

PRE-ALGEBRA – NEW ENGLAND

You have 60 minutes to complete the following 30 multiple choice questions. Choices A through D are answer choices for every problem. Choice E stands for “none of these answers”, or NOTA. Scoring is as follows: 5 points for a correct answer, 1 point if left unanswered, and 0 points for an incorrect response. Units are assumed. Diagrams not drawn to scale.

1. The Chiles MAΘ team is getting ready to tour the New England states! However, there is a problem: the sponsors are tired of driving and have gone on strike! Help the treasurer Vera decide which company will give them the cheapest driver! Company A has a base fee of \$20, and an additional fee of \$5 per hour of driving. Company B has a base fee of \$10 and an additional fee of \$7 dollars per hour of driving. Which company, A or B, would be the cheapest to rent for the day?

- A. Company A
- B. Company B
- C. They both cost the same amount of money
- D. Not enough information
- E. NOTA

2. Now the team has to decide how they're going to sit in the cars. One of their cars has five seats in the back. Jessica, Michael, Neha, Ben and Venkat are going to sit in the back row. Jessica and Michael, for everyone's sanity, cannot be seated next to each other. Jessica wants to sit next to Ben, and Venkat wants a window seat. How many ways can these five be seated?

- A. 6
- B. 14
- C. 16
- D. 18
- E. NOTA

3. Vera now needs to pay the driver in coins. It turned out the driver was a close friend of hers and gave her a discount. She only had to pay \$1.89, and she had nickels, dimes, pennies and quarters. What's the least amount of coins she could use to pay this amount?

- A. 9
- B. 12
- C. 17
- D. 189
- E. NOTA

4. Next, they decide to make a playlist for the car ride! Suppose that $A@B = (\frac{A}{2} \cdot B - 5)$ and

$A\&B = 4A+B$. The number of K-pop songs in the playlist is $((A@B)\&B)$ where A is 10, and B is the first prime number. How many K-pop songs are there in the playlist?

- A. 1
- B. 11
- C. 22
- D. 62
- E. NOTA

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5. First stop: Connecticut! The top priority in this state is to pay a visit to our friend and math genius Andrew Yuan at Yale. The Chiles MAΘ team is borrowing their friend Jackson's college merchandise to wear on this excursion. Given the following on Jackson's list, how many different outfits can we make if an outfit consists of pants, a shirt, a jacket, and an accessory? Mismatching schools is allowed.

List: Pants: one pair of Duke pants, one pair of Harvard pants

Shirts: two different Duke shirts, one Harvard shirt, one Yale shirt, one Stanford shirt

Jackets: one Harvard jacket, one Yale jacket, one Cornell jacket

Accessories: Duke socks, Harvard lanyard, Harvard water bottle, Harvard hat

A. 4 B. 14 C. 120 D. 196 E. NOTA

6. Now, using the information from question #5, find the probability that an outfit has a Yale jacket, making it appropriate for our trip?

A. $\frac{1}{72}$ B. $\frac{1}{3}$ C. $\frac{1}{2}$ D. $\frac{3}{4}$ E. NOTA

7. Now that we're all done in Connecticut, it's time to go to the smallest state in the United States, Rhode Island! Rhode Island's shape can be approximated by a rectangle with side length to width ratio of 3 : 4 and perimeter of 252 miles. Find the area.

A. 324 mi² B. 3888 mi² C. 47628 mi² D. 63504 mi² E. NOTA

8. Rhode Island is home to the Tennis Hall of Fame. Neha and Rahul insist that we visit! When they get there, they are disappointed to see that Roger Federer isn't a member, despite winning many Grand Slam singles titles. Solve for x, the number of Grand Slam singles titles this legend has won, and y, the amount of times he has reached finals using the following equations. The answer is x + y.

$$3x+y=91$$

$$y-x=11$$

A. 21 B. 25.5 C. 31 D. 51 E. NOTA

9. Rhode Island was the last of the thirteen original colonies to become a state. We are visiting on the anniversary of the day Rhode Island became a state! Lindsay is given the job of cutting the cake, and it is your job to tell her how many pieces to cut. Fifty percent of the kids in MAΘ want cake. Of the kids that want cake, 25% want two pieces. The rest of the kids that want cake want only one piece each- that is 9 people. How many pieces of cake must Lindsay cut for it to be enough for the kids who want two pieces to have two and for everyone else in MAΘ who wants cake to have one piece each?

A. 6 B. 9 C. 15 D. 24 E. NOTA

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10. The last thing we have to do in Rhode Island is visit Brown University. This college has an acceptance rate of 9.3%. If for some strange reason, only 1000 people applied how many students would be accepted?

- A. 0.093 B. 0.93 C. 9.3 D. 93 E. NOTA

11. Goodbye Rhode Island. Hello Massachusetts! Of course, after meeting Andrew at Yale, we cannot pass up the opportunity of meeting Victoria and Jennifer at MIT. We met a lot of students on our walk to the Starbucks where we were meeting the girls. We asked them all what Powerpuff Girls they liked. Sixty-four students said Buttercup, 94 said Blossom, 58 said Bubbles. We asked those 132 students about different combinations of Powerpuff girls and which ones they liked: 28 said both Buttercup and Bubbles, 26 said both Buttercup and Blossom, 22 said both Bubbles and Blossom, and 14 liked all three. Students may have like more than one combination. Find how many students liked exactly one Powerpuff Girl only.

- A. 11 B. 64 C. 106 D. 154 E. NOTA

12. Now that we've reached the Starbucks after our extensive Powerpuff Girls survey, we can finally order our favorite drinks! Elise, who doesn't like coffee, orders a mega-super-venti hot chocolate. Assuming the cup is a right cylinder with a base radius of 2 inches and a height of 1.5 feet, find the volume in cubic inches. (Volume of a right cylinder is $V = \pi r^2 h$)

- A. 3π B. 6π C. 36π D. 72π E. NOTA

13. It's time to have some of New England's famous clam chowder! The restaurant the Mu Alpha Theta sponsors go to has some peculiar serving sizes. The largest size chow is made up of 4 clammos. A clammo is made up of 9 chomps. Each chomp costs \$2.75. Freed wants 3 chows and Mrs. McLeod would like 3 clammos. How much money will this order of 3 chows and 3 clammos cost?

- A. \$74.25 B. \$173.25 C. \$297.00 D. \$371.25 E. NOTA

14. On the way back to the hotel from the clam chowder restaurant, Parul decides that she needs to take a nap immediately. She stops in the middle of the sidewalk, curls into a ball, and goes to sleep. Neha, disappointed but not surprised, picks Parul up, puts her in a wagon and drags her to the hotel. Assume that one of the wheels on the wagon is a sphere, and that Parul is a perfect sphere as well. The ratio of the radius of the wagon wheel's radius to the radius of sleeping Parul is 1:10. Find the ratio of the wheel's volume to Parul's volume. The volume of a sphere is $V = \frac{4}{3}\pi r^3$.

- A. 1:1000 B. 1:100 C. 1:9 D. 1:3 E. NOTA

15. Boston Common was the first public park in the United States. When we went to visit this historical landmark, we made Chris Lee do his sickest dance moves in the exact center of the park. The number of times he dabs is three less than four times the number of times he does the woah. If he dabs forty one times. Find the number of times Chris does the woah.

- A. 9.5 B. 11 C. 13.25 D. 161 E. NOTA

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16. The math team has finally reached Vermont, home of the famous Ben and Jerry's ice cream! They decided to drive to the Ben and Jerry's factory and take a tour of the area. On their way there, they noticed several blue cars pass by them. In fact, Brandon noticed that every two minutes the number of blue cars he saw was 3 more than before. If Brandon initially saw 6 cars and 6 minutes pass by, how many total blue cars would Brandon have seen by the end of those 6 minutes?

- A. 9 B. 15 C. 27 D. 42 E. NOTA

17. Meghana decided to be the navigator and use the GPS on her phone to find the Ben and Jerry's factory. Not surprisingly, her phone died. If they accidentally travel 12 miles north of the factory and then 16 miles east, what is the shortest distance they can travel back to reach the factory?

- A. 20 B. 28 C. 30 D. 34 E. NOTA

18. If the distance from the Vermont airport to the Ben and Jerry's factory is 25 miles and they travel at a rate of 35 miles per hour, how many minutes, rounded to the nearest minute, will it take for them to reach the factory?

- A. 30 B. 42 C. 43 D. 50 E. NOTA

19. If they travelled at 50 miles per hour, how many minutes would it take to reach the Ben and Jerry's factory, which is 25 miles from the Vermont airport?

- A. 15 B. 30 C. 50 D. 60 E. NOTA

20. Once they finally reached the factory, a security guard at the front door would not let them in until they answered this question correctly: What is the smallest integer value of x ?

$$-20 < 4x + 4 \leq 36$$

- A. $-\infty$ B. -6 C. -5 D. 9 E. NOTA

21. Ben and Jerry's offers a variety of flavors that nobody can resist. While taking a tour of the factory, the staff offers 3 different vanilla flavors and 4 different chocolate flavors. What is the probability that someone would select a chocolate flavored ice cream?

- A. $\frac{1}{7}$ B. $\frac{3}{7}$ C. $\frac{1}{2}$ D. $\frac{4}{7}$ E. NOTA

22. At the conclusion of their tour, one of the staff members mentioned that they were considering changing the packing shape from a cylinder to a rectangular prism. If the prism's height was 6 inches, the width was twice the length of the height, and the length was 4 more than the width, what is the sum of the dimensions of the rectangular prism in inches?

- A. 13 B. 18 C. 22 D. 25 E. NOTA

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23. After the math team left the Ben and Jerry's factory, they waited outside for Uber to pick them up to take them to the hotel. Because the group was quite big, two Ubers were needed to fit everyone. The first Uber came 10 minutes before the second Uber and travelled at a speed of 35 mph and made it to the hotel in 25 minutes. If the second Uber reached the hotel at the same time as the first Uber, how fast was the second Uber driving? Assume speed is constant and both Ubers took the same path to reach the hotel.

- A. $\frac{113}{4}$ mph B. $\frac{135}{4}$ mph C. $\frac{175}{3}$ mph D. $\frac{181}{3}$ mph E. NOTA

24. Next stop is New Hampshire! New Hampshire is known for being the site of Mount Washington, the tallest mountain in the northeastern region of the United States. The team decided they wanted to see this and pulled out a map to determine the distance and direction they need to travel. The distance from their location to the mountain is 60 miles and the legend on the map stated that every inch was 2.5 miles. If someone took a ruler and measured the distance on the map between these 2 points, how long would it be in inches?

- A. 24 in B. 48 in C. 125 in D. 150 in E. NOTA

25. Once they get to Mount Washington, Jessica decides she wants to climb the mountain! Jessica only wants to reach 35% of the total height of the mountain. If it takes 8 hours for Jessica to reach the peak, which is at an elevation of 4,000 feet, how long will it take for her to reach her goal?

- A. 2.8 hours B. 3 hours C. 5.2 hours D. 7 hours E. NOTA

26. After visiting the mountain, the team goes to a nearby local pizza shop to get some food. Because Andrew is really hungry, he orders a whole pizza for himself. However, Brandon, Jason, Jessica, and Parul decide to share one box of 12 slices of pizza. If Brandon eats $\frac{1}{3}$ of the pizza and Jason eats $\frac{1}{6}$ of the pizza, how many slices do Parul and Jessica eat if they have the same amount?

- A. 2 B. 3 C. 6 D. 9 E. NOTA

27. The math team decides to visit the next New England state, Maine! While waiting for their rental car to arrive, Ben decides to play a fun game of "guess the number." He said the first four digits of his number are 4657_. If his number is divisible by 12, then which number can be the last digit?

- A. 2 B. 6 C. 7 D. 9 E. NOTA

28. Finally, their transportation arrives and the team starts their drive to Maine. During the car ride, everyone decides to make plans of what they want to see once they arrive. Unfortunately, there were a few opposing opinions on where the team should go. Out of the 30 members, 18 of them wanted to visit Acadia National Park, 12 wanted to visit Mount Katahdin, and 2 wanted to visit both places. How many people did not want to see either of those places?

- A. 2 B. 3 C. 4 D. 5 E. NOTA

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29. Since the majority wanted to visit Acadia National Park, the math team decides to travel there first. Acadia National Park is known for its beautiful trails, so the team decides to go on the Great Head trail. If one mile is 5280 feet, then how many feet did they travel if the trail is 1.7 miles?

- A. 2341 ft B. 3450 ft C. 8976 ft D. 89760 ft E. NOTA

30. The tour of the New England states has sadly come to an end. It turns out that Jason has been collecting souvenirs from all six states they visited. If he collected 3 souvenirs from Connecticut, 4 from Rhode Island, 2 from Massachusetts, 1 from Vermont, and 4 from New Hampshire, how many souvenirs did he collect from Maine if the average number of souvenirs bought was 3?

- A. 2 B. 4 C. 6 D. 12 E. NOTA