

Theta Applications
2001 State Convention

1. Chelsea has 64 apples. Hillary has 81 apples. Bill has 100 apples. Bill's number of apples is T percent higher than Chelsey's number of apples. What is T? (Please round to the nearest tenths of a percentage point)

A. 36.0 % B) 43.7 % C) 56.3% D) 64 % E) NOTA

2. Let G=the smallest positive perfect square that has the following properties

It is the sum of four consecutive odd whole numbers
It is the sum of two consecutive odd whole numbers
It is the sum of five consecutive whole numbers

What are the sum of the digits of G?

A. 4 B. 7 C. 10 D. 13 E. NOTA

3. Two swimmers, at opposite ends of a 90 foot pool, start to swim the length of the pool, one at the rate of 3 feet per second, the other at 5 feet per second. They swim back and forth for 12 minutes. Allowing no loss of time at the turns, find the numbers of times they pass each other.

A. 38 B. 39 C. 40 D. 42 E. NOTA

4. Brett wants to build a triangular region in the shape of a right triangle for his backyard. He has already built the triangle. Let ABC be the vertices of that right triangle. Let AB be the hypotenuse. Brett wants to divide side AC of the triangle into 15 equal parts. Thus, he plans to put in 14 line segments parallel to BC that run to AB from the points of division. However, he does not know how many parallel fences he wants to put in and wants to figure it out in terms of d. If $BC=10$, then what is the possible sum of the lengths of the 14 segments :

A 70 B. 75 C. 140 D 150 E NOTA

5. If a square of a two digit number is decreased by the square of the number formed by reversing two digits, then the result is not always divisible by:

A. 9 B. the product of the digits C. the sum of the digits
D. the difference of the digits E. 11

6. In traveling to the state math competition, Martin Angelo Oremans High School traveled 50 miles on the bus but had to stop for gas. To make up for lost time, the bus went the last 300 miles while going three times as fast. The bus's travel time after gas, when compared to the travel time before gas, was what?

A) half as much B) twice as much C) three times as much
D) four times as much E) Not enough information is provided

7. Six bags of marbles contain 18, 19, 21, 23, 25, and 34 marbles respectively. However almost all the marbles are chipped, from years of use. 5 bags contain all chipped marbles. One bag contains new marbles. Mary Jane takes three of the bags and Kelly takes two of the others. Only the bag of new marbles remains. If Mary Jane gets twice as many marbles as Kelly, how many new marbles are there?
- A) 18 B) 19 C) 21 D) 23 E) 25
8. It takes D algebra books (all the same thickness) and U geometry books (all the same thickness, which is greater than that of an algebra book) to fill a shelf. Also, B of the algebra books and Y of the geometry books would fill the same shelf. Finally, A of the algebra books would fill this shelf. Given that D,U,B,Y,A all exist and are distinct positive integers, it follows that A is :
- A) $\frac{DY + BU}{Y + U}$ B) $\frac{DY^2 + BU^2}{Y^2 + U^2}$ C) $\frac{DY - BU}{Y - U}$ D) $\frac{DY^2 - BU^2}{Y^2 - U^2}$ E) NOTA
9. Michael, Marion, and CJ decided to have a race. In racing over a distance g at uniform speed, Michael can beat Marion by 20 meters, Marion can beat CJ by 10 meters, and Michael can beat CJ by 28 meters. If g is in meters, then what is the tenths digit of (ln g)?
- A. 0 B. 5 C. 6 D. 7 E. NOTA
10. What is the minimum value of the quotient of a (base ten) number of three different nonzero digits divided by the sum of its digits? (Please round to the nearest hundredth)
- A) 10.17 B) 10.37 C) 10.47 D) 10.50 E) NOTA
11. Kelly is thinking about washing his car. There is a 60 percent chance that Kelly will decide to wash his car. However, Kelly does not like when it rains, for it ruins his car-wash. There is a 50 percent chance that it will rain. If Kelly does decide to wash his car, was it the probability it will rain?
- A) .15 B) .30 C) .35 D) .6 E) NOTA
12. O-Town and Chi-Town are both located on a real Cartesian plane. O-Town is located at (-2, 9) and Chi-Town is located at (8,15). A new football franchise, the Chios, has been awarded to the Chi-Town/O-Town area. The owner of the Chios, Bobby Spurrier, wants to build the stadium on football road, which is the line $y=0$. Mr. Spurrier wants the stadium to be built on a coordinate that is the closest to both Towns. In other words, he wants the combined distances from each town to the stadium to be a minimum. When the stadium is built, it will be on the coordinate $(\frac{x}{y}, 0)$. If x and y are relatively prime, what is $x + y$?
- A) 3 B) 5 C) 9 D) 11 E) NOTA

13. During a 5-game span in November and December, Duke's basketball team gave up 48, 60, 61, 68, and 77 points to their opponents. Go back in time. In order for Duke to average giving up between 60 and 65 points (when rounding), Duke must give up between D points and U points in its next game. What is U-D?
- A) 30 B) 32 C) 35 D) 39 E) NOTA
14. During Algebra 2, you take 100 point test that has 42 problems. If some problems are worth 3 points and some are worth 2, how many problems are worth 3 points?
- A) 16 B) 20 C) 26 D) 30 E) NOTA
15. At the student delegate meeting for the state convention, there are 150 students. There is a motion to pass a bill that allows for students to have a period for counter disputes after the original disputes have been accepted. After deliberating, most of the students are unconvinced, and defeat the bill(all the students vote). However, eventually, some students make more convincing arguments, and the bill is passed after a revote by twice the margin by which it was originally defeated(all the students vote). The number voting for the bill on the re-vote was $\frac{7}{6}$ of the number voting against it originally. How many more students voted for the bill the first time than voted against it the second time?
- A) 15 B) 20 C) 30 D) 45 E) NOTA
16. An ant is on the top of a soda can. He decides that he is going to walk down it and walk around the can in the process. After a while, he has made 1.5 rotations and has ended up half way down the can. If the radius of the can is $\frac{3}{\pi}$ and the height of the can is 24, how far as the ant traveled?
- A) 10 B) 15 C) $6\sqrt{\pi^2 + 4}$ D) $3\sqrt{9\pi^2 + 16}$ E) NOTA
17. On a New York City street corner, you see a person trying offering a game to make money. Being a sucker for these things, you go over to play. The man shows you a card that says...

On this card exactly one statement is false.
 On this card exactly two statements are false.
 On this card exactly three statements are false.
 On this card exactly four statements are false.

In order to win the game, you must tell the man how many of these statements are false. How many statements on this card are false?

- A) 0 B) 1 C) 2 D) 3 E) 4

18. At a construction site, it took 45 days for 27 men of equal building ability to build 9 houses. However, the boss wants 12 more houses built in only 30 more days. How many more men must the boss hire?
- A) 31 B) 28 C) 20 D) 24 E) NOTA
19. In a bookstore, 11 books are lined up and numbered 1-11, with 1 being the book on the far left and 11 being the book on the far right. Assume that each book is priced three dollars greater than the book next to it. In order for the combined prices of books 1 and 6 to be greater than the price of book 11, book 8 must be greater than J dollars. What is J?
- A) 27 B) 30 C) 33 D) 36 E) NOTA
20. After finding the average of the 900 scores for his Intro Psychology Course, Professor Lightbulb accidentally included the average with the 900 scores and found the average of the 901 numbers. What was the ratio of the second average to the true average?
- A) 1:1 B) 35:36 C) 36:35 D) 2:1 E) NOTA
21. At a certain point in a basketball game, Duke has four times as many points as North Carolina. After a North Carolina player hits a three-pointer, Duke only has three times as many points as North Carolina. After the North Carolina player hits the three-pointer, Duke is winning by what margin?
- A) 21 B) 24 C) 27 D) 30 E) NOTA
22. Four students, Gregory, Orrin, Rodney, and Erin, worked together on a science project that won \$1,680 at a science fair. However, they wanted to split up the money on the basis of who worked the hardest. They agreed on the following ratios:
Gregory : Orrin = 17 : 12 Orrin : Rodney = 3 : 4 Rodney : Erin = 32 : 15
Rodney received W dollars for his effort. What is the hundredths digit of log W?
- A) 2 B) 3 C) 7 D) 8 E) NOTA
23. The sun hits Shaquille O'Neal, who is 7ft tall. How shadow is 2 feet long. The sun, at the same time of day and at the same angle, hits 5ft 10 Allen Iverson. What is the ratio of the length of Allen's shadow to Shaq's shadow?
- A) $\frac{4}{5}$ B) $\frac{5}{7}$ C) $\frac{5}{6}$ D) $\frac{5}{4}$ E) NOTA

Use the following data for questions 24 and 25.

The tower at weather station A is 120 feet tall. The tower at weather station B is 80 feet tall. Wires are connected between the two towers so that information can be shared between them. They are 100 feet apart.

24. If each wire runs from the top of one tower to the bottom of another, and the wires touch each other, what height do they intersect?
- A) 45 feet B) 48 feet C) 50 feet D) 100 feet E) NOTA
25. If each wire runs from the top of one tower to the *halfway* point on the other tower, and the wires touch each other, what height do they intersect? (Please round to the nearest foot)
- A) 65 feet B) 66 feet C) 70 feet D) 72 feet E) NOTA
26. At Plant High School, there are 61 juniors in AP Chemistry. There are 48 juniors in AP American History. There are 51 juniors in AP Biology. There are 37 juniors in both AP Chemistry and AP History. There are 31 juniors in AP Biology and AP Chemistry. There are 23 juniors in AP History and AP Biology. There are some students in all three classes. There are 86 students that take at least one of these AP classes. How many take all 3?
- A) 17 B) 15 C) 19 D) 16 E) NOTA
27. Paul is having a huge spring break party at his house. However, his pool is empty, and must be filled up. He turns on his two hoses to fill up the pool. One hose fills up the pool in 12 hours, while the other fills it up in 8 hours. 2 hours later, Thom, Paul's neighbor who has no friends and wants to destroy Paul's party, sneaks into Paul's backyard and turns on a drain that would drain the full pool in 6 hours. Luckily for Paul, he goes out, 9 hours later, and checks on the pool, only to see the drain on. He turns the drain off. Eventually, the pool is full. All in all, how long does it take for the pool to fill?
- A) 14 hours B) 12.5 hours C) 12 hours D) 13.5 hours E) NOTA
28. In Friday afternoon math class, Mary Beth and Beth Sue were doing a math problem for their teacher Mrs. Peggy Sue. Mrs. Sue asked the two girls to find the zeroes of a quadratic polynomial with a quadratic coefficient of 1. Beth Sue, who was thinking about her date with a hot guy later that night, copied the constant term wrong onto her paper. Mary Beth, who was thinking about how much she dreaded the fact that her family was visiting that night, copied the linear term wrong. As her answer, Mary Beth found the zeroes to be 20 and -6, while Beth Sue found the zeros to be 8 and -1. Assuming that each girl correctly used the quadratic equation for the polynomial that each girl copied down, then what is answer that Mrs. Sue is looking for?
- A) -8 and 15 B) 12 and -10 C) -12 and 10 D) -15 and 8 E) NOTA

29. How many ways can 8 people (4 men and 4 women) sit next to each other *in a line* if men and women sit in alternating seats?
- A) 5040 B) 1152 C) 40320 D) 4608 E) NOTA
30. How many ways can 8 people (4 men and 4 women) sit next to each other *in a circle* if men and women sit in alternating seats?
- A) 24 B) 48 C) 96 D) 144 E) NOTA