

ALGEBRA I – NORTHERN 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 to scale.

1. While Michael is packing his suitcase, he realizes that they’ve forgotten the code to unlock their suitcase! Luckily for him, they find a note with the following equation:

$$180\sqrt{441} = 2x + 2$$

If X is the correct passcode for Michael’s suitcase, what combination should he use to open their suitcase? (Hint- it’s also the year that Washington State became the 42nd state.)

A) 1789 B) 1799 C) 1889 D) 1899 E) NOTA

2. Before they leave for their trip, Neha, Michael, and Jason decide to buy for snacks. At the store they have fruit gummies, trail mix, granola bars, and potato chips. The group buy 9 snacks. The number of potato chips they buy is equal to the positive solution of $3x^2 - 12 = 0$. If they buy the same amount of potato chips as they do fruit gummies, and they buy only one granola bar, how many bags of trail mix do they buy?

A) 1 B) 2 C) 3 D) 4 E) NOTA

3. During their first day in Washington, Jessica sees a lot of flies while they’re driving. If the number of flies seen is equal to the sum of the first 10 terms in this sequence, how many flies did Jessica see?

$$1, 1, 2, 3, 5, \dots$$

A) 102 B) 122 C) 135 D) 143 E) NOTA

4. Neha and Jessica decide to visit Lake Siskiyou. During their walk on the Lake Siskiyou Trail they see a variety of animals, including bobcats and black bears! The proportion of squirrels to bobcats is 35:3, and the number of black bears is $\frac{11}{6}$ that of the bobcats, how many black bears did Neha and Jessica see if they saw 70 squirrels? (Round to the nearest whole number.)

A) 5 B) 6 C) 10 D) 11 E) NOTA

5. If the length (in miles) of the Lake Siskiyou Trail that Neha and Jessica visited is equal to the positive solution of the following equation, how far did they walk (in miles)?

$$2X^2 - 9X - 26 = 0$$

A) 2 B) 5.5 C) 6.5 D) 13 E) NOTA

6. Jason was distracted by the beautiful Mt. St. Helens while he was driving, causing them to miss a turn. He makes a U-turn, which follows the path of the parabola with the equation $y = \frac{x^2}{2} + x - \frac{35}{2}$. What’s the sum of the roots of this equation?

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

7. Neha, Michael, Jason, and Jessica all decide to visit Mount St. Helens together. The last time Mt. St. Helens erupted was in 1980, and it is still active. If the likelihood of the volcano erupting has an

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increase of 0.02% each year every year from 1981 to 2011 and 0.025% every year from 2012 to 2019, what's the likelihood that it'll erupt in 2019? Let the chance of eruption in 1981 be 5.1%. Round to the nearest tenth.

- A) 5.1%** **B) 5.7%** **C) 5.8%** **D) 5.9%** **E) NOTA**

8. After visiting Mount St. Helens, Jason and Neha decide to visit the Space Needle. The base of the Space Needle is shaped like the equation $y = -10|x + 1| + 20$. What are the coordinates of the equation's intersection with the x-axis?

- A) (-30,0), (10,0)** **B) (-3,0), (1,0)** **C) (-2,0), (2,0)** **D) (-1,0), (3,0)** **E) NOTA**

9. What's the area of the shape (above the x-axis) made by the equation from question 8 and the x-axis ?

- A) 20** **B) 40** **C) 50** **D) 80** **E) NOTA**

10. Before they leave Washington, the squad decides to visit the Olympic National Park to go fishing. At the lake they notice that there's a specific ratio among the fish species. Jessica concludes that there's 20 Steelhead trout for every 3 Chinook salmon, and 4 Chinook salmon for every 5 invasive Rainbow trout. If there's a total of 107 fish in the lake, how many Chinook salmon are in the lake?

- A) 12** **B) 15** **C) 16** **D) 24** **E) NOTA**

11. The first thing that they do when in Oregon is visit Crater Lake National Park. While they're there, Michael finds himself on top of a lava cliff. The height (in hundreds of feet) of the cliff is the solution to the following equation:

$$729 = 8 \left(\frac{x + 2}{2} \right)^3$$

How far off the ground is Michael?

- A) 7 feet** **B) 9 feet** **C) 700 feet** **D) 900 feet** **E) NOTA**

12. Neha is amazed when she finds out that there's an island in the middle of Crater Lake called Wizard Island. She is determined to find the area of this island, and measures its diameter in feet to be equal to the positive solution of the following equation:

$$500x^3 + 300000x^2 - 200000000x = 0$$

What's the area of Wizard Island?

- A) $20,000\pi \text{ ft}^2$** **B) $40,000\pi \text{ ft}^2$** **C) $160,000\pi \text{ ft}^2$** **D) $1,000,000\pi \text{ ft}^2$** **E) NOTA**

13. Everyone is hungry after their adventure at Crater Lake, so they go to Voodoo Doughnuts for a sweet snack. They order 7 doughnuts, with three people getting two doughnuts and one person getting one

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donut. Out of the dozens of flavors they choose chocolate, grape, and maple. No one who ordered a maple doughnut got a grape doughnut, and no one only ordered a grape doughnut. The amount of chocolate doughnuts they got is three times the number of grape doughnuts. If Neha is the only one who orders a grape doughnut, how many maple doughnuts did they order?

- A) 1 B) 2 C) 3 D) 4 E) NOTA**

14. Jason and Neha decide to have a race while they're kayaking in the Columbia River Gorge. Neha starts the race 10 feet in front of Jason. If Jason kayaks at a rate of 20 ft/s, and Neha kayaks at a rate of 17 ft/s, how far ahead is Jason after one minute?

- A) 160 feet B) 170 feet C) 180 feet D) 190 feet E) NOTA**

15. While in Oregon, Jason and Michael go to the beach. While they're there Jason spots a whale! The pair quickly notice that there's a whole pod of whales. The total number of whales they saw can be found by solving this equation for x:

$$3 \sqrt{\left(\frac{4}{3}(x - 15)\right)^2} = 2^2$$

- A) 12 B) 15 C) 17 D) 19 E) NOTA**

16. Neha has an intense passion for redwood trees and forces everyone to go to Redwood National Park in with her. When she gets there she recognizes that the trees are increasing height in the following geometric sequence:

5 ft, 10 ft, 20 ft, 40ft...

And that the diameters of the trees are increasing in the following arithmetic sequence:

2 in, 4 in, 6 in, 8 in...

Assuming the redwood trees are perfect cylinders, what is the volume of a particular tree that is the 4th smallest in height and 6th smallest in diameter?

- A) $10\pi ft^3$ B) $40\pi ft^3$ C) $1440\pi ft^3$ D) $5760\pi ft^3$ E) NOTA**

17. The gang decide to stop by Lassen Volcanic National Park but security won't let them in. The security guard instead gives them the following quadratic function:

$$y = 4x^2 + 9x + 3$$

and asks for the discriminant of equation. What should they say in order to bypass security?

- A) $\sqrt{33}$ B) 33 C) 81 D) 108 E) NOTA**

18. When they finally get past security, Michael notices two mud pots. One of them is bubbling at a rate of 3 bubbles per minute and the other is bubbling at a rate of 5 bubbles per minute. If Michael

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continues to observe these mud pots for the next two hours, what is the positive difference in the amount of bubbles produced from each of the mud pots?

- A) 20 B) 120 C) 240 D) 300 E) NOTA

19. Everyone finally decides to go to one last national park: Yosemite National Park. At Yosemite, Jason decides that it's a good idea to climb El Capitan, the largest vertical rock formation in the park. Jason climbs at a rate of 4 feet per minute, but slides back down 2 feet every minute. If the height of El Capitan is 3,000 feet tall, how much time does it take Jason to climb it?

- A) 750 minutes B) 1499 minutes C) 25 hours D) 1501 minutes E) NOTA

20. Neha insists on seeing the state capitol building in Sacramento. In fact, she is so determined that she starts to calculate the distances between Sacramento and other cities using coordinates. If Sacramento is at the origin, and San Francisco is at the point (160, 120) and Santa Rosa is at the point (150, 360) how far is San Francisco and Santa Rosa from Sacramento?

- A) San Francisco- 200, Santa Rosa- 390
B) San Francisco- 150, Santa Rosa- 300
C) San Francisco- 200, Santa Rosa- 360
D) San Francisco- 230, Santa Rosa- 390
E) NOTA

21. When they are in Sacramento, they meet the governor of California Gavin Newsom! Mr. Newsom gives them the following equation:

$$y = x^2 - x - 90$$

He asks them to find the sum of the reciprocals of the roots. What should they tell Mr. Newsom?

- A) $-\frac{1}{90}$ B) $\frac{1}{90}$ C) $\frac{1}{19}$ D) 19 E) NOTA

22. Finally, they are about to reach the best part of California, the Bay Area. Jessica is so excited about going to the Bay Area, she starts driving faster on the highway. For the first 15 minutes, she drives at a speed of 50 mph, then for the next 15 minutes she increases her speed by 5 miles per hour and continues this pattern for a total driving time of an hour. What is her average speed?

- A) 57.5 mph B) 58 mph C) 60 mph D) 61.5 mph E) NOTA

23. If $873^2 = 762129$ then what is $871 * 875$?

- A) 762115 B) 762124 C) 762125 D) 762135 E) NOTA

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24. While driving across the Golden Gate Bridge, Jessica and Neha are debating on how long the Golden Gate Bridge actually is. Jessica thinks its 8980 feet long while Neha thinks its 8970 feet long. In reality they are both wrong. The real length of the Golden Gate Bridge is the solution to this equation:

$$11x - 35279 = 7x + 645$$

Whose guess was closer and how close to the correct answer was the guess?

A) Jessica, 1 foot B) Neha, 1 foot C) Jessica, 10 feet D) Neha, 10 feet E) NOTA

25. Everyone decides to stop for boba tea at The Boba Guys. Jessica wants 25% sweetness and Michael wants 75% sweetness. However Jason is sneaky and makes some changes to both of their drinks. If both Jessica and Michael had 16 fluid ounces in both of their drinks, and Jason took 12 fluid ounces out of both of their drinks and swapped them, then what percentage is the sweetness in Jessica's drink?

A) 37.5% B) 50% C) 62.5% D) 100% E) NOTA

26. For dinner, Michael wants to eat in Chinatown which is 12 miles to the west, but Jason wants to eat at Fisherman's Wharf which is 16 miles south. So their group splits up and decides to eat dinner then meet in the middle of both places. How far is their meeting point from their dinner locations?

A) 10 miles B) 14 miles C) 16 miles D) 20 miles E) NOTA

27. How many of the following statements are true?

I. $\sqrt{16} = \pm 4$

II. $\sqrt{16} = 4$

III. $\sqrt{16} = -4$

A) I, II, III B) I only C) III only D) II only E) NOTA

28. To decide which city to go to next, Michael decides to flip a coin twice. If the coin lands two heads in a row, Jessica gets to choose where to go and if the coin lands two tails in a row Michael gets to choose where to go. Assuming the coin is fair, what is the probability that Jessica gets to choose where to go next?

A) $\frac{1}{8}$ B) $\frac{1}{4}$ C) $\frac{1}{3}$ D) $\frac{1}{2}$ E) NOTA

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29. They decide to make their last stop of their north California road trip in Stanford University. However, they keep getting directions that are a little confusing.

Steve: "Melissa and I are from different places."

Chris: "Leon is from Berkeley and Steve is from L.A."

Leon: "I'm from Berkley and so is Melissa."

Melissa: "I'm from Berkeley."

If people from L.A. lie and people from Berkeley tell the truth, whom should they ask for directions?

- A) Chris B) Leon C) Melissa D) Steve E) NOTA

30. Everyone finally arrives at Stanford! Jason is so happy to be at Stanford he jumps in a perfect parabola with the equation:

$$y = -2x^2 + 24x - 40$$

If the vertex can be represented in the ordered pair (x,y), what is x + y?

- A) 37 B) 38 C) 39 D) 40 E) NOTA