



# KMMC 2

## Official Solutions

Karate Masters Mathematics Competitions 2

1st Annual

# KMMC 2 A

Saturday, January 1, 2022



This official solutions booklet gives at least one solution for each problem on this year's competition and shows that all problems can be solved without the use of a calculator. When more than one solution is provided, this is done to illustrate a significant contrast in methods. These solutions are by no means the only ones possible, nor are they necessarily superior to others the reader may devise.

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**DeToasty3, pandabearcat, and pog.**

The problems and solutions for this KMMC 2 were prepared by the KMMC 2 Editorial Board under the direction of

DeToasty3, pandabearcat, & pog

## Answer Key:

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

### Problem 1:

(pog) If  $5 + \square = 8$ , what is the value of  $\square$ ?

- (A) 2      (B) 3      (C) 6      (D) 8      (E) 13

**Answer (B):**

Since  $5 + \square = 8$ , we get that  $\square = 8 - 5 = \boxed{\text{(B) } 3}$ . ■

### Problem 2:

(DeToasty3) Which of these numbers has the largest tens digit?

- (A) 32      (B) 78      (C) 123      (D) 756      (E) 1048

**Answer (B):**

The tens digits of the five numbers are 3, 7, 2, 5, and 4. Of these, 7 is the largest, so our answer is  $\boxed{\text{(B) } 78}$ . ■

### Problem 3:

(DeToasty3) How many letters in the word *KARATE* are vowels?

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

**Answer (D):**

We get that  $\boxed{\text{(D) } 3}$  of the letters of *KARATE* are vowels: A, A, and E. ■

**Problem 4:**

**(DeToasty3)** Exactly two years ago, Karate was 16 years old. How many years old will Karate be exactly four years from now?

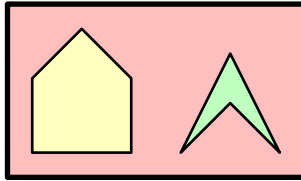
- (A) 20    (B) 21    (C) 22    (D) 23    (E) 24

**Answer (C):**

Since Karate was 16 two years ago, he is now  $16 + 2 = 18$ . Consequently, in four years, Karate will be  $18 + 4 = \boxed{\text{(C) } 22}$ . ■

**Problem 5:**

**(pog & pandabearcat)** What is the number of sides of each of the yellow and green shapes added together?



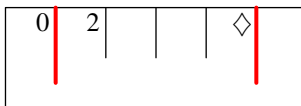
- (A) 7    (B) 8    (C) 9    (D) 10    (E) 11

**Answer (C):**

The yellow shape has 5 sides, and the green shape has 4 sides. Thus, our answer is  $5 + 4 = \boxed{\text{(C) } 9}$ . ■

**Problem 6:**

**(pog)** If the spaces between every two markings next to each other on the ruler are equal in length, what is the value of  $\diamond$ ?



- (A) 4    (B) 6    (C) 8    (D) 10    (E) 12

**Answer (C):**

Since the space between every two markings on the ruler is equal, the number of units between every two markings is equal. Hence, the third marking is  $2 + 2 = 4$ , the fourth marking is  $4 + 2 = 6$ , and  $\diamond$  is  $6 + 2 =$  **(C) 8**. ■

**Problem 7:**

**(pandabearcat)** What is the result when the thousands, hundreds, and ones digit of the four-digit number 9716 are added together?

- (A) 19    (B) 20    (C) 21    (D) 22    (E) 23

**Answer (D):**

The thousands, hundreds, and ones digit of 9716 are 9, 7, and 6. Thus, our answer is  $9 + 7 + 6 =$  **(D) 22**. ■

**Problem 8:**

**(DeToasty3 & pog)** In a race between 10 people, Karate finished first in the race, and Judo finished last in the race. If there were no ties in the race, how many people finished behind Karate but ahead of Judo?

- (A) 7    (B) 8    (C) 9    (D) 10    (E) 11

**Answer (B):**

Note that since Karate finished first and Judo finished last, the number of people that finished behind Karate but ahead of Judo is equal to the number of people in the race other than Karate and Judo. Thus, our answer is  $10 - 2 =$  **(B) 8**. ■

**Problem 9:**

**(DeToasty3 & pandabearcat)** Karate has 58 pencils. Judo then gives him 40 pencils. After Judo gives Karate the pencils, Naruto then takes away 74 of Karate's total pencils. How many pencils does Karate have now?

- (A) 20    (B) 24    (C) 28    (D) 32    (E) 36

**Answer (B):**

After Judo gives Karate 40 pencils, Karate has  $58 + 40 = 98$  pencils. Thus, after Naruto takes away 74 of Karate's pencils, Karate now has  $98 - 74 = \boxed{\text{(B) } 24}$ .

**Problem 10:**

**(DeToasty3)** Haruka is skip-counting by 4. She starts by saying the number 15, then the number 19, then the number 23, and so on. Which of these numbers will she eventually say?

- (A) 30      (B) 31      (C) 32      (D) 33      (E) 34

**Answer (B):**

Continuing Haruka's skip-counting, she will say  $23 + 4 = 27$  and then  $27 + 4 = \boxed{\text{(B) } 31}$ .

**Problem 11:**

**(pog & pandabearcat)** Karate is thinking of a number whose ones digit is 2. How many different numbers from 10 to 100 could Karate be thinking of?

- (A) 9      (B) 10      (C) 11      (D) 12      (E) 13

**Answer (A):**

The numbers from 10 to 100 are the two-digit numbers. Thus, the tens digit of the number can be any number from 1 to 9, while the ones digit must be 2, for an answer of  $\boxed{\text{(A) } 9}$ .

**Problem 12:**

**(pandabearcat)** Karate is a fan of the singer Taylor Swift. He has set a goal to listen to 61 minutes and 18 seconds of her song, "All Too Well", every day. If he has already listened to the song for 51 minutes and 5 seconds, how many more minutes and seconds of "All Too Well" does he need to listen to in order to reach his goal?

- (A) 9 minutes, 23 seconds      (B) 9 minutes, 58 seconds  
(C) 10 minutes, 9 seconds      (D) 10 minutes, 13 seconds  
(E) 10 minutes, 23 seconds

**Answer (D):**

If Karate listens to “All Too Well” for another  $61 - 51 = 10$  minutes, he will have listened to “All Too Well” for 61 minutes and 5 seconds. Thus, to reach his goal of 61 minutes and 18 seconds, he must listen to “All Too Well” for another  $18 - 5 = 13$  seconds, for an answer of **(D) 10 minutes, 13 seconds**.

**Problem 13:**

**(DeToasty3)** For all numbers  $\square$  and  $\triangle$ , the value of  $\square \ominus \triangle$  is equal to  $\triangle - \square$ , where  $-$  is the subtraction sign. What is the value of  $3 \ominus 5$ ?

- (A)  $-2$     (B)  $-1$     (C)  $0$     (D)  $1$     (E)  $2$

**Answer (E):**

We get  $3 \ominus 5 = 5 - 3 =$  **(E) 2**.

**Problem 14:**

**(DeToasty3)** If there are twelve inches in a foot, and there are three feet in a yard, how many inches long is a stick which is a yard and two feet long?

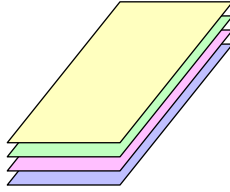
- (A) 24    (B) 36    (C) 48    (D) 60    (E) 72

**Answer (D):**

Since there are twelve inches in a foot and three feet in a yard, there are  $12 + 12 + 12 = 36$  inches in a yard. Thus, a stick which is a yard and two feet long is  $36 + 12 + 12 =$  **(D) 60** inches long.

**Problem 15:**

**(pandabearcat & pog)** Karate has 4 worksheets he needs to do: a math worksheet, a logic worksheet, a reading worksheet, and a science worksheet. He wants to do the math worksheet last, the logic worksheet before the science worksheet, and the reading worksheet after the science worksheet. In what order does Karate have to do the worksheets?



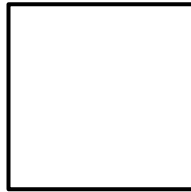
- (A) logic, reading, science, math      (B) math, science, reading, logic  
 (C) science, reading, logic, math      (D) logic, science, reading, math  
 (E) reading, science, math, logic

### Answer (D):

The math worksheet is last. Since the logic worksheet is before the science worksheet and the reading worksheet is after the science worksheet, the science worksheet is between the logic worksheet and the reading worksheet. Thus, our answer is **(D) logic, science, reading, math**. ■

## Problem 16:

**(DeToasty3 & pog)** Which of the following is **not** true about a square?



- (A) Squares have four sides.      (B) All sides of a square are equal.  
 (C) Squares are rectangles.      (D) Squares have two lines of symmetry.  
 (E) Squares have more sides than triangles.

### Answer (D):

Squares have four sides, so (A) is true.

All sides of a square are equal, so (B) is true.

Squares are rectangles as they have four right angles and four sides, so (C) is true.

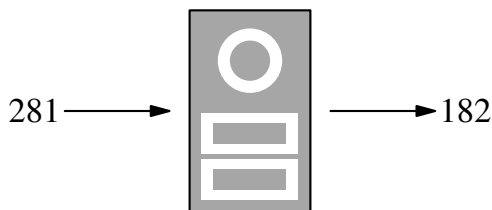
Squares have four lines of symmetry, so (D) is not true.

Squares have four sides, while triangles have three sides, so (E) is true.

Hence, our answer is (D) Squares have two lines of symmetry. ■

## Problem 17:

(pog) A machine reads the digits of a number from right to left and outputs what it read. (For example, putting the number 281 into the machine would output the number 182.) When put into the machine, which of these numbers would **not** cause the machine to output a valid number?



- (A) 0    (B) 37    (C) 64    (D) 121    (E) 140

### Answer (E):

For each answer choice, the machine will output 0, 73, 46, 121, and 041, respectively. Of these, 041 is not a valid number, so our answer is (E) 140. ■

## Problem 18:

(DeToasty3) Karate has 20 sheets of paper. He wants to create packets by stapling either two sheets of paper or three sheets of paper together. If Karate makes seven packets with two sheets of paper each, how many packets with three sheets of paper each can Karate make with the sheets of paper left over?

- (A) 1    (B) 2    (C) 3    (D) 4    (E) 5

### Answer (B):

Karate will use  $2 + 2 + 2 + 2 + 2 + 2 + 2 = 14$  sheets of paper to make seven packets with two sheets of paper each. Now, he has  $20 - 14 = 6$  sheets of paper left over.

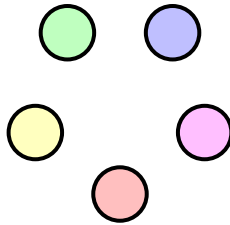
He can't make 3 packets with the sheets of paper left over, as he needs



$3 + 3 + 3 = 9$  sheets of paper for that, but he can make **(B) 2** packets with the sheets of paper left over, as it only takes  $3 + 3 = 6$  sheets of paper. ■

## Problem 19:

**(pandabearcat & pog)** Karate has a red, a yellow, a green, a blue, and a pink marble in a bag. He picks a random marble from the bag. What is the chance that he picks the red marble?



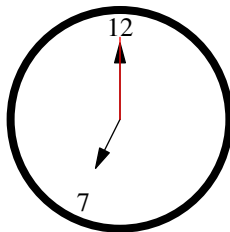
- (A) 1 in 7      (B) 1 in 6      (C) 1 in 5      (D) 1 in 4      (E) 1 in 3

**Answer (C):**

If Karate picks a random marble of the 5 marbles and 1 of the marbles is the red marble, the chance that he picks the red marble is **(C) 1 in 5**. ■

## Problem 20:

**(DeToasty3 & pog)** At 7:00, all of the gears of an analog clock stopped working. Karate wants to display 7:30 on the clock. Which of the three hands of the analog clock does Karate have to move?



- (A) hour hand only      (B) minute hand only      (C) seconds hand only  
 (D) both hour hand and minute hand      (E) all three hands

**Answer (D):**

We have to move the hour hand to halfway between the 7 and the 8, and we have to move the minute hand from the 12 to the 6. Since we don't have to move the seconds hand, our answer is **(D) both hour hand and minute hand**.

**Problem 21:**

**(DeToasty3)** Karate is taller than Judo but shorter than Haruka. Naruto is taller than Ayaka but shorter than Judo. Who is the shortest among the five people?

- (A) Karate    (B) Judo    (C) Naruto    (D) Haruka    (E) Ayaka

**Answer (E):**

Since Karate is taller than Judo but shorter than Haruka, Haruka is taller than Karate and Karate is taller than Judo. Thus, Judo is the shortest of the three.

Since Naruto is taller than Ayaka but shorter than Judo, Judo is taller than Naruto and Naruto is taller than Ayaka. Thus, Ayaka is shorter than Judo and Naruto. Judo and Naruto are both shorter than Karate and Haruka, so **(E) Ayaka** is the shortest among the five people.

**Problem 22:**

**(DeToasty3)** A recipe for one bowl of soup calls for 3 carrots, 2 cups of water, and 3 potatoes. If Karate has 9 carrots, 7 cups of water, and 8 potatoes, at most how many bowls of soup can he make?

- (A) 1    (B) 2    (C) 3    (D) 4    (E) 5

**Answer (B):**

If Karate makes 1 bowl of soup, it takes 3 carrots, 2 cups of water, and 3 potatoes, which he has.

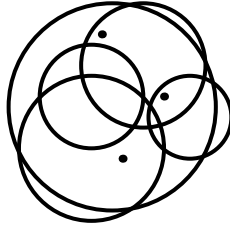
If Karate makes 2 bowls of soup, it takes 6 carrots, 4 cups of water, and 6 potatoes, which he has.

If Karate makes 3 bowls of soup, it takes 9 carrots, 6 cups of water, and 9

potatoes. However, Karate only has 8 potatoes, so he can not make more than **(B) 2** bowls of soup. ■

## Problem 23:

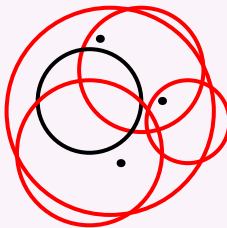
**(DeToasty3)** How many of the circles have at least one dot inside of them?



- (A) 1      (B) 2      (C) 3      (D) 4      (E) 5

**Answer (D):**

There are 5 circles in the diagram. Of them, only 1 of them has no dots in it. Thus, our answer is  $5 - 1 =$  **(D) 4**.



## Problem 24:

**(DeToasty3)** Aki and Judo each have 10 grapes. Aki gives Judo 2 of his grapes. Then, Judo gives Aki 5 of his grapes. Finally, Aki eats 3 of his grapes. Afterwards, who has more grapes, and by how many?

- (A) Aki, 1      (B) Aki, 3      (C) Judo, 1      (D) Judo, 3      (E) neither

**Answer (B):**

After Aki gives Judo 2 of his grapes, Judo has  $10 + 2 = 12$  grapes and Aki has  $10 - 2 = 8$  grapes. Then, after Judo gives Aki 5 of his grapes, Judo has  $12 - 5 = 7$  grapes and Aki has  $8 + 5 = 13$  grapes. Finally, after Aki eats 3 of his grapes, he has  $13 - 3 = 10$  grapes and Judo still has 7 grapes. Hence, Aki has  $10 - 7 = 3$  more grapes than Judo, so our answer is **(B) Aki, 3**. ■

**Problem 25:**

**(DeToasty3)** A group of people are standing in a row, including Karate and Judo. Karate is standing somewhere to the right of Judo. As well, there are 7 people standing to the left of Karate, and there are 5 people standing to the right of Judo. If there are 2 people standing in between Karate and Judo, how many people are standing in the row, including Karate and Judo?

- (A) 10    (B) 11    (C) 12    (D) 13    (E) 14

**Answer (A):**

There are 7 people to the left of Karate, including Judo. There are 5 people to the right of Judo, including Karate. However, the two people between Judo and Karate are counted twice, so we have to exclude them each once. Hence, our answer is  $7 + 5 - 2 =$  **(A) 10**. ■