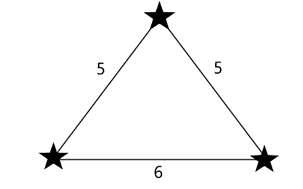
21. My favorite constellation is one of the 12 zodiac constellations, and you are trying to guess it. Your guesses are random and without replacement. What is the probability that you will guess my favorite constellation on your third guess?

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

22. Sarah and Karen are arguing about who can identify more constellations. Sarah says, “The number of constellations I can identify is equal to the difference between the tenth prime number and the tenth composite number.” Karen says, “The number of constellations I can identify is equal to . Who can identify more constellations, and how many can that person identify?

(A) Sarah; 11 (B) Sarah; 15 (C) Karen; 10 (D) Karen;14 (E) NOTA

23. Farhana sees a constellation with three stars, as shown below. The three stars form an isosceles triangle, with two sides of length 5 units and one side with length 6 units. What is the total area of the triangle?



(A) 6 units2 (B) 10 units2 (C) 12 units2 (D) 24 units2 (E) NOTA

24. Mari’s favorite constellation is Gemini. The number of stars in the Gemini constellation is equal to the sum of the prime factors of 220. How many stars are in Gemini?

(A) 14 (B) 18 (C) 20 (D) 22 (E) NOTA

25. Nonoko wants to use Katharine’s binoculars to look at her favorite constellation. Katharine will only give up the binoculars if Nonoko can tell her the 11th prime number. What is the correct answer?

(A) 21 (B) 23 (C) 29 (D) 31 (E) NOTA

26. Lilly wants to travel from Betelgeuse to Bellatrix (both of which are stars in the Orion constellation) and stop at Orion’s belt on the way. Given that Betelgeuse is at (1,7), Bellatrix is at (6,5), and Orion’s belt is the line y=0, determine the minimum distance Lilly needs to travel.

(A) 5 (B) 8 (C) 10 (D) 13 (E) NOTA

27. Linda’s favorite star is the Sun because it’s only 93 million miles away. If 1 mile = 1.6 kilometers, how many kilometers is the Sun from the Earth? Round your answer to the nearest ten.

(A) 130 million (B) 140 million (C) 150 million (D) 160 million (E) NOTA

28. If there are 88 major constellations in the night sky, and 12 of those are zodiac constellations, what is the probability that a randomly selected constellation will NOT be a zodiac constellation?

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

29. Farhana wants to know what the most popular constellation is, so she asks each of her friends. 7 of her friends say Orion is their favorite, 4 say the Big Dipper, 3 say Leo, and 1 says Cassiopeia. What percentage of her friends like Leo the most?

(A) 10% (B) 15% (C) 20% (D) 25% (E) NOTA

30. Linsey is putting star stickers on her wall to make a constellation with 4 stars in a straight line. Linsey has small, medium, and large stickers. How many options does Linsey have to make this constellation?

(A) 4 (B) 64 (C) 81 (D) 1000 (E) NOTA