

ALGEBRA I – SOUTHERN CALIFORNIA

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. Alex and Hayden are planning on taking a road trip through Southern California. If the population from 2010 was 37,000,000 people and the current population is 40,000,000 people, what was the percent increase from 2010? (To the nearest tenth of a percent)?

A) 7.9% B) 8.0% C) 8.1% D) 8.2% E) NOTA

2. The distance from Tallahassee to Los Angeles is 2000 miles long and the flight takes a few hours. On the plane, Alex challenges Hayden to a card game called Fish. Hayden quickly gets bored and decides to show Alex a magic trick in return. Alex must pull two cards from the deck for the trick to work. What is the probability that Alex pulls a King and then a Queen from a standard deck of 52 cards, without replacement?

A) $\frac{1}{169}$ B) $\frac{4}{663}$ C) $\frac{1}{52}$ D) $\frac{1}{13}$ E) NOTA

3. It gets very hot in California! To cool down, Jason buys himself and his 4 friends, bowls of ice cream. There is a 40% discount at the store today for a bowl and Jason has 20% off coupon he can use on one bowl. If the coupon is applied after the store discount and each bowl costs \$5.00, how much money does Jason spend on himself and his friends after the discounts and 9.5% tax are applied (tax is applied after discounts)?

A) \$13.14 B) \$14.95 C) \$15.77 D) \$16.37 E) NOTA

4. Meanwhile, Vera and Kaitlin go to Hollywood Bowl to watch a concert with their friends. Their seat numbers correspond to the positive integer solutions of the inequality below. What is the median seat number?

$$-2 < \sqrt{x + 6} < 4$$

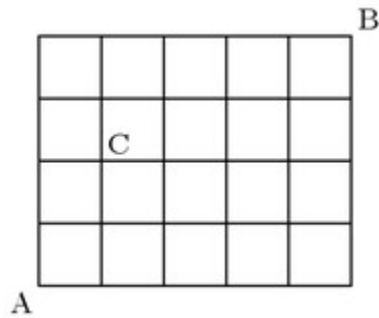
A) 4 B) 5 C) 6 D) 8 E) NOTA

ALGEBRA I – SOUTHERN CALIFORNIA

5. Jack, Ben, and Daniel are analyzing a chess game and get hungry. To decide who pays for lunch, they try to solve a math question. Given the system of equations below, what is the sum of the distinct positive abscissa(s) (x-coordinates) that satisfies both equations?

$$\begin{aligned}x^2 + y^2 &= 100 \\ x^2 - y^2 &= 28\end{aligned}$$

- A) 6 B) 8 C) 12 D) 16 E) NOTA
6. Michael and James are walking back to their hotel together in the evening, starting at Point A and walking to Point B. However, they must stop at point C to grab a snack. If they can only move up or to the right, how many different ways can they walk from point A to point B, if they must pass through point C?



- A) 28 B) 36 C) 40 D) 45 E) NOTA
7. Brighten and Bryan travel down to San Diego to visit Balboa Park. There they can see the zoo, museums, gardens, and much more! While they are there Brighten's phone dies, so he asks Bryan to borrow his. He doesn't know Bryan's 4-digit password, but Bryan gives him a hint: it has no zeros, does not repeat any digits, and the sum of the digits is 28. How many unique four-digit passwords fit this description?
- A) 14 B) 24 C) 48 D) 96 E) NOTA
8. Michael is trying to get a girlfriend at an IN-N-OUT. To impress the ladies, he wants to answer a hard math question. What is $\frac{-4^{15}}{1,048,576}$?
- A) -1024 B) 256 C) 512 D) 1024 E) NOTA
9. Michael takes his new girlfriend to see a magic show. The magician has 5 show-girls, 5 hair-styles, 6 dresses, and 4 shirts. How many unique combinations of one show-girl, one hair-style, one dress, and one shirt can he make?

- A) 25 B) 120 C) 600 D) 625 E) NOTA

ALGEBRA I – SOUTHERN CALIFORNIA

10. Delanie, Michael's new girlfriend, sees a popcorn booth when at the magic show. Popcorn sells for \$5.00 a bucket. If there is a sale going on where if two buckets of popcorn are purchased in the same transaction, the customer gets a 39% discount. If one bucket of popcorn is purchased a single transaction, the customer gets a 33% discount. Delanie wants to purchase two buckets of popcorn. How many cents would she save by purchasing both buckets together in a single transaction instead of both buckets separately in two transactions?

A) \$0.30 B) \$0.50 C) \$0.55 D) \$0.60 E) NOTA

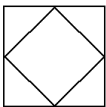
11. Jessica travels to the Los Angeles River and sees Neha there. They decide to rent a canoe and row down the river together. If they can row 36 miles downstream in 3 hours and 16 miles upstream in 2 hours, what is the speed of the river's current (in miles/hour)?

A) 2 mph B) 3 mph C) 6 mph D) 9 mph E) NOTA

12. Coincidentally, Daniel and Jae are staying at the same hotel as Alex and Hayden in Los Angeles. They bump into each other in the hotel lobby and Alex invites them to play some Smash. However, Hayden tells Daniel and Jae that they can only play if they can answer this question correctly: How many zeros are at the end of 2019!?

A) 502 B) 503 C) 504 D) 505 E) NOTA

13. The next day, Hayden, Alex, Jae, and Daniel drive to Zuma Beach in Malibu to go surfing. When they get there, they see a sign on the beach with the picture below. If the vertices of the smaller square bisect the sides of the bigger square, what is the ratio of the area of the bigger square to the area of the smaller square?



A) 1:1 B) 2:1 C) 4:1 D) 22:1 E) NOTA

14. While at Zuma Beach, Hayden spots Michael and his new girlfriend, Delanie sitting together on the beach. Besides getting a new girlfriend, Michael has also retrieved a new beach chair; a regular hexagonal prism with a side length of 12 inches and a height of 2 feet. What is the volume, in cubic feet, of Michael's abnormal beach chair?

A) $\sqrt{3}$ B) 2 C) $2\sqrt{3}$ D) $3\sqrt{3}$ E) NOTA

ALGEBRA I – SOUTHERN CALIFORNIA

15. David wishes to travel to the Team 10 House in Hollywood Hills to meet his inspiration, Jake Paul. How many distinct orderings of the word ITSEVERYDAYBRO are there if the I and T must remain next to each other in the distinct orderings.

A) 13! B) 14! C) $\frac{13!}{8}$ D) $\frac{14!}{8}$ E) NOTA

16. Filippo and Rahul are on a long car ride down to Disneyland Park. They are very bored on the way so Rahul suggests they play some Cool math games. Instead, Filippo takes this opportunity to start studying equilateral triangles. Rahul tests Filippo's knowledge by asking him a question: If an equilateral triangle with side length $2x$ has an area of $\sqrt{3}$, what is x ?

A) $\frac{1}{2}$ B) 1 C) $\frac{3}{2}$ D) 2 E) NOTA

17. At Disneyland, Rahul and Filippo ride Mater's Junkyard Jamboree! While on the ride, they hear five different tracks: "The One You Want to Call", "Square Dance", "Let's Go Driving", "Junkyard Jamboree", "Big BullDozer". What is the remainder when 5^5 is divided by 11?

A) 1 B) 2 C) 5 D) 10 E) NOTA

18. Rahul and Filippo decide to walk to the infamous Space Mountain. While searching for the Tomorrow-Land roller coaster, they stumble upon Michael and his girlfriend, Delanie. Yet again, Michael has acquired an abnormal object, "Big Stuff". If "Big Stuff" is packaged in a box with a length of 5 ft, a width of 5 ft, and a height of 278570 ft. What is the volume of the "Big Stuff" in cubic feet? (Hint: It is equivalent to the area of the Disneyland Park in square feet)

A) 1,292,850 ft³ B) 1,392,840 ft³ C) 1,392,860 ft³ D) 2,491,750 ft³ E) NOTA

19. After much begging, David has finally convinced his friend, Alex, to go to the Team 10 house in Hollywood to see his idol, Jake Paul. There is a 40% chance of actually finding the Team 10 House and a 30% chance it will rain (The two events are independent). What is the percentage chance that David and Alex find the Team 10 house and it doesn't rain?

A) 12% B) 18% C) 28% D) 42% E) NOTA

ALGEBRA I – SOUTHERN CALIFORNIA

20. Ernie likes the package with the “Big Stuff” in it. In order to get to the “Big Stuff”, he must figure out the numerical password to open the package. The password is the positive difference between the two solutions of the equation below:

$$x^2 - 20x - 69$$

- A) 10 B) 13 C) 16 D) 23 E) NOTA
21. Lindsay loves nature and pictures. To combine both of her passions she travels 25 miles from LA to Brea, California. There, she goes to take pictures of the huge redwood trees in Carbon Canyon Regional Park. What is the tens digit of 25^{69} ?

- A) 0 B) 1 C) 2 D) 5 E) NOTA

22. While at the Carbon Canyon Regional Park, Lindsay brings an empty 25 mL jar and fills it with completely with air. If by volume, dry air contains 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.04% carbon dioxide, and small amounts of other gases, how many mL of carbon dioxide are in the jar?

- A) 0.001 mL B) 0.01 mL C) 0.1 mL D) 1 mL E) NOTA

23. Michael and his girlfriend, Delanie, decide to travel to Santa Monica Pier to catch some Pika Pikas. While on the car ride there, he decides to ask Delanie a tough math question. What is the positive difference between how many ways 4 people can split 8 apples (apples must stay whole), and how many ways 4 people can split 7 apples (apples must stay whole), if a person can have 0 apples?

- A) 10 B) 15 C) 25 D) 45 E) NOTA

24. Upon arriving at Santa Monica Pier, Michael shows Delanie another one of his strange and abnormal objects. This time it is an equilateral triangular prism with a base side length of 6 inches and a height of 3 feet attached to a cube with side length of 7 inches. If the abnormal object is hollowed out and filled with water, how many cubic inches can fit in the object?

- A) $324\sqrt{3}$ B) $343\sqrt{3}$ C) $324\sqrt{3} + 343$ D) $343\sqrt{3} + 324$ E) NOTA

25. The truth is that Michael only brings his abnormal objects everywhere because it reminds him of his first true love, Ms. Banana (Shhhh don't tell Delanie!). If California is infamous for its fresh produce, and 73% of the state's agricultural revenue is derived from crops, what is the thirty-first prime number?

- A) 109 B) 113 C) 119 D) 127 E) NOTA

ALGEBRA I – SOUTHERN CALIFORNIA

26. After visiting Jake Paul, Alex and David decide to go visit the famous Hollywood sign, situated on Mount Lee, in the Hollywood Hills area of the Santa Monica Mountains. Suppose that Alex and David is located on point (14, 13), and the Hollywood sign is located on the point (1, 0), find the equation in slope intercept form that contains the two points.

A) $y = x - 1$ B) $y = \frac{6}{7}x - 1$ C) $y = \frac{6}{7}x + 1$ D) $y = x + 1$ E) NOTA

27. In 1984, Los Angeles hosted the Summer Olympic Games. During the games, the Hollywood sign illuminated for the first time since 1949. How many different prime factors does the number, 1984, have?

A) 2 B) 3 C) 4 D) 6 E) NOTA

28. To wrap up this Southern California trip, the gang wants to visit the Hollywood Walk of Fame. On the Walk of Fame they ran into Neil deGrasse Tyson. He was very interested in their math skills and said when they graduated if they could answer the question below he'd be interested in having them intern for him? Well do you want to be an intern to a famous astrophysicist?

What is one of the roots of $\frac{x^2}{18} = x - a$?

A) -18 B) 9 C) $9+3\sqrt{3a}$ D) $9-\sqrt{81-18a}$ E) NOTA

29. While at the Hollywood Walk of Fame, Delanie notices an abnormal object that is surprisingly not owned by Michael. Filippo also sees it and recognizes the 3-dimensional shape as something he had studied earlier in the trip, an icosidodecahedron. If the icosidodecahedron can hold 23 mL of water, though, only 11.3 mL is filled up, what percent of the icosidodecahedron is filled with water? (Rounded to the nearest thousandth)

A) 47.936% B) 49.130% C) 49.131% D) 49.129% E) NOTA

30. Alas the trip to Southern California has come to an end. Throughout the trip, we visited many famous areas in California, including IN-N-OUT and Santa Monica Pier. We also answered many fun math questions. Here is the final question of this test: Find the positive difference of the solutions of the equation $4x^2 - 8x - 60$.

A) 2 B) 3 C) 5 D) 8 E) NOTA