Mu Alpha Theta 2015 National Convention   Theta Applications

For all questions, choice E, "NOTA", means "None of these answers".

1. Rachael's goal is to make an A in Algebra II, which requires an average grade on her tests of at least 89.5. So far, her test grades are 92, 85, 90, 91, and 83. There is one more test. What is the lowest grade she can make on the remaining test in order for her final grade to be an A?

   A) 94   B) 95   C) 96   D) she can't make an A   E) NOTA

2. Randal left home for a math competition at 7:00 a.m. and drove at a constant speed of 30 mph. At 7:15 a.m. his wife Dede noticed that he had forgotten his phone, so she got in her car and followed the same route Randal did, and drove at a constant speed of 40 mph. What time will Dede catch up with Randal?

   A) 7:40 am   B) 8:00 am   C) 8:10 am   D) 8:30 am   E) NOTA

3. The sum of a number and its reciprocal is 13/6. What is the absolute value of the difference of the number and its reciprocal?

   A) $\dfrac{5}{6}$ B) $\dfrac{7}{6}$ C) $\dfrac{3}{2}$ D) $\dfrac{11}{6}$ E) NOTA

4. The perimeter of a rectangle is 26 meters. The length is 5 meters less than twice the width. What is the area enclosed by the rectangle in square meters?

   A) 42   B) 36   C) 35   D) 32   E) NOTA

5. Water is filling an empty swimming pool at a rate of 20 gallons per minute. Meanwhile, water is draining out of a hole in the pool at a rate of 12 gallons per minute. After how many *hours* will the pool reach its total capacity of 16,200 gallons?

   A) 37   B) 36 ½   C) 34 $^2/_3$ D) 33 ¾   E) NOTA

6. With a head wind, a plane flew 1,440 miles in 4 hours. With a tail wind of the same strength, the return trip took only 3.6 hours. Find the speed of the wind.

   A) 20 mph   B) 24 mph   C) 28 mph   D) 30 mph   E) NOTA

7. The sum of three numbers is 188. The second number is 12 more than the first, and the third number is twice as large as the second. Find the positive difference between the largest number and the smallest number.

   A) 52   B) 62   C) 68   D) 74   E) NOTA

8. An isosceles triangle with a base of 10 cm has an area of 60cm^2. Find the perimeter of the triangle in cm.

   A) $2\sqrt{41}+10$ B) 31   C) 41   D) 36   E) NOTA

9. A Student Government committee includes 8 seniors and 6 juniors. What is the probability that a subcommittee of 5, chosen at random, will include 4 seniors and 1 junior?

A) $\dfrac{5}{143}$ B) $\dfrac{15}{143}$ C) $\dfrac{30}{143}$ D) $\dfrac{72}{143}$ E) NOTA

10. An open box is made by cutting a square with side length 3 inches from each corner of a square piece of tin. If the volume of the box must be 363 cubic inches, what must be the length of one side of this square piece of tin?

A) 11 in.   B) 13 in.   C) 17 in.   D) 21 in.   E) NOTA

11. How many ways can the 9 members of the Scrabble club line up for a photograph if the three officers must be in the center of the line?

A) 30,240   B) 15,120   C) 10,800   D) 4,320   E) NOTA

12. If y varies directly as the square of x and inversely as z, and if $y = 6$ when x and z equal 2 and 3, respectively, what is the value of z when $y = 12$ and $x = 6$?

A) 27   B) 18   C) 4½   D) 2¼   E) NOTA

13. A mechanic has 7 quarts of a solution that is 10% antifreeze, and needs to add pure antifreeze to bring the concentration up to 30%. How many quarts of pure antifreeze need to be added?

A) 4   B) 3.5   C) 2.8   D) 2   E) NOTA

14. The length of a diagonal of a closed rectangular box is 13 inches. The box's total surface area is 192 square inches. What is the sum of the lengths of all the edges of the box?

A) 68   B) 76   C) 80   D) 96   E) NOTA

15. The difference between two numbers is 6 and the product of the numbers is 25. Find the sum of the squares of the numbers.

A) $308+24\sqrt{34}$ B) 256   C) 61   D) no solution   E) NOTA

16. A horse is tied to the corner of a 16' by 20' barn. The rope the horse is tied with is 24' long. What is the total area (in square feet) over which the horse can roam?

A) $576\pi - 144$ B) 452π C) 432π D) 164π E) NOTA

17. Assume the earth is a sphere, and suppose a steel band could be wrapped tightly around the earth at the equator. Suppose 36 additional feet of steel is spliced into the band. If the slack is evenly dispersed, how many feet will there be between the surface of the earth and the band? (Use an approximate value of 24,000 miles for the radius of the earth).

A) less than 2'   B) between 3'and 4'   C) between 5' and 8'   D) more than 8'   E) NOTA

18. All the digits used to number the pages of a book were individually cut out and tossed into a box. If the box contained 1,128 digits, how many pages were in the book? The pages were numbered consecutively beginning with 1.

    A) 413   B) 412   C) 410   D) no solution   E) NOTA

19. A display in a grocery store has a triangular stack of cans with 1 can on the top row, 2 cans on the 2nd row, 3 cans on the 3rd row, and so on. How many rows will it take to stack a total of 300 cans?

    A) 29   B) 25   C) 22   D) 21   E) NOTA

20. A rectangular garden is bordered on all four sides by a walkway of uniform width when measured perpendicularly to one of the sides of the garden. The area of the entire region that includes both the garden and the walkway and nothing else measures 9 feet by 15 feet and is a rectangle, and the walkway itself has an area of 63 square feet. What is that uniform width of the walkway?

    A) 1¼ ft.   B) 1½ ft.   C) 1 ¾ ft.   D) 2 ft.   E) NOTA

21. Calvin, Todd, and Thom were on a road trip to the convention. They split the driving so that each one drove the same distance. Calvin drove at an average speed of 75 mph, Todd drove at an average speed of 60 mph, and Thom drove at an average speed of 45 mph. Which of the following is closest to their average speed for the entire road trip?

    A) 57 mph   B) 59 mph   C) 60 mph   D) 61 mph   E) NOTA

22. A start-up company is analyzing the results of their on-line advertising for their product. Of all the potential customers, 20% have made a purchase of the product. Of all the customers who have made a purchase, 35% have seen the on-line advertising. Of the potential customers who did not make a purchase, 40% had seen the on-line advertising. Find the percentage (to the nearest 1%) of those who have seen the on-line advertising that will make a purchase.

    A) 58%   B) 33%   C) 21%   D) 18%   E) NOTA

23. An antique dealer purchased a china platter for $1,620, and 4 years later sold it for $5,120. If the value of the platter at the end of each year the dealer owned it increased geometrically at a uniform rate, find the average rate at which the value of the platter increased each year, to the nearest percent.

    A) 30%   B) 36%   C) 42%   D) 54%   E) NOTA

24. An arch of a bridge is semi-elliptical, with its major axis horizontal. The base of the arch is 36 feet across, and the highest part of the arch is 12 feet above the horizontal roadway. If a certain point on the arch is 6 feet above the base, what is the horizontal distance in feet between this point and the center of the ellipse from which the arch comes?

    A) $2\sqrt{41}+10$ B) $9\sqrt{3}$ C) $6\sqrt{5}$ D) $6\sqrt{3}$ E) NOTA

25. A tee-shirt printing company offers v-neck and crew neck shirts. The profit on each v-neck shirt is $1.50, and the profit on each crew neck shirt is $2.00. The company can print a total of 1,200 shirts, and the number of crew necks is at most half the number of v-necks. The number of v-necks cannot exceed the number of crew necks by more than 600. Find the maximum profit possible under these conditions.

   A) $1,950   B) $2,100   C) $2,250   D) $3,000   E) NOTA

26. A group of people responded to a survey about their preferences for fruit. The results were as follows: 45 people liked cantaloupe, 30 liked strawberries, 25 liked pears, 14 liked both cantaloupe and strawberries, 16 liked both strawberries and pears, 10 liked both cantaloupe and pears, 8 liked all three, and 12 people did not like any of those three fruits. How many people responded to the survey?

   A) 112   B) 96   C) 88   D) 80   E) NOTA

27. The basic formula R = *log* I states that the Richter scale value (R) of an earthquake is equal to the log of the Intensity (I) of the earthquake. If an earthquake measures 4.5 on the Richter scale, which of the following is the approximate Intensity of this earthquake, rounded to the nearest thousand?

   A) 50,000   B) 45,000   C) 32,000   D) 22,000   E) NOTA

28. There are between 300 and 350 m & m's in a jar. If the m & m's are counted out 5 at a time, or 7 at a time, or 9 at a time there are always 2 m & m's left. If the m& m's are counted out 11 at a time, how many will be left?

   A) 3   B) 5   C) 7   D) 9   E) NOTA

29. The units digit of a two-digit number is 2 more than the tens digit. If the digits are reversed, the new number is 39 less than twice the original number. What is the smallest prime factor of the original number?

   A) 2   B) 3   C) 5   D) 7   E) NOTA

30. Becky, Paul, and Frank called in take-out orders at their favorite diner. Becky ordered 2 salads and 3 cheeseburgers, and the total cost was $11.30. Paul called in an order for 4 salads and 5 cheeseburgers, and the total cost was $21. Frank ordered 3 salads and 2 cheeseburgers. What will be the cost of Frank's order?

   A) $10.75   B) $9.95   C) $12.95   D) $14.30   E) NOTA