

ALGEBRA 1 – SOCIAL ANSWERS AND SOLUTIONS

1. C
2. B
3. C
4. B
5. B
6. D
7. C
8. A
9. C
10. D
11. A
12. A
13. B
14. D
15. E
16. B
17. A
18. E
19. C
20. D
21. C
22. B
23. D
24. C
25. D
26. A
27. A
28. D
29. C
30. D

Solutions

1. The percent increase from 37,000,000 to 40,000,000 can be modeled by the equation $37,000,000 + 37,000,000x = 40,000,000$, where x is the percentage growth as a decimal. This can be written to $37,000,000x = 3,000,000$. Dividing by 37,000,000 gives $x = 3/37$. To convert this decimal into a percent we multiply by 100 and get $300/37$. This simplifies to 8.1 when rounding to the nearest tenth. **Answer C**
2. When you take out a King (Prob: $1/13$) there will be 51 cards left. There are still 4 Queens (Prob: $4/51$). Prob of King->Queen – $1/13 * 4/51 = 4/663$. **Answer B**
3. Each bowl of ice cream is worth \$5. After the 40% discount, each bowl costs \$3. One bowl gets an additional 20% discount which decreases the cost to \$2.40. The total ice cream cost is $2.4 + 3 + 3 + 3 + 3 = 14.4$. Adding in the 9.5% tax gives us $1.095 * 14.4 = 15.768$ or \$15.77. **Answer C**
4. Squaring the inequality gives us $4 < x + 6 < 16$. Subtracting 6 gives us $-2 < x < 10$. The positive integer solutions are {1, 2, 3, 4, 5, 6, 7, 8, 9}. The median of this set is 5. **Answer B**
5. Add the two equations together to get $2x^2 = 128$. Divide by 2 to get $x^2 = 64$. Take the square root to get $x = \pm 8$. Plugging $x = \pm 8$ into either equation gives us $y = \pm 6$. The set of solutions are (8,6), (8,-6), (-8,6), and (-8,-6). There is only one distinct positive solution, 8. **Answer B**
6. To find the total paths from point A to B that also pass through C, we can find the number of paths from point A to point C and multiply that with the number of paths from point C to point B. Because Michael and Venkat only move up or right, we can represent their movements with U and R. From point A to point C, there are 2 ups and 1 right. The number of paths is just the number of combinations of UUR. This is equal to $3!/2! = 3$. From point C to point B, there are 2 ups and 4 rights. The number of paths is the number of combinations of UURRRR. This is equal to $6!/(4!2!) = 15$. Therefore, the total number of paths is $3 * 15 = 45$. **Answer D**
7. Starting off with the biggest to numbers 9 and 8, the second two numbers can either be 7,4 or 6,5 ($9+8+7+4 = 28$, $9+8+6+5 = 28$). 9 and 7 add up to 16 so the last two numbers need to add up to 12. However, this will repeat numbers (75 or 66) so this won't work. Therefore 9874 and 9865 are the only set of numbers that fit the description. Each set has 24 unique variations for a total of 48. **Answer C**
8. Putting the numerator and denominator into exponents with a base of 2 gives - $2^{30}/2^{20}$. This simplifies to -2^{10} or -1024. **Answer A**
9. The total number of combinations is just the product of all possibilities so $5*5*6*4 = 600$. **Answer C**

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10. If she bought two buckets of popcorn in one transaction she would get 39% off of \$10 of popcorn. She would pay $\$10 * 0.61 = \6.10 . If she bought one bucket of popcorn in two transactions she would get 33% off of \$5 two times. She would pay $\$5 * 0.67 * 2 = \6.70 . This means that she would save $\$6.70 - \$6.10 = \$0.60$. **Answer D**
11. Distance = (rate)(time). The rate going downstream is the speed of the boat plus the river's current which we can represent with $B+C$. The rate going upstream is the speed of the boat minus the river's current which we can represent with $B-C$. Therefore, the two equations we have are:

$$36 = (B+C)3$$

$$16 = (B-C)2$$

This simplifies to:

$$12 = B+C$$

$$8 = B-C$$

Adding the two equations together gives us:

$$20 = 2B, \text{ so } B = 10$$

If $B = 10$, then $C = 2$, so the current of the river is flowing at 2 miles per hour.

Answer A

12. The number of zeros at the end of $2019!$ is caused by multiples of 10. Because 10 is $2*5$ and there are a lot less factors of 5s than factors of 2s in $2019!$, if we just count the number of 5s, we can figure out the number of zeros at the end. $2019/5 = 403$, $2019/25 = 80$, $2019/125 = 16$, and $2019/625 = 3$. $403+80+16+3 = 502$. **Answer A**

13. If we set the side length of the larger square to $2x$, then the distance to the midpoint would be x . We can use this length and the Pythagorean Theorem to find the side length of the smaller square to be $\sqrt{2}x$. This means that the area of the larger square is $4x^2$ and the area of the smaller square is $2x^2$. The ratio of the larger square to the smaller square is $4x^2/2x^2 = 2$. **Answer B**

14. Because the unit of the answer choices is feet, we can convert the side length of 12 inches to 1 foot. The area of a hexagon with a side length of 1 is $3\sqrt{3}/2$. Multiplying this area by the length of 2 gives the volume of $3\sqrt{3}$. **Answer D**

15. Because the I and T must remain next to each other we can count them as one letter. There are 12 other letters to make a total of 13. The number of unique combinations is therefore $13!$. However, because there are two E's, two Y's, and two R's, we have to divide by 2, 2, and 2 for a total of $13!/8$. The I and T must remain next to each other but can be switched to T and I. This doubles the number of unique combinations to $13!/4$. **Answer E**

16. The formula for the area of an equilateral triangle is $\frac{s^2\sqrt{3}}{4}$. Because the area is $\sqrt{3}$, the side length is equal to 2. This means that $2x = 2$ so $x = 1$. **Answer B**

17. Because 5^5 isn't that big of a number you can simply multiply it out to get 3125. Then divide by 11 to find a remainder of 1. **Answer A**

18. To find the volume we can simply multiply the length, width, and height to get $5*5*278570 = 6964250$ cubic ft. **Answer E**

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19. If there is a 30% chance that it rains then there is a 70% chance that it doesn't rain. Therefore, the probability that they find Team 10 and it doesn't rain is $40\% * 70\% = 28\%$.

Answer C

20. The equation factors to become $(x - 23)(x + 3)$ so $x = 13, -3$. The positive difference is $13 - (-3) = 16$. **Answer D**

21. After testing a couple of exponents we can see that 25 to any power has a tens digit of 2. **Answer C**

22. Carbon dioxide takes up 0.04% of dry air. Converting this to a decimal gives us 0.004. To find the amount of carbon dioxide in 25 mL of dry air we simply multiply to get $25 * 0.0004 = 0.01$ mL. **Answer B**

23. Using stars and bars, we $(11 \text{ C } 3) - (10 \text{ C } 3) = 11 * 5 * 3 - 10 * 3 * 4 = 165 - 120 = 45$

Answer D

24. The height of the triangular prism is 3 feet or 36 inches. The area of the bottom face of the triangular prism is $36\sqrt{3}/4 = 9\sqrt{3}$. Multiplying this by the height, 36 to get $324\sqrt{3}$ cubic inches. The volume of the cube on the bottom is simply $7^3 = 343$ cubic inches. Adding these together gives a total of $324\sqrt{3} + 343$ cubic inches. **Answer C**

25. There are 25 prime numbers below 100. The next prime numbers are 101 (26), 103 (27), 107 (28), 109 (29), 113 (30), and 127 (31). Therefore, 127 is the 31st prime number. **Answer D**

26. The slope of the point is $(y_2 - y_1)/(x_2 - x_1)$. This gives a slope of $(13 - 0)/(14 - 1) = 13/13 = 1$. Using the slope-intercept form of $y = mx + b$ and replacing the known values we get $0 = 1 + b$, $b = -1$. Therefore, the equation of the line in slope-intercept form is $y = x - 1$. **Answer A**

27. To find the number of factors of 1984 we first need to find the prime factorization. This is $2^6 * 31$. Therefore, there are two different prime factors. **Answer A**

28. First rearrange the equation to be $x^2 - 18x + 18a$ then use completing the square to get $(x-9)^2 = 81 - 18a$ root both sides $x-9 = \pm\sqrt{81 - 18a}$ therefore $x = 9 \pm \sqrt{81 - 18a}$ **Answer D**

29 To find the percent we divide $11.3/23$ which is $113/230$. This is equal to 0.491304. Converting this to a percentage is $0.491304 * 100 = 49.1304\%$ which rounds to 49.130%.

Answer C

30. $4x^2 - 8x - 60$ factors into $4(x^2 - 2x - 15)$ which factors into $4(x-5)(x+3)$. The two solutions are 5 and -3. The positive difference is $5 - (-3) = 8$. **Answer D**